

Trends in Hospital Admissions For Diabetes Complications 2004-2010

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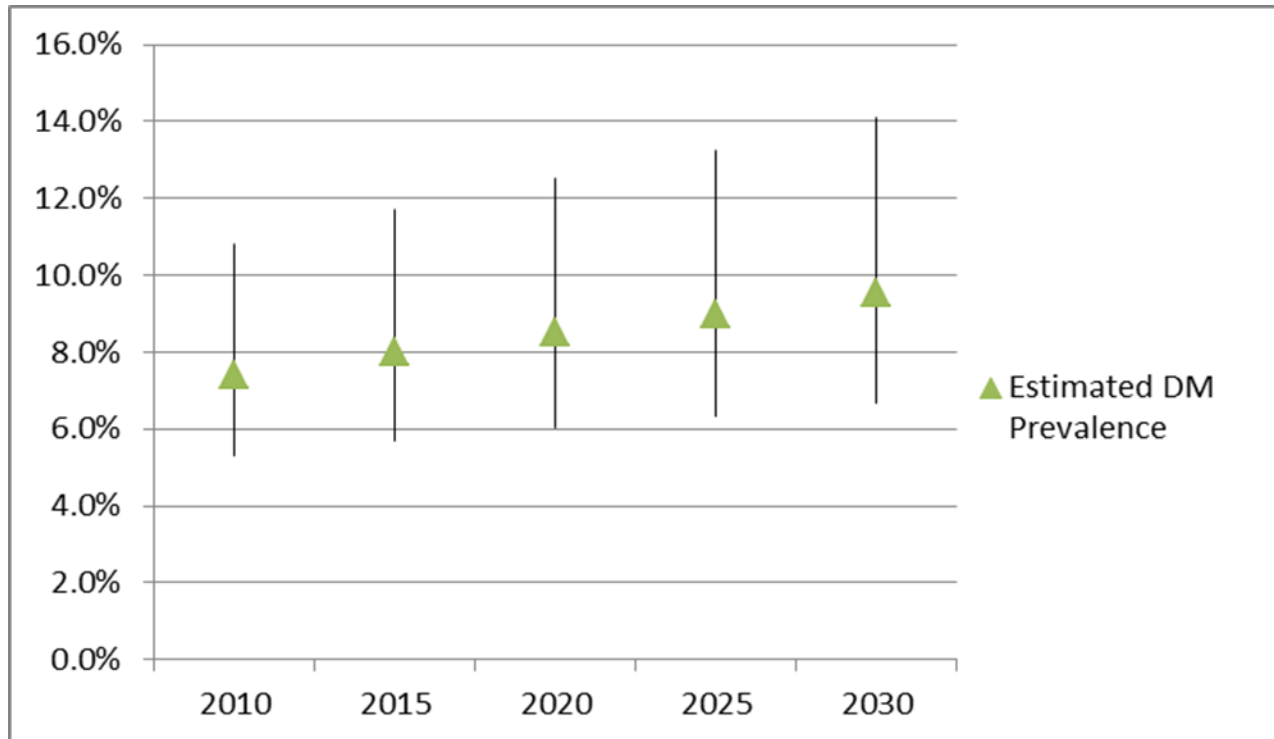
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Outline of Presentation

- Two studies:
 - Trends in diabetes admissions
 - Effects of a community-based interventions on diabetes outcomes: local multivariable analysis
- Background
- Aim of Studies
- Methods
- Results
- Conclusions

Diabetes prevalence is rising

- The Association of Public Health Observatories Diabetes Prevalence Model (England)
- 3.1 Million (7.4%) 2010 - 4.6 Million (9.5%) 2030



What does this mean for NHS?

- A need to manage effectively with little growth in resources
- Hospital admissions are expensive (but are they more expensive than alternatives?)
- Aim to reduce emergency hospital admissions for diabetes and other chronic diseases



Primary Care Sensitive Conditions

Ambulatory or primary care-sensitive conditions (PCSC) are conditions where (in theory) hospital admissions can be avoided by high quality primary care

- Lists of PCSC produced by expert consensus in
 - Australia
 - England
 - US
 - OECD

All lists include DIABETES but not overall international consensus on what defines a PCSC

Coding a PCSC

- WHO ICD-10 (rest of the world)
 - NHS Institute
 - OECD HCQIs
 - NCHOD / NHS Outcomes Framework 2012-13
- WHO ICD 9-CM (USA until 2013)
 - Agency for Healthcare & Research (AHRQ)
- As a primary (principal) diagnosis

ICD10 Codes of Interest in our Analysis

ICD-10 3 character code	ICD_10 Extention	Description	
E10		Insulin-dependent diabetes mellitus (type 1)	
E11		Non-insulin-dependent diabetes mellitus (type 2)	
E14		Unspecified diabetes mellitus	
	0	with coma	Acute (Short term complications)
	1	with ketoacidosis	
	2	with renal complications	Chronic (Long term complications)
	3	with ophthalmic complications	
	4	with neurological complications	
	5	with periph circ complications	
	6	with other spec complications	
	7	with multiple complications	
	8	with unspec complications	
	9	without complication	Without complications
E16 2		Hypoglycemia, unspecified	Hypoglycaemia

4th Character

		0	0.1	.2+	.3+	.4+	0.5	0.6	0.7	0.8	0.9
E10 IDDM (Type 1)	NHS Institute	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	White
	NCHOD	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	US AHRQ	White	White	White	White	White	White	White	White	White	Orange
	OECD HCQIs	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	Current analysis	Light Orange	Light Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Grey
E11 NIDDM (Type 2)	NHS Institute	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	White
	NCHOD	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	US AHRQ	White	White	White	White	White	White	White	White	White	Orange
	OECD HCQIs	Light Orange	Light Orange	White	White	White	White	White	White	White	Light Orange
	Current analysis	Light Orange	Light Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Grey
E12 Malnutrition related DM	NHS Institute	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	White
	NCHOD	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	US AHRQ	White	White	White	White	White	White	White	White	White	White
	OECD HCQIs	White	White	White	White	White	White	White	White	White	White
	Current analysis	White	White	White	White	White	White	White	White	White	White
E13 Other specified DM	NHS Institute	White	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	White
	NCHOD	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	US AHRQ	White	White	White	White	White	White	White	White	White	White
	OECD HCQIs	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	Current analysis	White	White	White	White	White	White	White	White	White	White
E14 Unspecified DM	NHS Institute	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	White
	NCHOD	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	US AHRQ	White	White	White	White	White	White	White	White	White	White
	OECD HCQIs	Light Orange	Light Orange	White	White	White	White	White	White	White	White
	Current analysis	Light Orange	Light Orange	Orange	Orange	Orange	Orange	Orange	Orange	Orange	Grey

		0.2
E16 Hypoglycaemia	NHS Institute	White
	NCHOD	White
	US AHRQ	White
	OECD HCQIs	White
	Current analysis	Grey

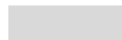
Key:



Short Term Complications



Long Term Complications



Without Complications



Hypoglycaemia

Aim of Study 1

- To determine national (England) time trends in admission rates for 4 diabetes complications categories
 - Acute complications
 - Chronic complications
 - Without complications
 - Hypoglycaemia

Methods

- Design
 - National observational study over 6 years 2004/5 - 2009/10
- Setting
 - English Diabetic Population (patients registered with 8,140+ general practices in 152 primary care trusts.
- Data
 - HES inpatient Data
 - QOF prevalence data
 - Primis+ Audit data (2006)

Extracting HES Data

- Years 2004/5-2009/10
- First episode of each spell
- Emergency Admissions
- Patients from QOF registered practices only
- ICD10 codes in Diagnosis 1 field

Aggregated by year into PRIMIS+ age/sex groups
(180 data points)

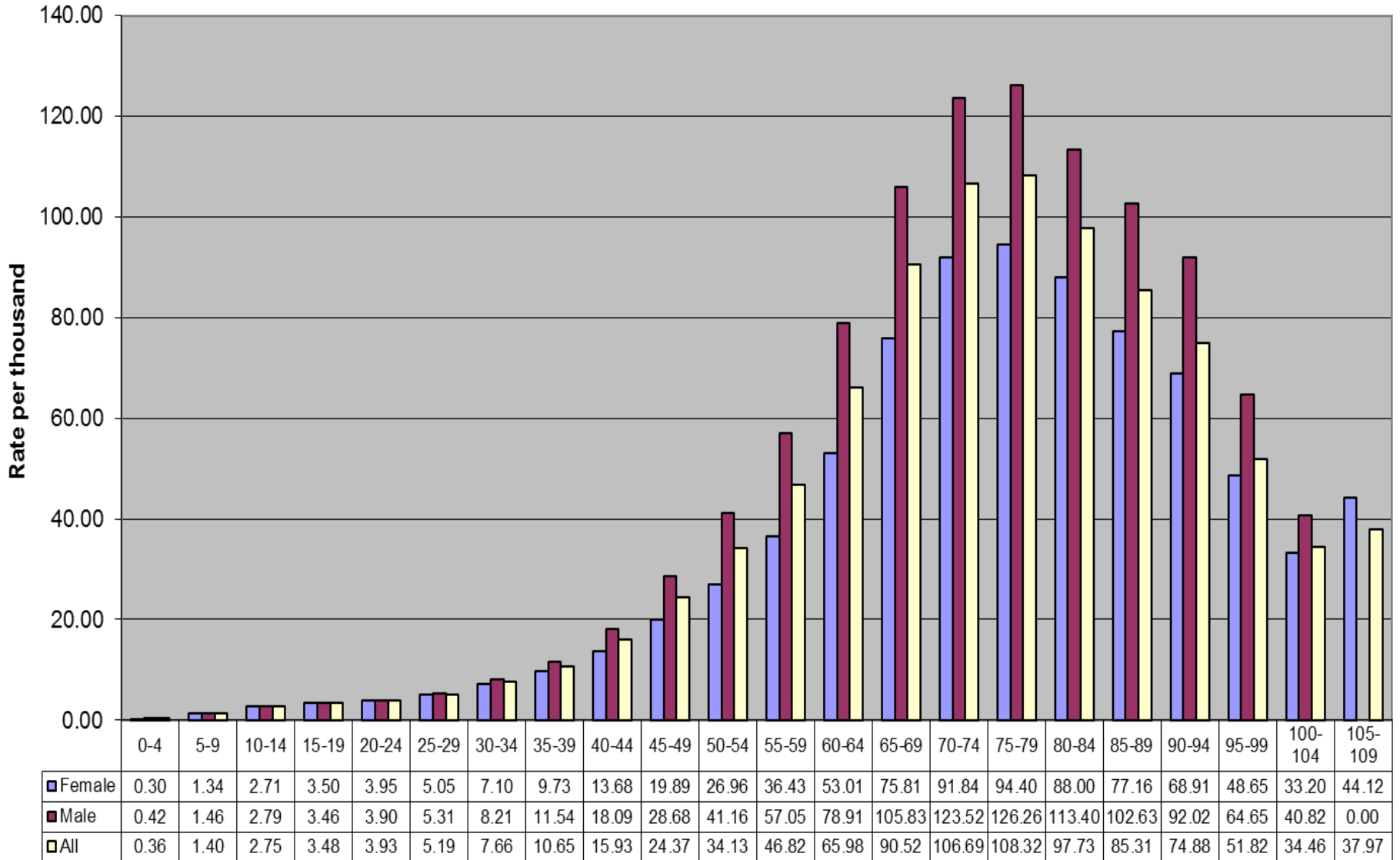
QOF Prevalence Data

- England level QOF prevalence from the NHS Information Centre for the years 2004-5 to 2009-10.
- In 2006/7 the QOF prevalence data changed from all DM recorded patients to those of 17+
- Logistic Regression techniques used to estimate the number of DM patients aged 17+ in years 2004/5 & 2005/6

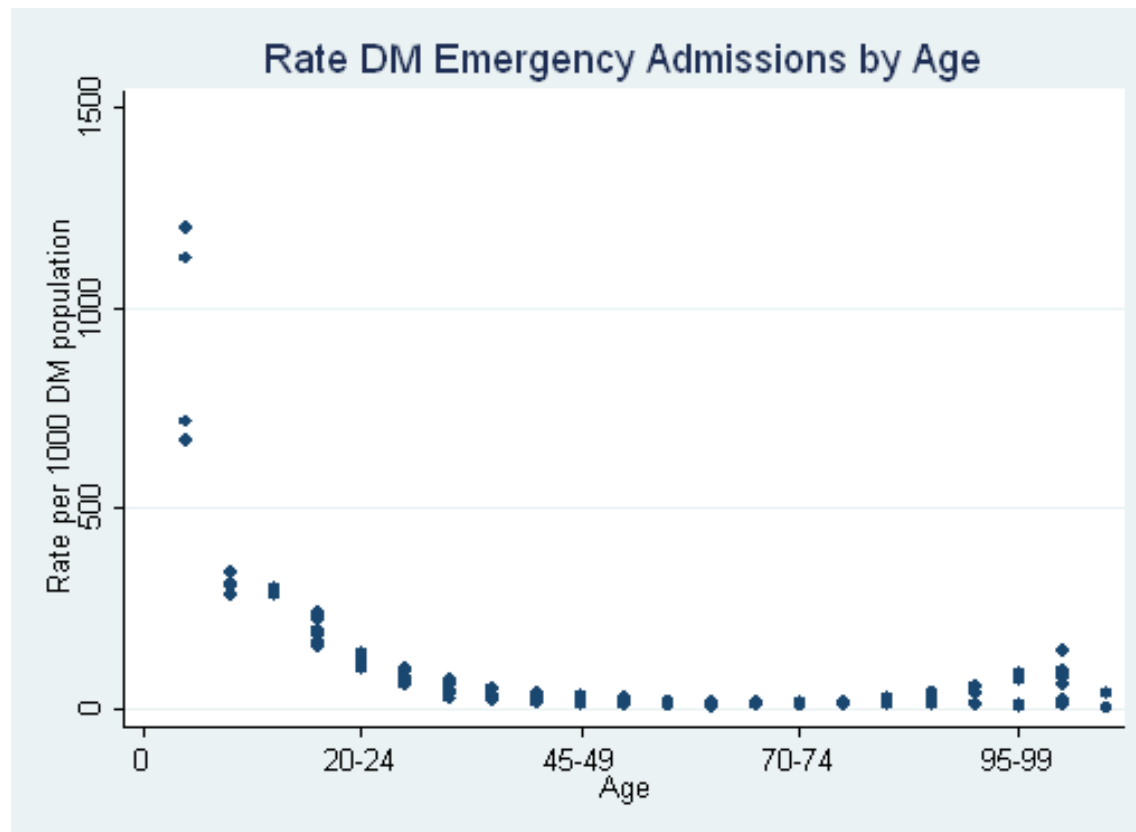
Primis+ Data

- PRIMIS+ is a service to primary care organisations in England. It helps to make the practice effective in use of primary care data.
- About 14% of England practices participate.
- Data drawn from total practice population 7,494,367 of whom 229,227 are on diabetic registers (3.1%)
- Year is 2006 (QOF prevalence = 3.6%)
- Counts of registered diabetics are broken down into 5 year age bands.

Diabetes Mellitus: Agesex breakdown rate per thousand



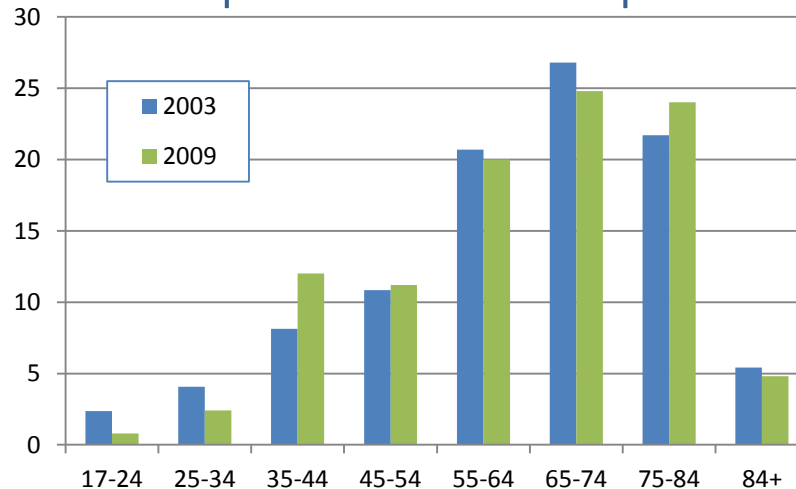
Strong Association between Emergency Admission and Age



Assumption

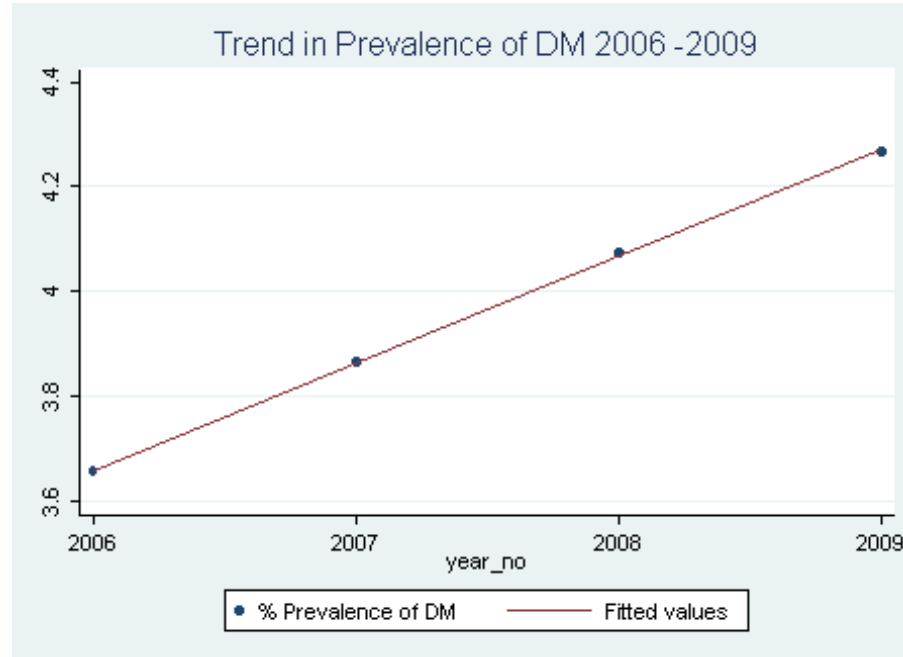
- We make the assumption that the proportion of diabetes, across age/sex groups, has not changed between 2004/5 and 2009/10.

HSE Data – Proportion of Diabetic patients in 7 age groups



- Also assume that proportion across groups does not vary across different regions of England.

Prevalence



- There is strong evidence that the prevalence is increasing linearly
Yearly increase = 0.18%, 95%CI(0.16, 0.20)

QOF Indicators

Indicator	Points	Payment thresholds*
Diabetes quality indicators		
Diabetes 20: The percentage of patients with diabetes in whom the last HbA1c is 59 mmol-mol (7.5%) or less (or equivalent test- reference range depending on local laboratory) in the previous 15 months	17	40-50%
Diabetes 23: The percentage of patients with diabetes in whom the last HbA1c is 53 mmol-mol (7.0%) or less (or equivalent test- reference range depending on local laboratory) in the previous 15 months	17	40-50%
Diabetes 12: The percentage of patients with diabetes in whom the last blood pressure is 145-85 or less	18	40-60%
Diabetes 17: The percentage of patients with diabetes whose last measured total cholesterol within previous 15 months is 5 or less	6	60%

2009-2010 Quality and Outcomes Framework indicators for diabetes management and patient experience which were analysed

** Where there are two values, the lower and upper achievement levels required to receive the minimum and maximum payment.*

Characteristics of practice populations and QOF achievement 2004 & 2009

	2004		2009		% change	P-value ^a
	Mean	IQR	Mean	IQR		
Ind. DM 12 (%)	70.96	63.50-78.13	81.36	76.19-86.27	12.78%	<0.001
Ind. DM 17 (%)	72.59	64.85-79.31	83.33	79.20-86.91	12.89%	<0.001
Ind. DM 6/20/23 (%)	59.12	51.70-65.91	53.24	48.48-59.32	-11.04%	<0.001

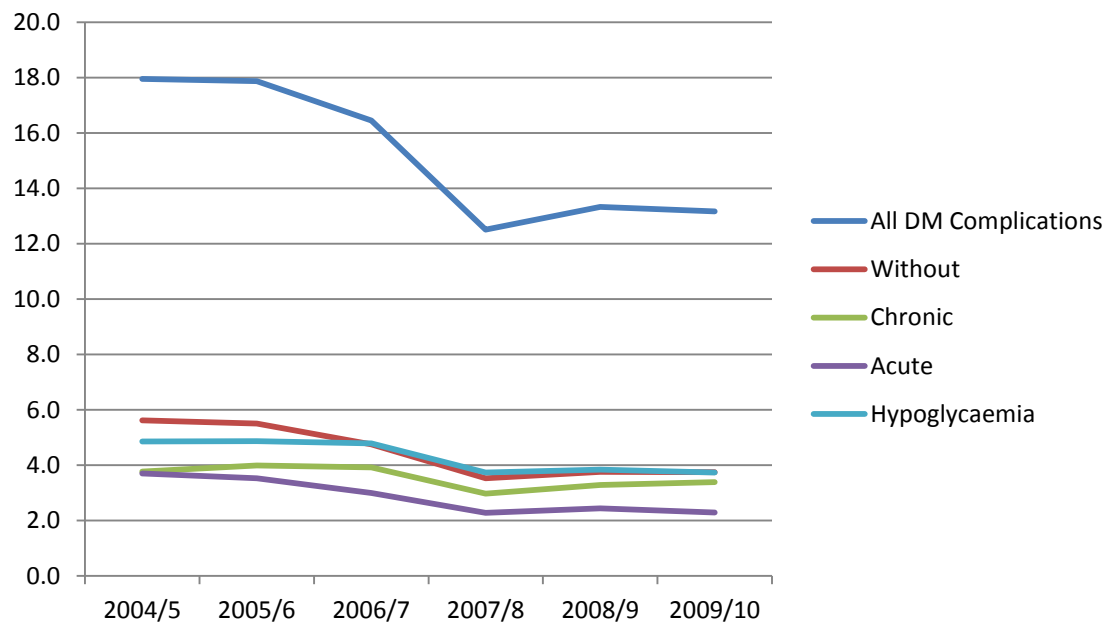
Calderón-Larrañaga A et al (2012)

Does higher quality of primary healthcare reduce admissions for diabetes complications? National observational study

Unadjusted Rates of Emergency Admissions by Complication

Rates of Emergency admissions per 1,000 diabetic patients

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10
All DM Complications	17.95	17.87	16.45	12.50	13.32	13.16
Without Complications	5.62	5.50	4.75	3.52	3.76	3.74
Chronic Complications	3.77	3.99	3.92	2.97	3.28	3.39
Acute Complications	3.70	3.52	2.99	2.28	2.44	2.29
Hypoglycaemia	4.85	4.87	4.79	3.73	3.84	3.73



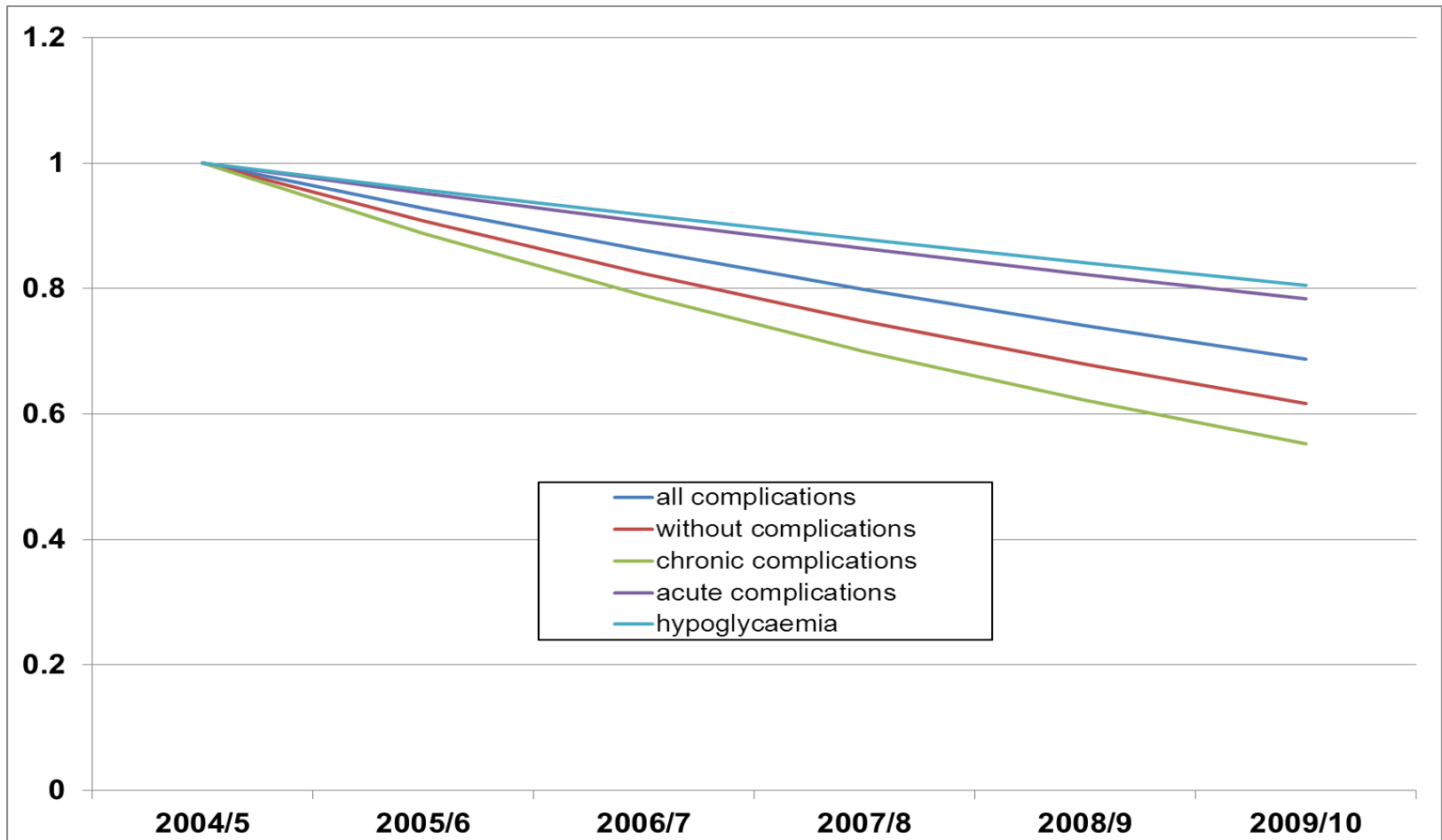
Poisson Regression

- Poisson models fitted for each complication using age/sex/year rates.
- Looking at trends, therefore Year is added as a continuous variable
- Model adjusts for age of patient and sex where necessary.
- The goodness-of-fit chi-squared test, was used to check the fit of the Poisson model.
- Likelihood ratio tests compared models.

Incidence Rate Ratios by DM Complication (Primary Diagnosis)

	All DM	Without	Chronic	Acute	Hypoglycaemia
	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)	IRR (95%CI)
Year	0.93 (0.91, 0.95) ***	0.91 (0.88, 0.93) ***	0.89 (0.85, 0.93) ***	0.95 (0.93, 0.97) ***	0.96 (0.92, 1.00) *
Age Bands (baseline 17-19)					
25-29	0.37 (0.31, 0.44) ***	0.5 (0.43, 0.58) ***	2.04 (1.27, 3.28) **	0.29 (0.26, 0.32) ***	0.73 (0.55, 0.96) *
45-49	0.09 (0.08, 0.12) ***	0.14 (0.11, 0.18) ***	1.98 (1.23, 3.20) **	0.04 (0.03, 0.05) ***	0.27 (0.18, 0.40) ***
65-69	0.04 (0.03, 0.06) ***	0.06 (0.04, 0.08) ***	1.21 (0.72, 2.05)	0.01 (0.00, 0.01) ***	0.22 (0.15, 0.34) ***
85+	0.14 (0.11, 0.17) ***	0.17 (0.14, 0.21) ***	1.73 (1.06, 2.82) *	0.02 (0.02, 0.03) ***	1.17 (0.91, 1.49) NS
Gender (baseline Male)					
Female	0.77 (0.70, 0.84) ***	0.79 (0.73, 0.87) ***	0.55 (0.46, 0.65) ***	NS	NS
Wald test p value *** = <0.001, ** = <0.01 * = <0.05 NS>0.1					

IRRs by DM Complication



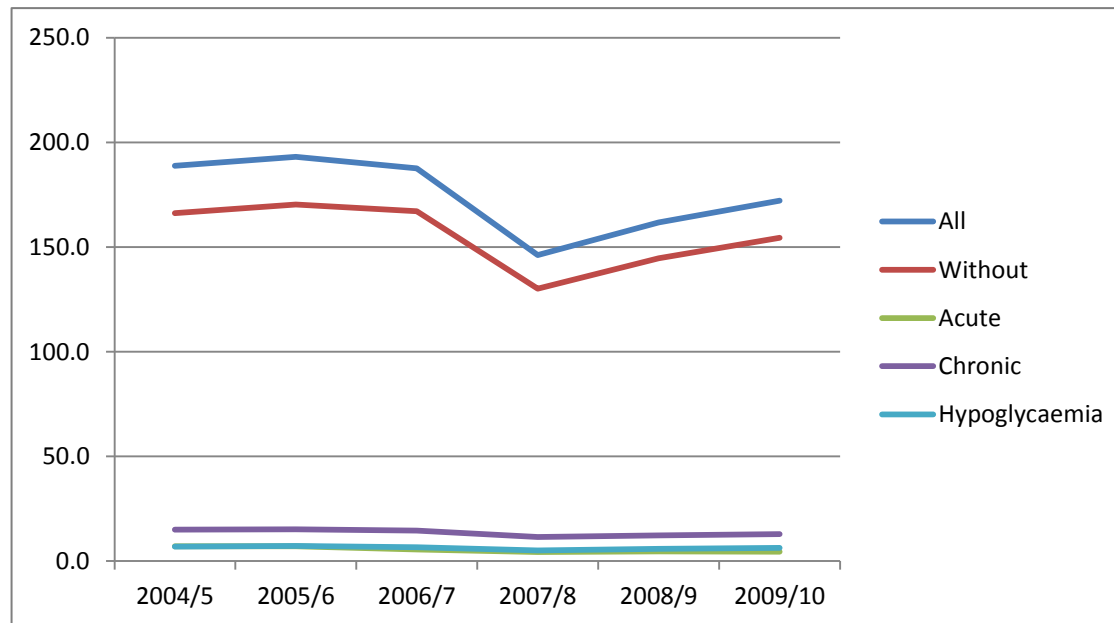
So Are Diabetes Emergency Admissions are falling?

- Strong evidence that prevalence is increasing linearly with time.
- Strong evidence that in most complications rate of emergency admissions is decreasing
- Could this reflect improved management of diabetes in a primary care setting?
- One explanation for these findings could be diagnostic coding transfer.
 - That the decrease in diabetes as a primary diagnosis is because of an increase in coding of diabetes as a secondary diagnosis. This could be due to Payment by Results (introduced for emergency admissions in 2006-7).

DM in any Diagnosis Field

Rates of Emergency admissions per 1,000 diabetic patients

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10
All Complications	188.7	193.1	187.5	146.2	161.7	172.1
Without Complications	166.2	170.3	167.0	130.2	144.6	154.4
Acute Complications	7.1	7.1	5.6	4.4	4.6	4.5
Chronic Complications	15.1	15.2	14.6	11.5	12.3	12.9
Hypoglycaemia Complications	6.9	7.3	6.6	5.1	5.8	6.3



Incident Rate Ratios by DM Complication (Any Diagnosis field)

	All DM	Without	Chronic	Acute	Hypoglycaemia
	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)	IRR (95% CI)
Year	0.96	0.96	0.95	0.95	0.98
	(0.94, 0.98)	(0.94, 0.98)	(0.92, 0.97)	(0.93, 0.97)	(0.94, 1.01)
	***	***	***	***	NS
Age Bands (baseline 17-19)					
25-29	0.62	0.84	3.10	0.30	0.76
	(0.50, 0.77)	(0.67, 1.05)	(2.29, 4.21)	(0.27, 0.34)	(0.59, 0.98)
	***	NS	***	***	*
45-49	0.46	0.77	2.65	0.05	0.29
	(0.37, 0.57)	(0.62, 0.97)	(1.95, 3.61)	(0.04, 0.06)	(0.21, 0.41)
	***	*	***	***	***
65-69	0.47	0.84	2.11	0.01	0.26
	(0.37, 0.58)	(0.67, 1.05)	(1.54, 2.90)	(0.01, 0.02)	(0.18, 0.36)
	***	NS	***	***	***
85+	1.70	3.17	3.65	0.03	1.41
	(1.37, 2.11)	(2.55, 3.95)	(2.70, 4.93)	(0.03, 0.04)	(1.13, 1.77)
	***	***	***	***	**
Gender (Baseline Male)					
Female	0.79	0.81	0.71	0.95	0.98
	(0.73, 0.86)	(0.75, 0.88)	(0.64, 0.78)	(0.88, 1.04)	(0.87, 1.11)
	***	***	***	NS	NS

Wald test p value *** = <0.001, ** = <0.01 * = <0.05 NS>0.1

So it doesn't look like a shift in DM coding

QOF and Admissions

- Bottle A et al (2008)
 - Improving the quality of primary care services may lead to modest reductions in demand for hospital services among older patients with diabetes. However, low neighbourhood socioeconomic status is more strongly associated with hospital admission rates for diabetes.
- Dusheiko M et al (2010)
 - Cross-sectionally, family practices with better quality of diabetes care had fewer emergency admissions for short-term complications of diabetes. Over time, after controlling for national trends in admissions, improvements in quality in a family practice were associated with a reduction in its admissions.
- Calderón-Larrañaga A et al (2012)
 - After controlling for population factors, we found that better scheduled access to primary care and better glycaemic control were associated with lower admission rates. Effect sizes were not large, but might be greater in countries where primary healthcare is less well developed and more variable than in England. We found effects of primary care factors across most categories of complications, suggesting that there is little rationale in restricting PCSC definitions to acute complications.

Aim of Study 2

- To analyse an examples of initiative to improve management of diabetes in two PCTs
- To compare PCT/polyclinic practice level QOF indicators and rates, of diabetes emergency admissions, with London as a whole over a 6 year period

PCT A

- High deprivation
In 2010 median (IQR) practice deprivation score 42.2 (37.6 – 45.8)
Compared to London 26.3 (17.3 – 34.6),
 $p < 0.001$
- High proportion of population Asian ethnicity
- High rate of emergency (all) admissions
In 2009/10: Mean Rate = 93.3 vs 77.8 per
1,000 population, $p = < 0.001$

Intervention PCT A

- Diabetes programme was supported by a budget of £2,245,000 in 2008-9
- Diabetes patient education programme.
 - A revised-condensed self-management programme
 - Key message courses
 - DVDs and workbooks for self-learning
 - Practical sessions e.g. cookery and exercise classes, drop in sessions and personalised visits.

PCT A

Intervention Timetable

- 5th January 2009 - 2nd May 2009
- 11,140 patients on primary care diabetes registers
- The project successfully put 7,634 people with diabetes through the various courses

=> 69% of PCT A diabetic population took part
High coverage of a patient-based intervention

PCT B

- Since 2004 deprivation in the PCT has risen however no statistical difference to rest of London (2010)
Median (IQR) 24.76 (20.33, 27.37), $p=0.505$
- Ethnicity similar rest of London
- Emergency admissions similar to rest of London
- DM prevalence lower than the rest of London
3.13 (2.62 - 5.10) vs 5.38 (4.27 - 6.66), $p<0.001$

Intervention PCT B

- In PCT B, work began on creating a diabetes care pathway in the community in 2007.
- A GP education module was put in place by a Diabetes Specialist Nurse (DNS) and diabetes leads in four collaboratives to support GPs in managing more diabetes patients in primary care.
- Intermediate care in the community followed
 - specialist nurse-led service which provides an intense period (between three and eight months) of monitoring and education and, once stabilised, are discharged with care plan back to their GPs.
- In the first year of operation the service received a total of 148 referrals.
- So low coverage of intervention

Analysing Emergency Admissions for DM Complications

- Design
 - Observational study over 6 years
2004/5 -2009/10
- Setting
 - Practice Population (patients registered with 1,500+ general practices in London SHA.
 - PCT A – 32 practices
 - PCT B/polysystem – 15 practices
- Data
 - HES inpatient Data
 - Attribution Data Set

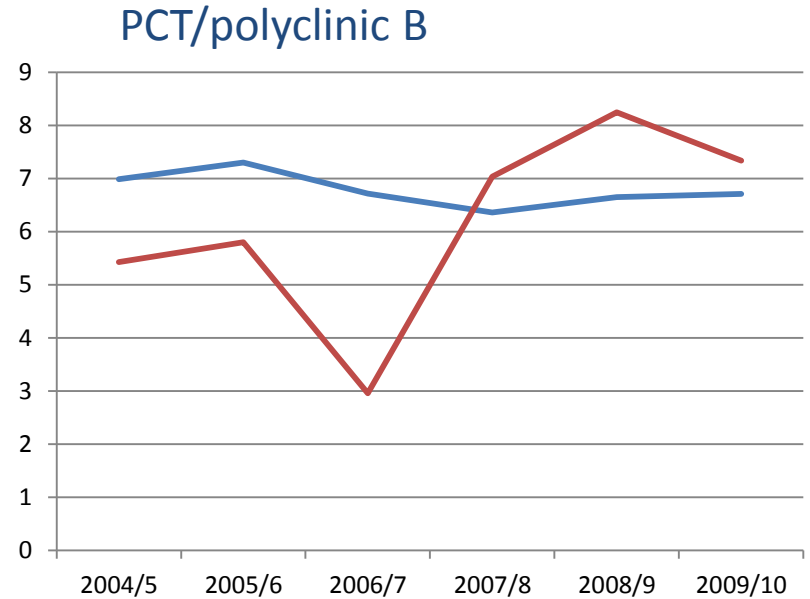
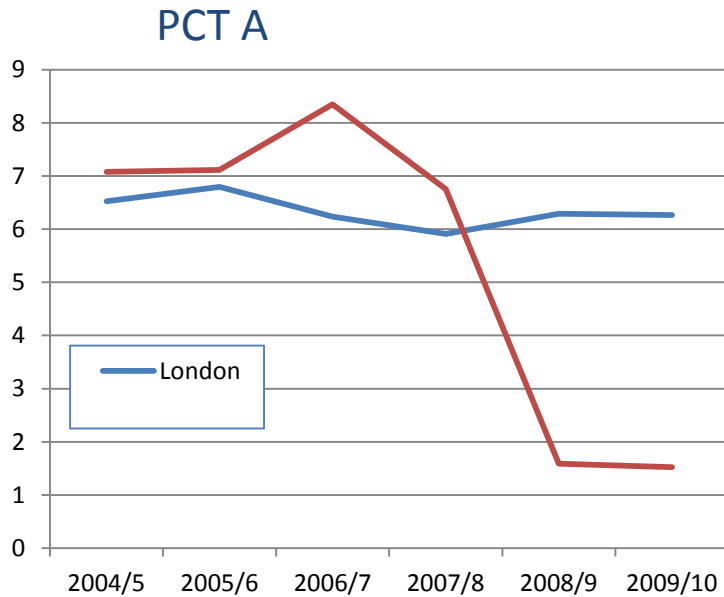
Indirectly standardized at GP practice level

Model

- Poisson/Negative Binomial Model
(Depending on the dispersion of the data)
- Adjusted for population factors, primary care quality and resourcing factors
- Adjusted for clustering effect of GP practice
- Incorporation of interaction terms between year and intervention practice
 - allowing PCT A practices to independently modify the rates over time

Results All Complications (Primary Diagnosis)

Crude Rates per 1,000 practice population



Diabetes Emergency Admissions Rate Ratios

PCT A

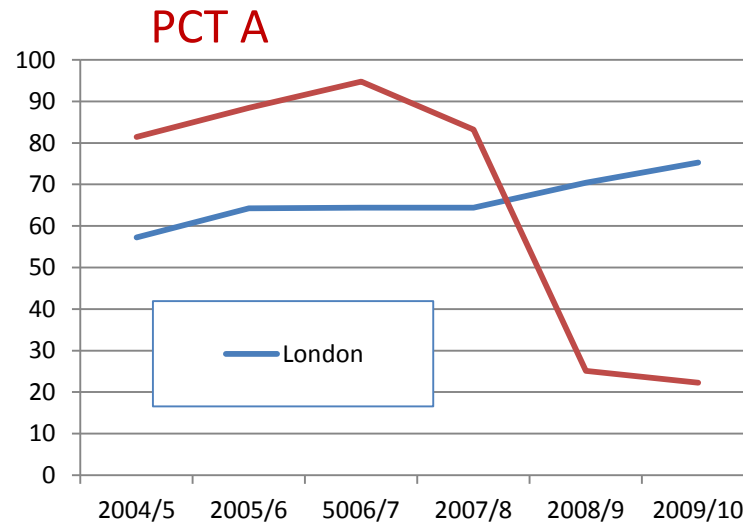
	IRR (95%CI)	p value
PCT A Practice	1.08 (0.88, 1.32)	p=0.475
Year	Baseline: 2004/5	
2005/6	0.98 (0.94, 1.03)	p=0.522
2006/7	0.86 (0.79, 0.92)	p<0.001
2007/8	1.00 (0.91, 1.09)	p=0.932
2008/9	0.91 (0.82, 1.01)	p=0.082
2009/10	0.88 (0.78, 0.99)	p=0.031
Year*A	Interaction Coefficients (95% CI)	
2005*A	0.95 (0.79, 1.13)	p=0.555
2006*A	1.19 (0.95, 1.48)	p=0.124
2007*A	1.10 (0.86, 1.41)	p=0.453
2008*A	0.20 (0.13, 0.31)	p<0.001
2009*A	0.24 (0.17, 0.34)	p<0.001

What do the IRRs tell us?

- In 2004/5 there is no evidence that the rate of diabetes emergency admissions from PCT A practices differ from the rest of London
- In 2005/6 – 2007/8 there is no evidence that the rate of diabetes emergency admissions in PCT A is different from the rest of London
- Strong evidence that the estimated rate of diabetes emergency admissions in 2008/9 and 2009/10 in PCT A, were one fifth of the estimated rates in the rest of London after controlling for major confounders.

Could this be a Coding issue?

- Possible coding changes in local Hospital? An incentive not to record DM complications in principal diagnosis field?



- Similar pattern for any diagnosis field so unlikely

Results of Individual Complications (Primary Diagnosis)

	Acute		Chronic		Hypoglycaemia		Without complication	
	IRR ^a (95% CI)	p value ^j	IRR (95% CI)	p value ^j	IRR (95% CI)	p value ^j	IRR (95% CI)	p value ^j
2005/6	0.98 (0.90, 1.07)	p=0.711	0.97 (0.87, 1.07)	p=0.553	1.09 (0.98, 1.21)	p=0.102	0.94 (0.87, 1.01)	p=0.113
2006/7	0.81 (0.70, 0.94)	p=0.006	0.87 (0.74, 1.03)	p=0.103	0.95 (0.83, 1.09)	p=0.489	0.85 (0.75, 0.96)	p=0.007
2007/8	0.90 (0.75, 1.07)	p=0.222	0.91 (0.75, 1.10)	p=0.330	1.19 (1.02, 1.39)	p=0.025	1.04 (0.90, 1.21)	p=0.566
2008/9	0.78 (0.64, 0.96)	p=0.018	0.85 (0.68, 1.07)	p=0.158	1.13 (0.95, 1.35)	p=0.156	0.91 (0.77, 1.08)	p=0.301
2009/10	0.76 (0.61, 0.96)	p=0.021	0.81 (0.63, 1.04)	p=0.092	1.04 (0.86, 1.25)	p=0.706	0.92 (0.76, 1.11)	p=0.393
PCT A	1.23 (0.81, 1.85)	p=0.329	0.63 (0.40, 0.98)	p=0.040	0.86 (0.51, 1.45)	p=0.579	1.62 (1.30, 2.01)	p<0.001
	Interaction Coefficient (95%CI)		Interaction Coefficient (95%CI)		Interaction Coefficient (95%CI)		Interaction Coefficient (95%CI)	
2005*A	0.65 (0.40, 1.06)	p=0.082	2.50 (1.52, 4.10)	p<0.001	0.98 (0.49, 1.97)	p=0.953	0.84 (0.62, 1.13)	p=0.251
2006*A	0.98 (0.57, 1.68)	p=0.929	2.00 (1.21, 3.32)	p=0.007	2.20 (1.34, 3.60)	p=0.002	0.89 (0.64, 1.25)	p=0.500
2007*A	1.05 (0.55, 2.00)	p=0.888	1.96 (1.06, 3.63)	p=0.032	1.84 (1.00, 3.39)	p=0.051	0.79 (0.56, 1.10)	p=0.157
2008*A	0.20 (0.09, 0.45)	p<0.001	0.45 (0.15, 1.32)	p=0.146	0.36 (0.15, 0.85)	p=0.021	0.11 (0.05, 0.26)	p<0.001
2009*A	0.14 (0.06, 0.35)	p<0.001	0.76 (0.25, 2.34)	p=0.632	0.50 (0.23, 1.05)	p=0.067	0.13 (0.07, 0.23)	p<0.001
j Wald test p value								
^a DM Emergency Rate Ratios adjusting for DM prevalence and practice deprivation								

QOF Scores in PCT A

- Not enough evidence to suggest that the incentives introduced in 2008/9 & 2009/10 had any effect on DM QOF achievement scores
- Why?
 - QOF scores have a ceiling effect.
 - Only 32 practices and effect maybe small

PCT B

- No evidence of an effect modification of PCT B polysystem practices on rate of DM emergency admissions with time.
- Why?
 - Intervention too small

Conclusions

- Evidence that diabetes rate of emergency admissions are falling in DM population
 - Fall seen across all DM complications
- We have seen an example of where a DM management initiative is associated to a reduction in emergency admissions.
 - To make changes need to do on large scale
- PCT A incentive seen to have effect on all DM complications
 - Should all complications be included as PCSC?