



Improving the utility of comorbidity records

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UK Renal Registry

Importance of comorbidities in patients on RRT

- Individual patient comorbidity and prognosis
- UK country and centre level comparisons and comorbidities
- International comorbidity comparisons

UK Renal Registry comorbidities

15 Comorbidities:

- Heart disease: angina, MI in past 3 months, MI >3 months ago, CABG/angioplasty, heart failure
- Non-cardiac vascular disease: cerebrovascular disease, claudication, ischaemic/neuropathic ulcers, amputation for PVD, non-coronary angioplasty/vascular graft
- Other: diabetes (not cause of ERF), liver disease, *'smoking'*, malignancy, COPD

Drawbacks of current comorbidity data

- Important comorbidities not collected: dementia and mobility
- Heart failure not collected by all centres
- Degree of severity not collected
- Smoking: current smoker, smoking within last year
- Malignancy

Recording of comorbidities

- Comorbidities are captured at start of renal replacement therapy (RRT)
- Manual data entry into the renal IT system
- Process of data entry varies by renal centre:
 - Directly entered by senior medical staff (consultant)
 - Entered from updated form by data management staff



Challenges in analysing UK Renal Registry comorbidity data

- Comorbidity completeness
- Renal IT systems
- Statistical challenges

Comorbidity completeness of incident patients, 2003-2008

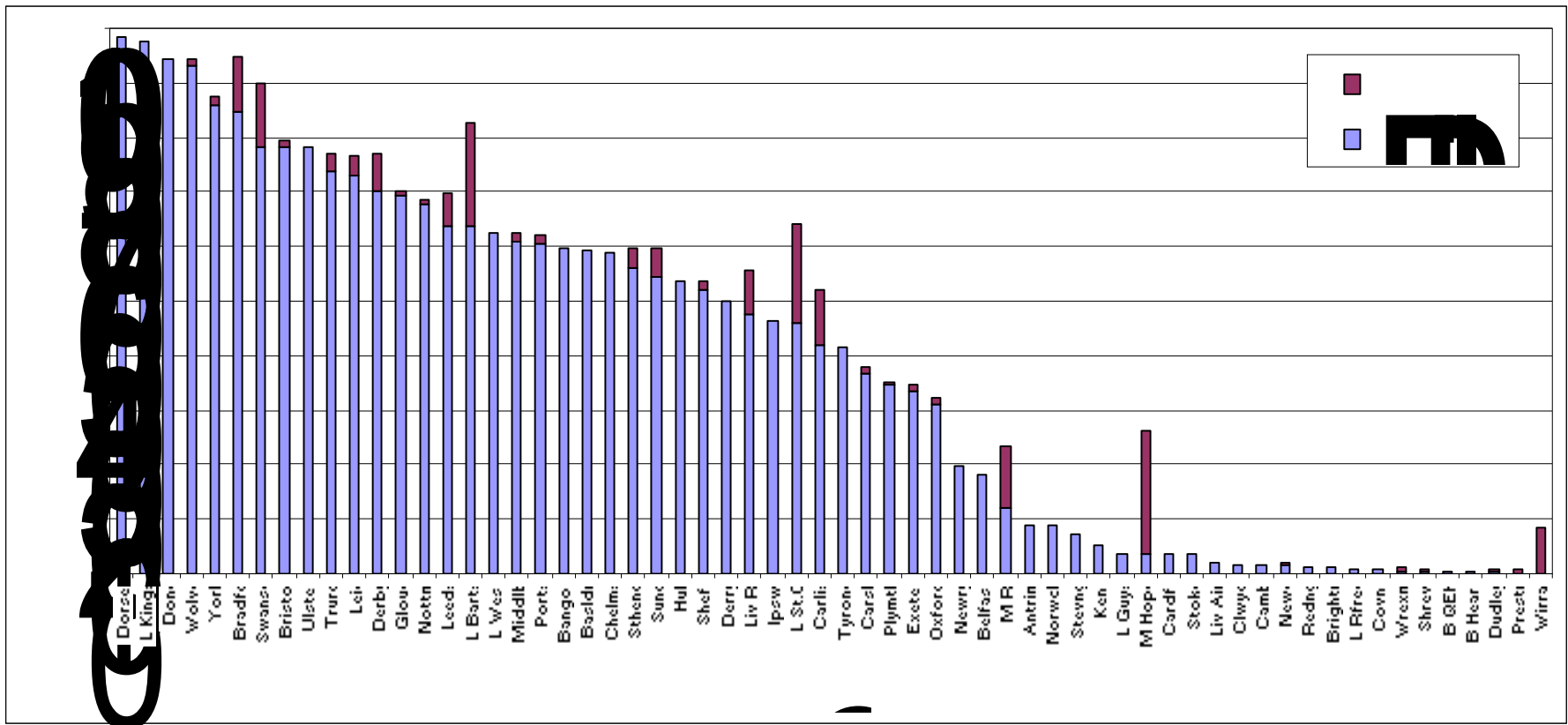
	2003	2004	2005	2006	2007	2008	2003-2008
Number of renal centres	43	50	56	57	62	63	
Number of new patients	4,183	4,827	5,436	5,727	6,076	6,107	32,356
Number of patients with comorbidity data	2,271	2,470	2,498	2,555	2,673	2,442	14,909
Percentage	54.3	51.2	46.0	44.6	44.0	40.0	46.1
Median % for centres returning >0% comorbidity	63.7	67.5	52.3	62.5	56.6	52.0	60.2

Comorbidity recording, 1998 to 2006



Number of comorbidity records (out of total of 14)	Number of patients	% of patients
0 (No data)	24,391	63.2
1	27	0.1
2	8	<0.1
3	8	<0.1
4	7	<0.1
5	6	<0.1
6	1	<0.1
7	4	<0.1
8	3	<0.1
9	12	<0.1
10	4	<0.1
11	128	0.3
12	149	0.4
13	914	2.4
14 (Complete data)	12,944	33.5

Completeness of comorbidity recording by renal centre, incident patients 1998-2007



Renal IT systems

- Different renal centres have differing renal IT software systems
- Renal IT systems sometimes handle the capturing of comorbidities differently
- Comorbidity not filled out (blank) should mean that the comorbidity has not been collected, but not all IT systems have worked in this way

Statistical challenges

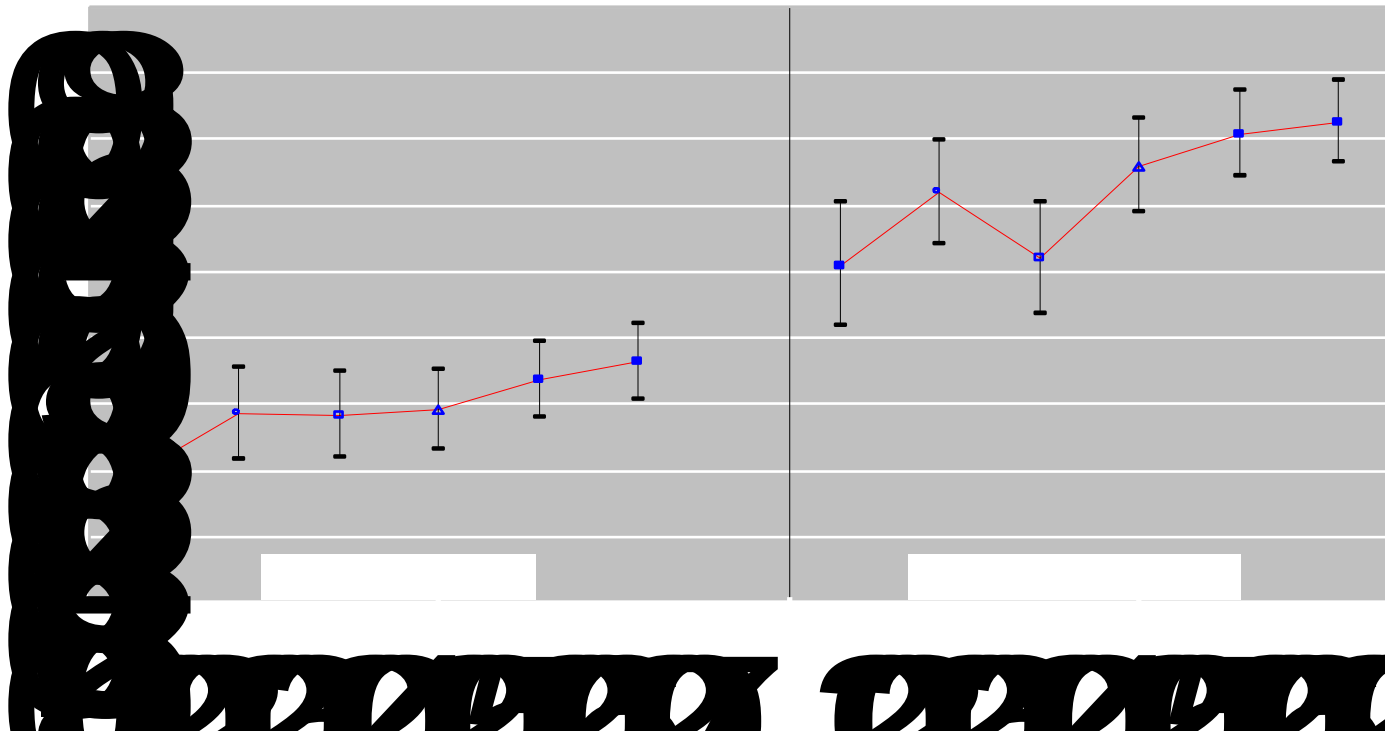
- Not adjusting for comorbidity might lead to inadequate case-mix adjustment
- Case-mix adjustment in statistical models are limited to complete cases
 - Loss of statistical power
 - Selection bias
 - Lack of generalisability
- Most standard statistical methods assumes complete data



Missing comorbidity data strategies

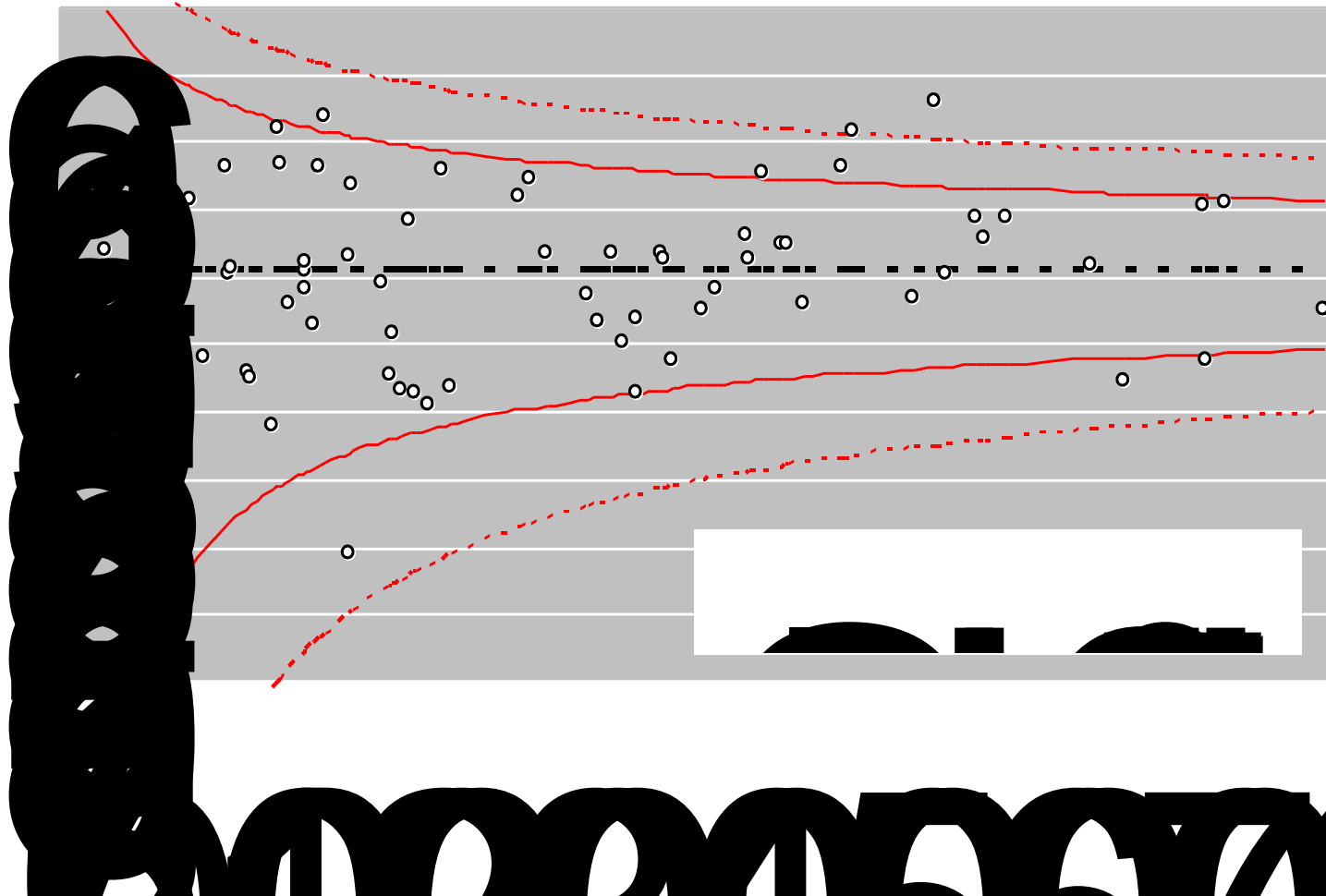
- Not adjusting for comorbidities at all to avoid the drop in patient numbers
- Restrict analysis to a subset of centres with $\geq 85\%$ comorbidity returns
- Include other measures such as transplant wait listing status as a proxy for comorbid conditions
- Complete case analysis

Survival 1 year after 90 days by first treatment modality, age adjusted



“ There appeared to be better one year survival on PD compared with HD after age adjustment; however, a straightforward comparison of the modalities may be misleading ”

1 year after 90 days survival, incident RRT patients, 2004-2007 age adjusted

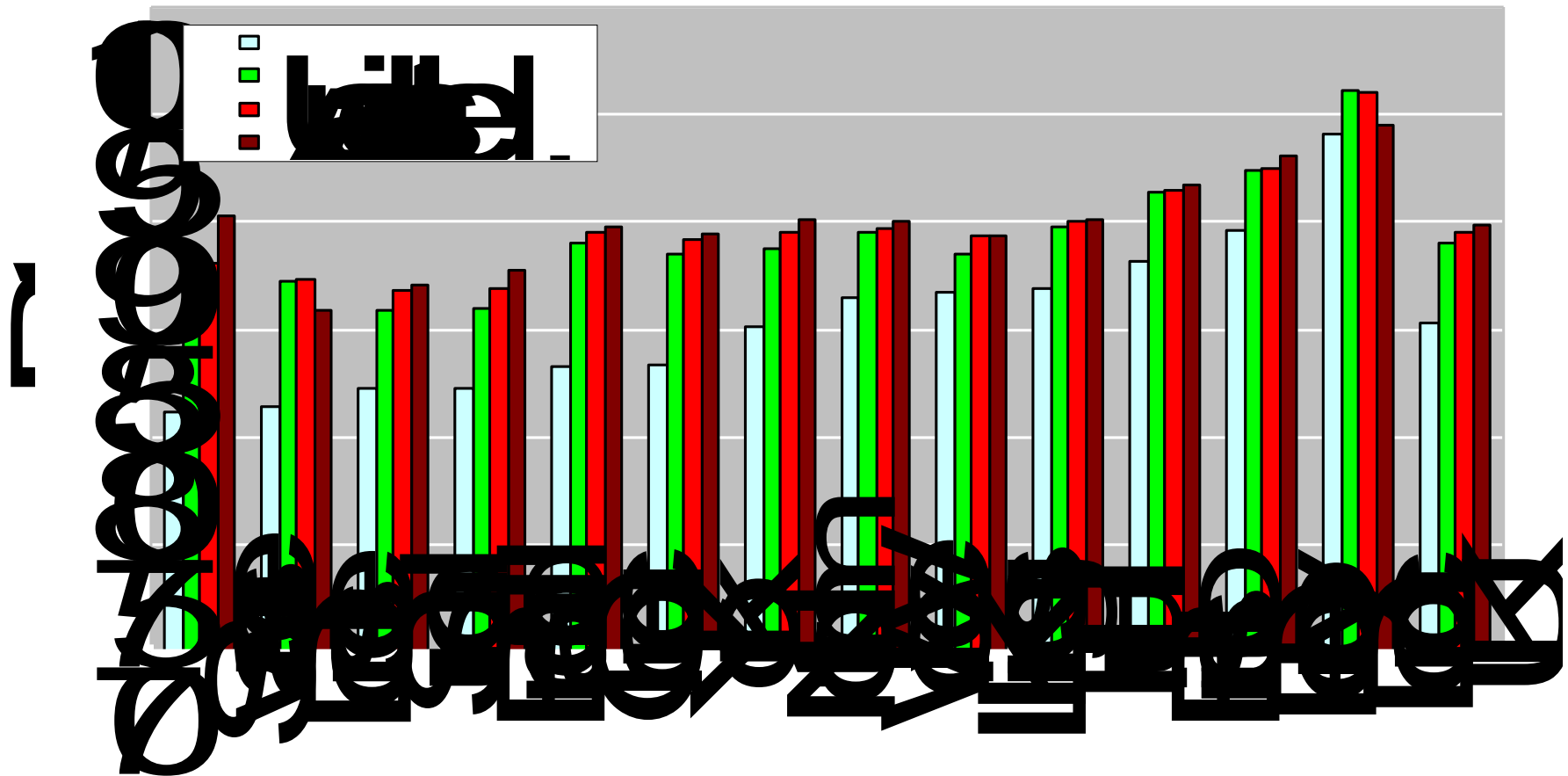


Incident patient survival across UK countries, 2005-2006, age adjusted

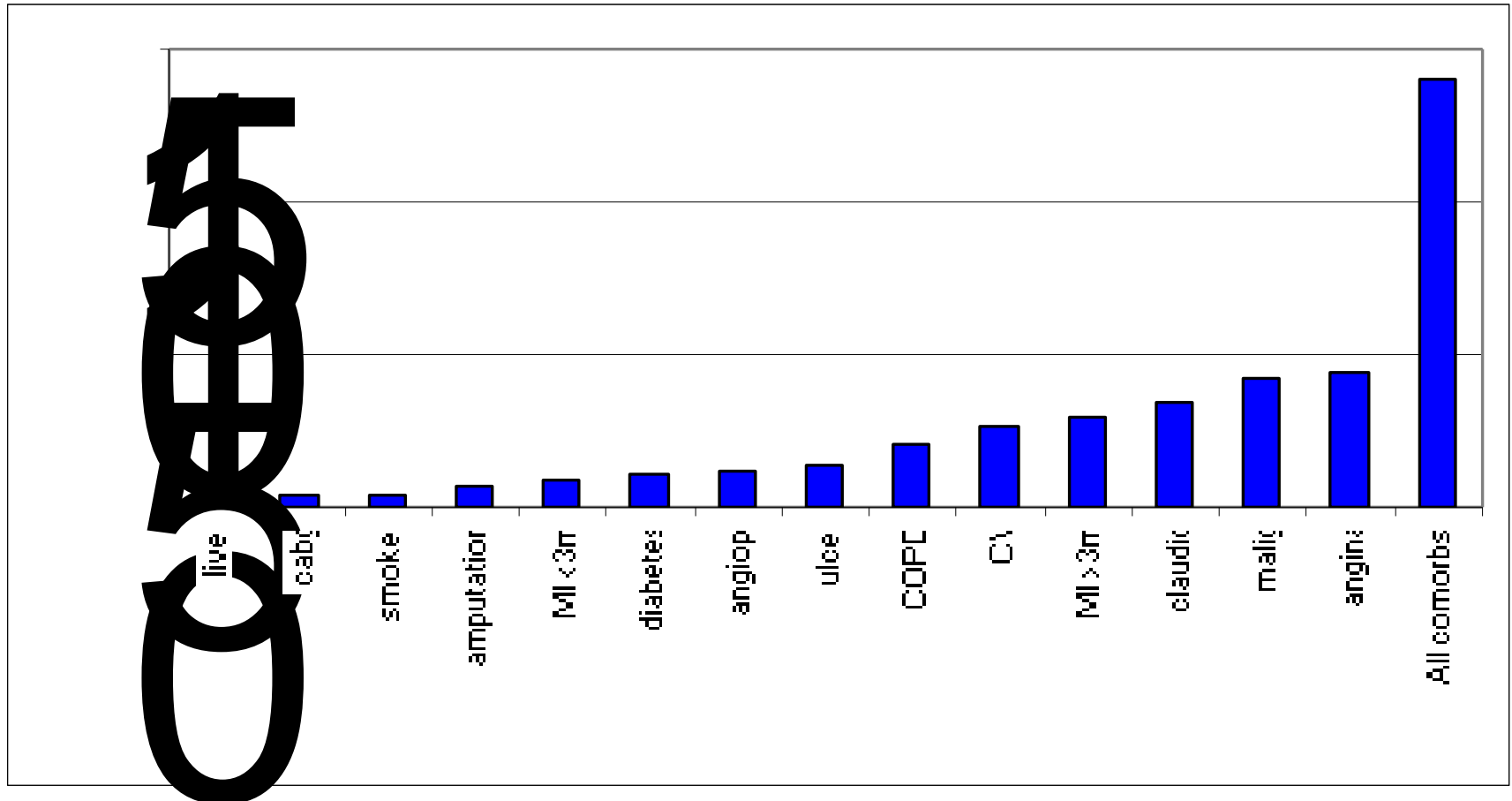
Survival	England	N Ireland	Scotland	Wales	UK
At 90 days	95.7	97.4	94.7	95.1	95.6
95% CI	95.3 - 96.1	96.2 - 98.6	93.5 - 95.8	94.0 - 96.3	95.2 - 96.0
1 year after 90 days	89.6	90.8	85.9	85.8	89.1
95% CI	88.9 - 90.3	88.3 - 93.3	83.9 - 87.9	83.7 - 88.1	88.4 - 89.7

“These data have not been adjusted for differences in primary renal diagnosis, ethnicity or comorbidity ”

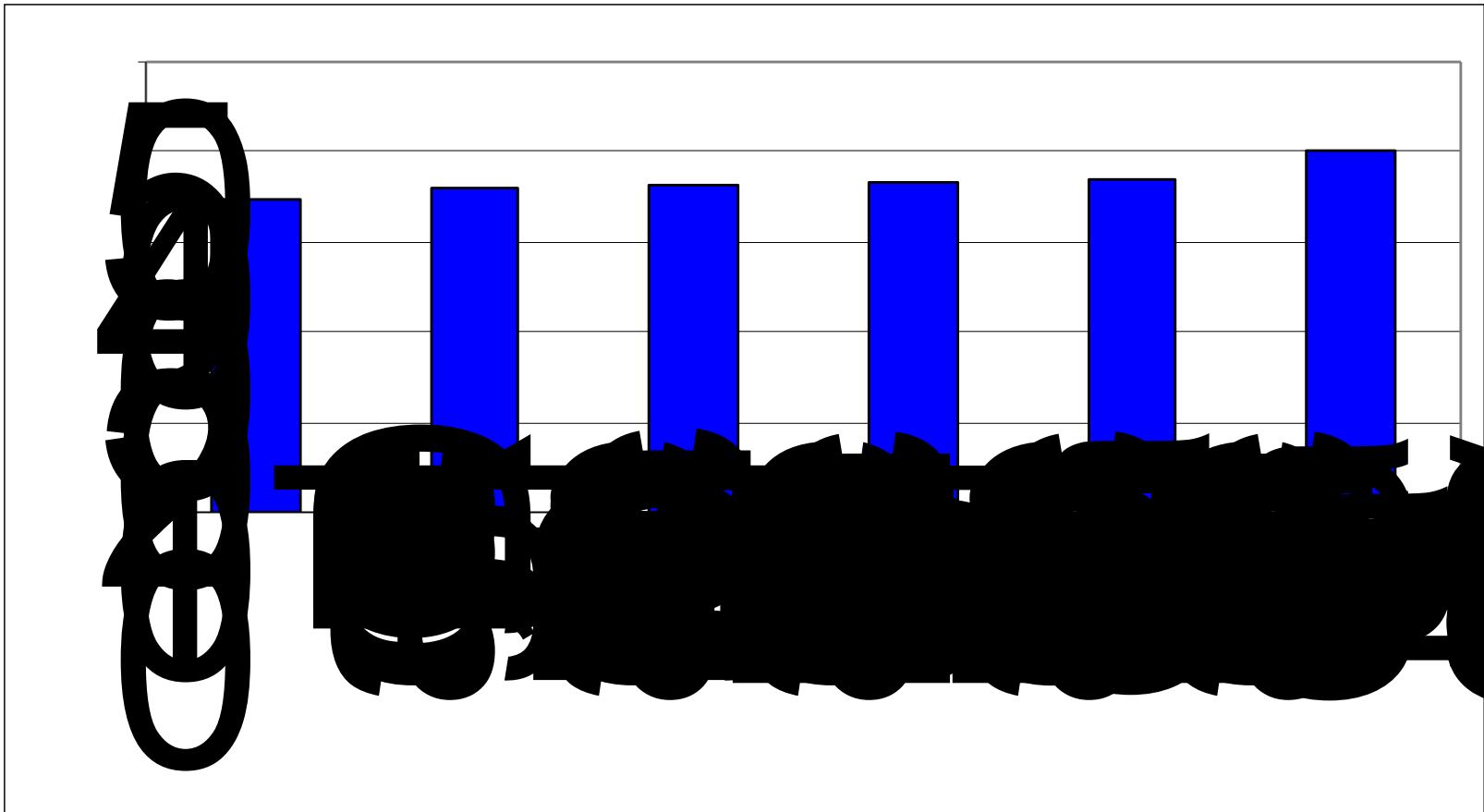
Survival 1 year after 90 days for incident RRT patients in 2003-2007, adjusted for age, diagnosis and comorbidity



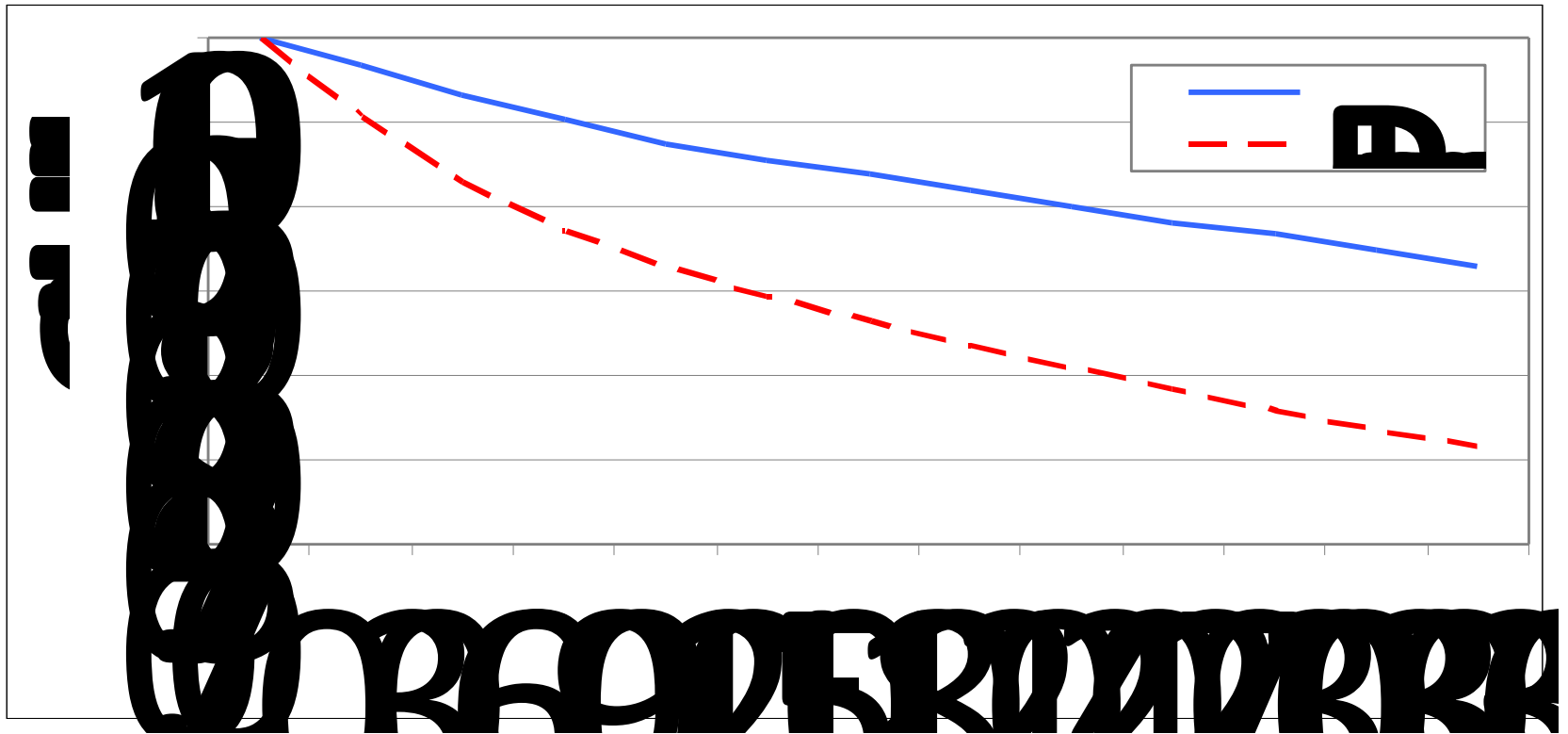
Variance explained by individual comorbidities, survival after 90 days



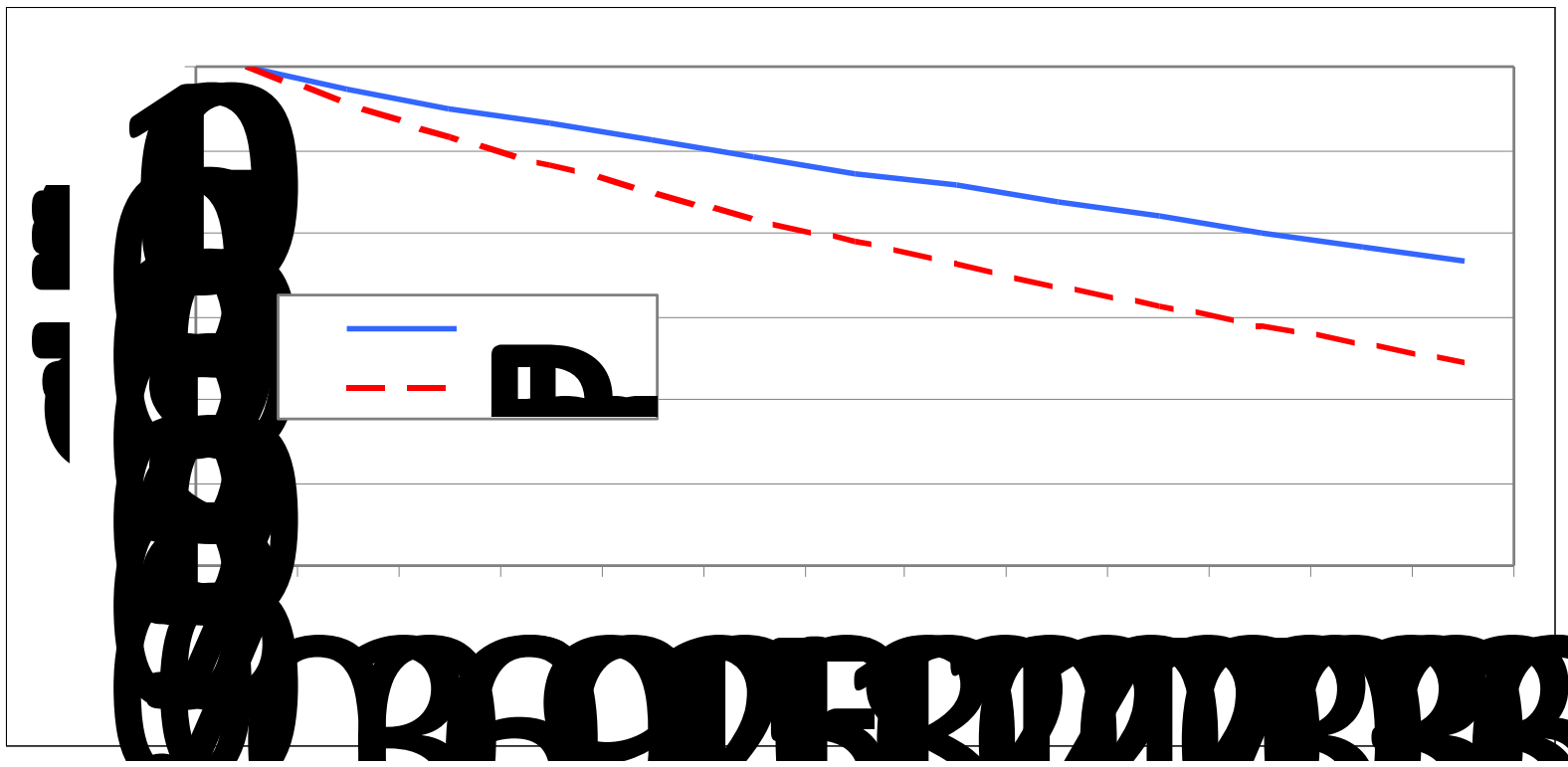
Additional variance explained, survival after 90 days



Unadjusted 1 year survival of incident RRT patients, 1997-2007



Unadjusted 1 year after 90 days survival of incident RRT patients, 1997-2007



Demographic comparison of patients with and without comorbidity returns

	Missing	Present	p-value
Median age at start of RRT	65.4	63.9	<.0001
	%	%	
Gender			0.4234
Male	56.2	43.8	
Female	56.6	43.4	
Ethnicity			
Asian	49.8	50.2	<.0001
Black	49.9	50.2	
Other	45.7	54.3	
White	52.8	47.2	
Missing	73.3	26.7	
Primary Renal Disease			<.0001
Diabetes	53	47	
Hypertension	48	52	
Other	88	12	
Polycystic kidney	51	49	
Pyelonephritis	51	49	
Renal vascular disease	50	50	
Uncertain	62	38	
Glomerulonephritis	50	50	
Missing	54	46	

Improving comorbidity completeness



- Encourage clinicians to complete comorbidity returns
- Highlight the problems with case-mix adjustment
- National Renal Dataset
- HES linkage
- Ultimately work on a system that rewards clinicians returning comorbidity data by providing them with a prognostic survival prediction tool
- Missing data imputation



Prognostic survival prediction tool

- Difficult to accurately discuss prognostic information with patients
- Provide objective information to patients and their families
- Prognostic tool to predict early death will aid in decision making related to RRT

What is multiple imputation?



Developed by Rubin in a survey setting as a statistical technique for analysing data sets with missing observations

1. Imputation:

Missing values are replaced by imputations

The imputation procedure is repeated many times with each dataset having the same observed values and different sets of imputed values for missing observations

1. Analyse using standard statistical methods

2. Pooling parameter estimates



Conclusion

- Comorbidity is an important predictor of outcome
- Important in explaining differences between centres and UK nations and important for individual prognosis
- Outcome differences between patients with and without comorbidity



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