Imperial College London

Trends in Community-acquired pneumonia mortality (2000-2011)

association with age, co-morbidity and social deprivation

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Background

- Community acquired pneumonia (CAP) is common.
  - Up to 11 cases in 1000 adults per year
  - Resulting in over 75,000 hospital admissions across England in year 2000/1
  - Large utilisation of health service resources

http://www.dailyrecord.co.uk/news/health

Risk factors

- Age
  - infants, young children
  - elderly.
- Lifestyle
  - smoking, alcohol
- Preceding viral infections
  - influenza predisposing to *Streptococcus pneumoniae* infection.
- Underlying disease
  - Respiratory
  - Immunosuppression
  - Diabetes mellitus
  - Cardiovascular disease

CAP Mortality

- CAP is associated with significant mortality
  - CAP is the fifth leading cause of death in the UK
  - In 2000/1, 30% of England hospitalized CAP patients died during their stay.

Acute Medicine

- In 2000 acute medicine was in its infancy
- In 2003 acute medicine recognised as a separate subspecialty of general medicine
- Today acute medical units are integrated into most acute hospitals in England.

Aim

- To investigate whether associations of CAP mortality with age, co-morbidity and social deprivation have changed over time.

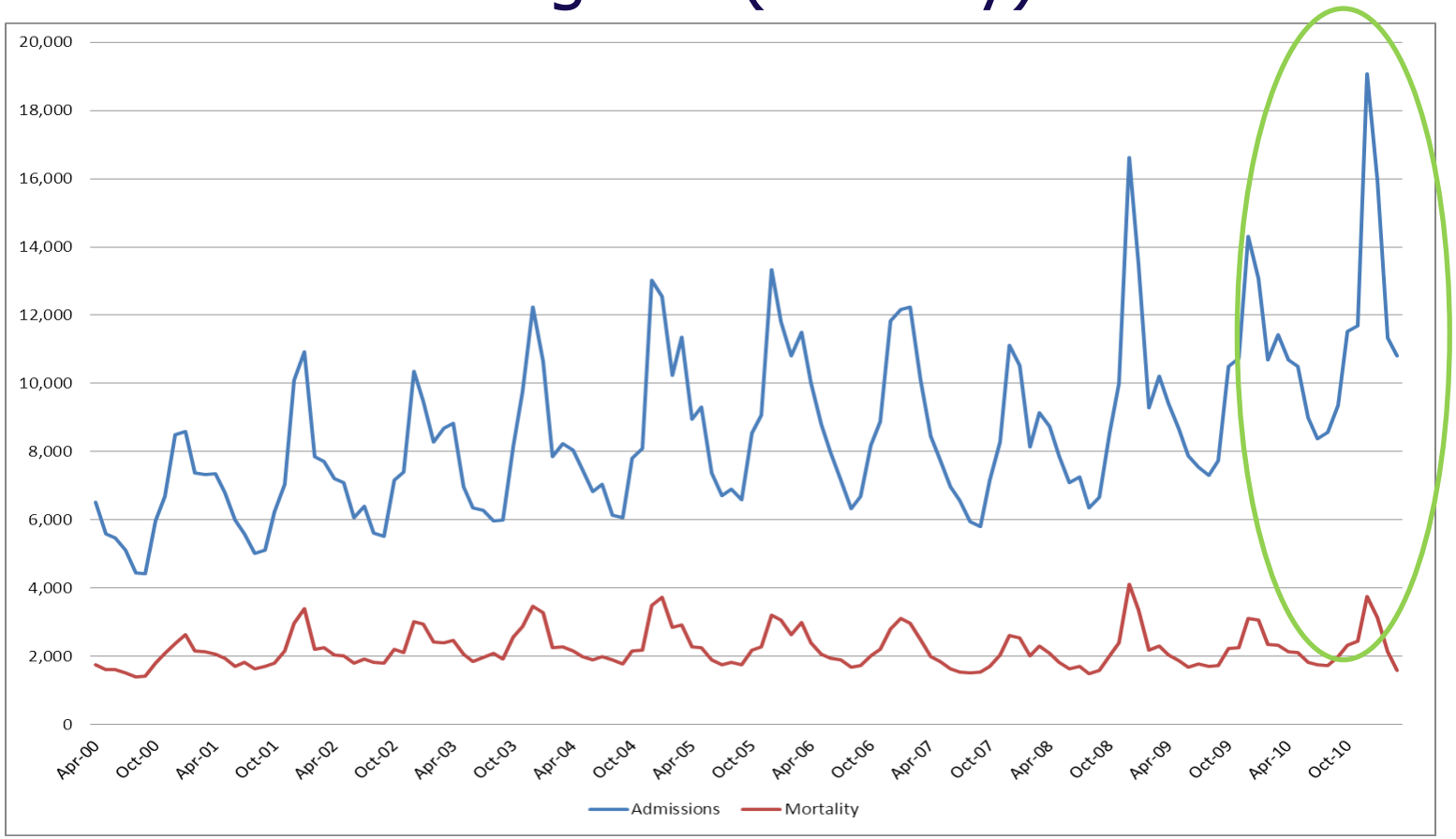
Data

Extracted from Hospital Episode Statistics Dataset

- Years 2000/01 – 2010/11
- ICD10 codes J12*-J18*
- Exclude admissions where patient transferred from another NHS provider
- Define mortality as Method of Discharge = ‘Died’

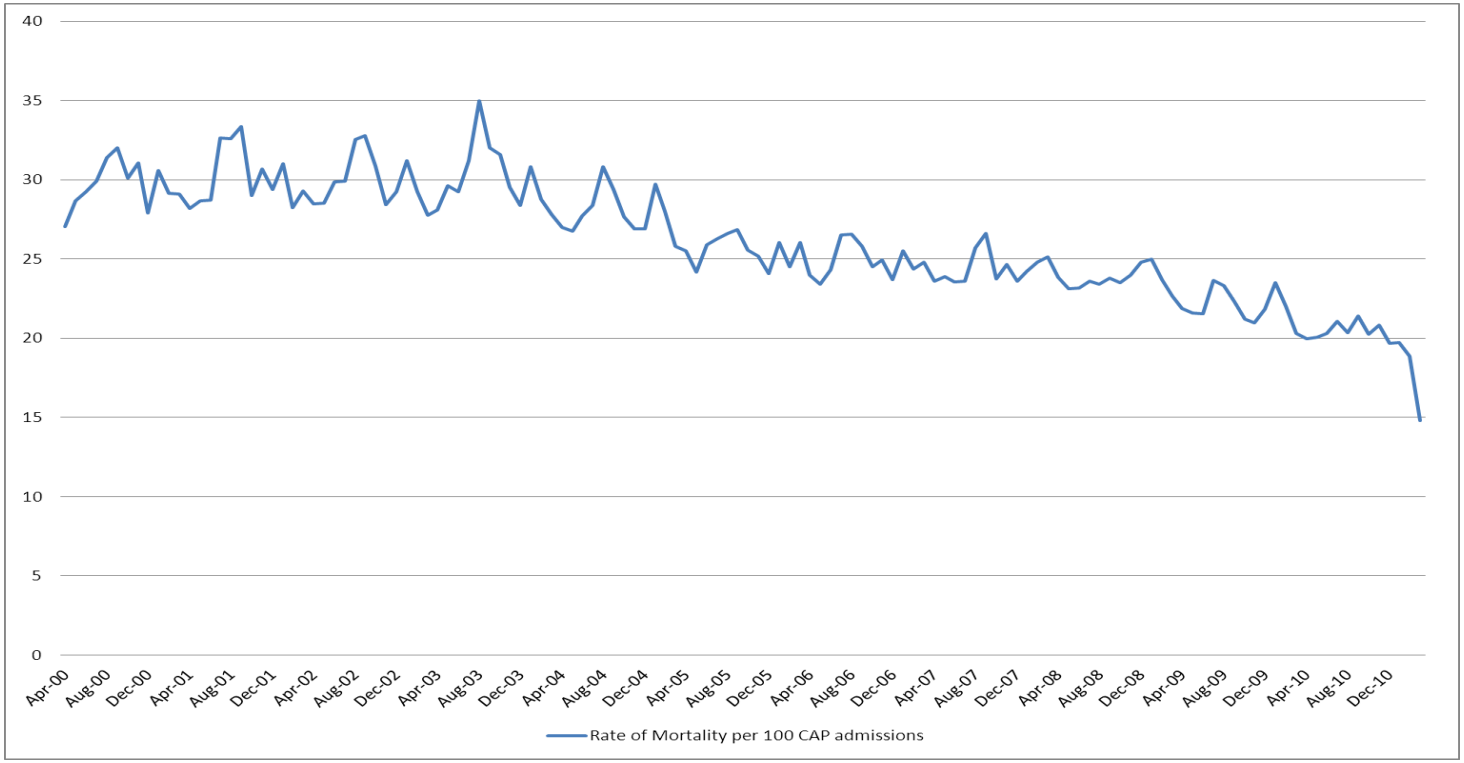
CAP Hospital Admissions/Mortality

in England (Monthly)



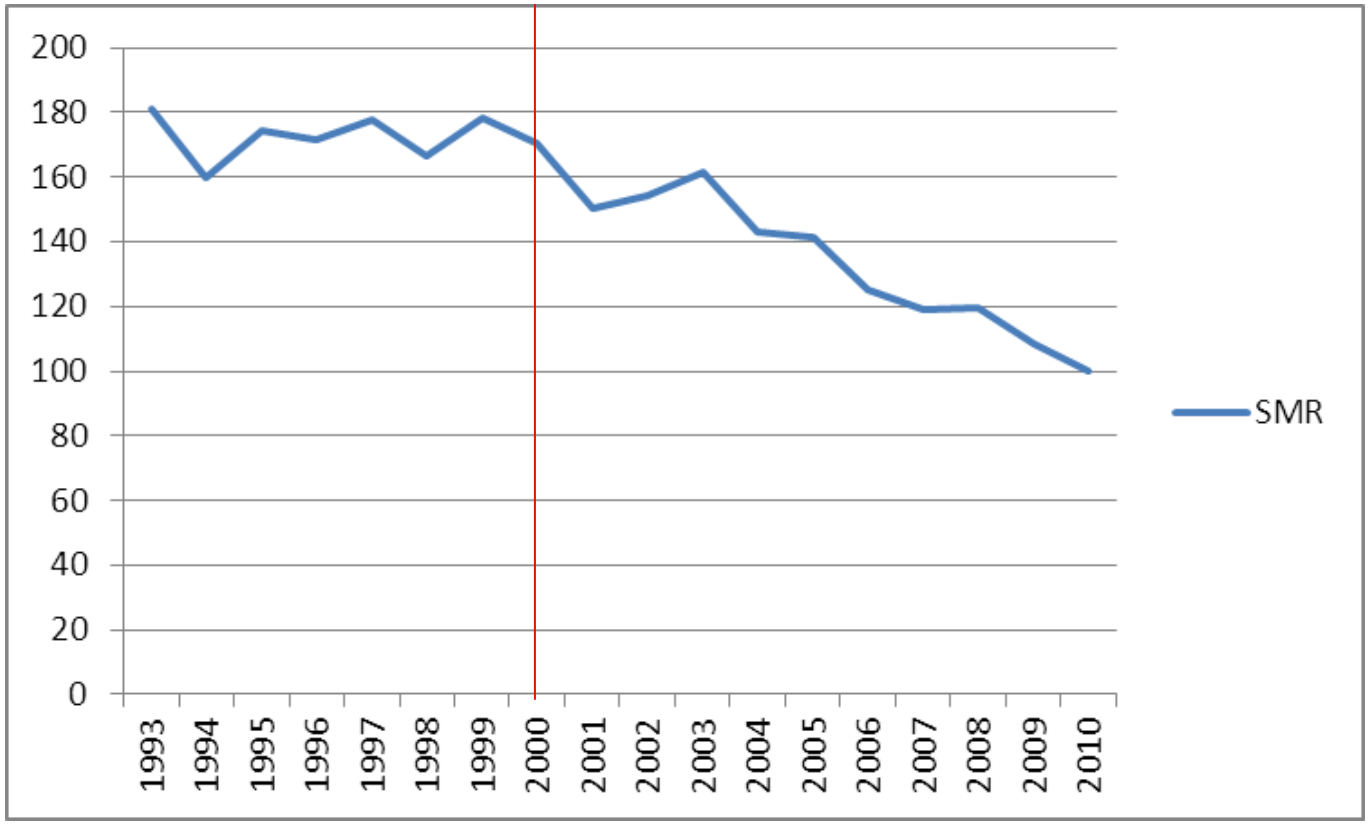
CAP Mortality Rates

per 100 admissions in England (Monthly)



Mortality from pneumonia

Indirectly standardised ratios (SMR) 1993-2010



Data from The NHS Information Centre for health and social care

Methods

- Logistic regression modelling with interaction factors to allow effect modification of CAP mortality time trends by
  - Age
  - A comorbidity risk score (Charlson risk score)
  - Deprivation (IMD 2010 score for patient LSOA)
- Best fit model determined by likelihood ratio test

CAP Admissions

Descriptive Statistics

	Admission Numbers (%)				
Comorbidities - Charlson Index	0	1	2	3+	
2000	40,559 (53.9)	19,943 (26.5)	8,738 (11.6)	6,065 (8.1)	
2010	44,248 (31.4)	43,885 (31.2)	24,675 (17.5)	28,09 (26.0)	
Deprivation	V. Deprived	Deprived	Average	Affluent	Affluent
2000	19,118 (25.8)	16,123 (21.7)	14,375 (19.4)	13,221 (17.8)	11,398 (15.4)
2010	35,310 (25.5)	30,152 (21.8)	27,459 (19.8)	24,055 (17.4)	21,592 (15.6)
	Age	**Mortality**			
	Mean (SD)	Rate per 100 admissions (95% CI)			
2000	61.9 (29.3)	29.5 (29.2, 29.9)			
2010	67.2 (25.1)	19.9 (19.6, 20.1)			

Results

	Year	Age	Deprivation level				
			Very Deprived	Deprived	Average	Affluent	Very Affluent
OR (95% CI)	0.979 (0.969, 0.989)	1.067 (1.066, 1.068)	1.003 (0.972, 1.034)	1.009 (0.978, 1.042)	*Baseline*	0.940 (0.909, 0.972)	0.939 (0.907, 0.972)
p value (wald test)	p<0.001	p<0.001	p=0.871	p=0.567		p<0.001	p<0.001
		Year*Age	Year*Very Deprived	Year*Deprived		Year*Affluent	Year*Very Affluent
Interaction factor (95% CI)		0.999 (0.999, 0.999)	0.997 (0.993, 1.002)	0.999 (0.994, 1.003)		1.008 (1.003, 1.013)	1.006 (1.001, 1.011)
p value (wald test)		p<0.001	p=0.254	p=0.554		p=0.002	p=0.013
	Charlson Co-Morbidity Score						
	0	1	2	3	4	5	6+
OR (95% CI)	0.647 (0.639, 0.655)	*Baseline*	1.376 (1.357, 1.394)	1.700 (1.671, 1.729)	2.012 (1.965, 2.061)	2.523 (2.425, 2.626)	3.504 (3.416, 3.593)
p value (wald test)	p<0.001		p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

Age and Mortality

- Age is strongly associated with CAP mortality
- Evidence that patient age becomes less of a factor over time
- The magnitude of the effect modification factor (of age*time) to CAP mortality is small but highly statistically significant ($p<0.001$)
  - In 2000 the odds of mortality increased by 6.7% with every one year increase in patient age
  - By 2010 this had reduced to 5.6%

Comorbidities

- Charlson comorbidity score is a weighted index that takes into account the number and the seriousness of comorbid disease. The score is derived from the ICD10 diagnostic codes of individual patients' hospital activity data

Comorbidities and Mortality

- Charlson comorbidity score is strongly & linearly associated with CAP mortality
  - The odds of a CAP patient with a Charlson index score of 0 dying in hospital is 35% less than a patient with a score of 1*
  - The odds of a CAP patient with a Charlson index score of 6+, dying in hospital is 3.5 times more likely than a patient with a score of 1*
  - There is no evidence this association has changed with time

**given same age and deprivation level*

English Indices of Multiple Deprivation

- English Indices of Multiple Deprivation are derived by combining a number of indicators, chosen to cover a range of economic, social and housing issues, into a single deprivation score for each LSOA in England.

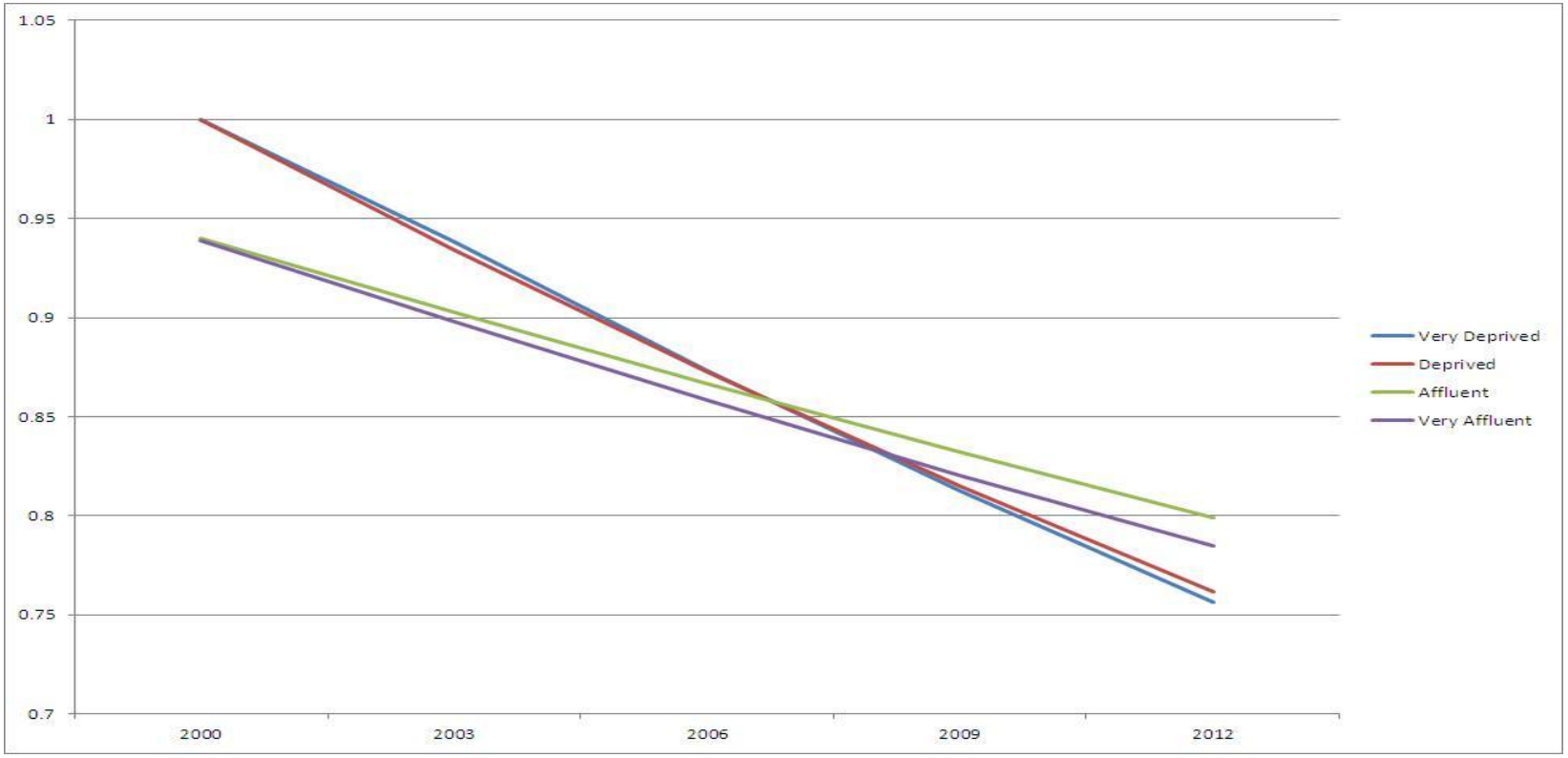
Deprivation Level & Mortality

- In 2000/01
  - The odds of an affluent CAP patient dying in hospital is 6% less likely than a deprived patient*: OR 0.94 95%CI(0.91, 0.97)
- By 2010/11
  - There ceases to be a difference between levels of deprivation. The fall in mortality in the affluent group has been less pronounced than in the patients from a deprived local area

**given same age and comorbidity score*

Deprivation Level & Mortality

Odds Ratios



Strengths & Limitations

- Limitations
  - HES is administratively coded
  - Charlson score is based on an America setting
  - IMD 2010 used across all years
  - Deprivation Score not individual but at LSOA level

- Strengths
  - Patient level data
  - National dataset (over 1 million admissions)

Summary of Findings

- The positive association between deprivation and mortality diminishes over the course of the study period

- The positive association between age and mortality reduces over the course of the study period

Possible explanations for the reduction

Reduction in disease severity

- Increase in influenza/pneumonia vaccinations

- Increase likelihood to admit
  - Increase in influenza pandemic scares
  - Increase in fear of litigation

Better treatment

- Increase in acute medical units
  - AMUs primary role is to provide rapid definitive assessment, investigation and treatment for patients admitted urgently or as an emergency.
- Guidelines for management of the disease
  - Published by British Thoracic Society and regularly updated

Other unmeasured population factors

- Smoking may be a strong confounder.
  - Smoking prevalence strongly associated with deprivation
  - Introduction of the smoking ban 2007 would have more of an impact on the deprived community

Thank you

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& Any Questions

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