

Chief Health Officer's report and smoking in pregnancy: two aspects of small area analysis in NSW Health

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Outline

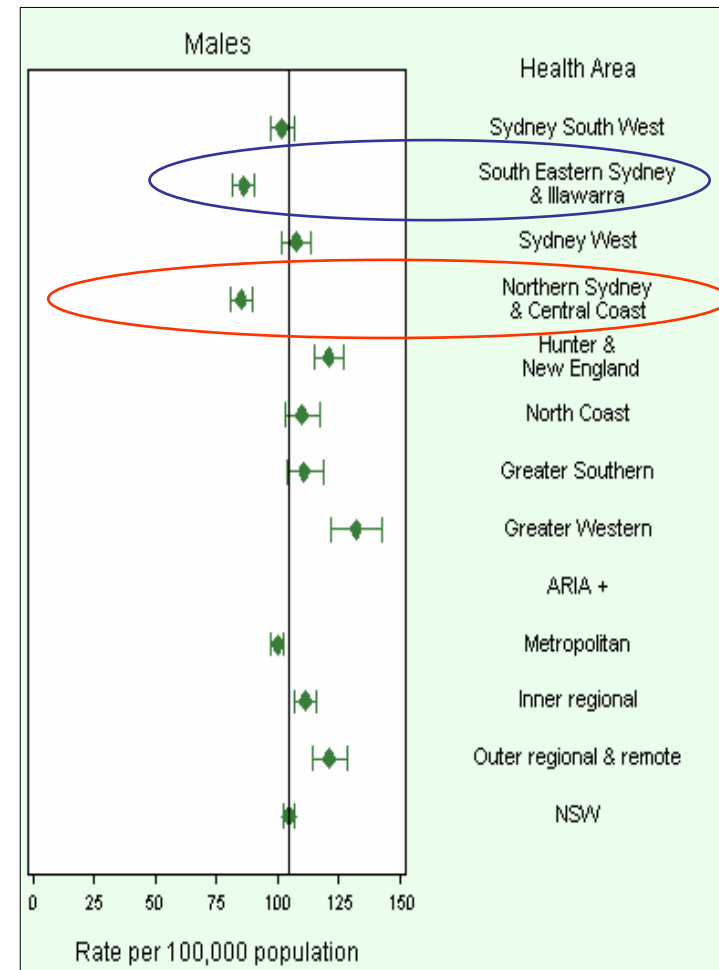
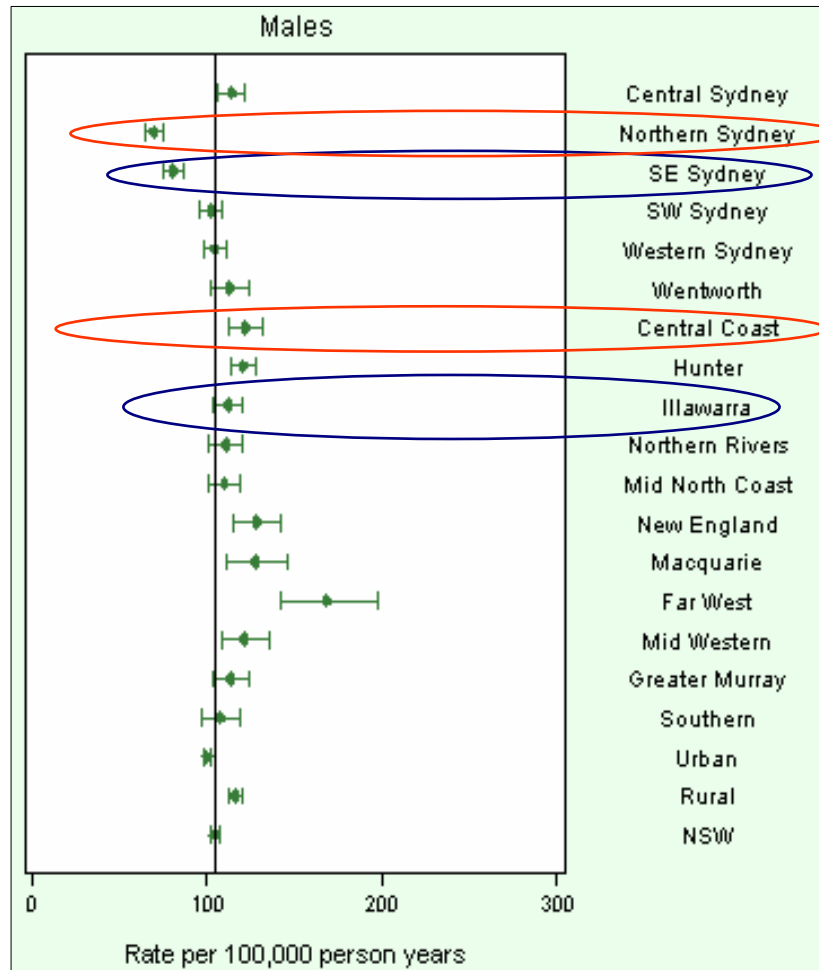
- LGA maps and analysis for CHO.
- Variation in rate of smoking during pregnancy in NSW by local government area (LGA)
- Why important?
- Method (cases, covariates, modelling)
- Results
- Discussion

CHO – the need for small area analysis

- Chief Health Officer's Report –NSW Health flagship document on a wide range of population health indicators
- Indicators mainly presented at state level (trend over time)
- Many also presented at health area level
 - NSW separated into 8 health areas (used to be 17)
 - 4 include parts of Sydney
 - Remainder are all rural, but cover large areas
 - This can mask variability

Effect of amalgamation on indicators.

Deaths from coronary heart disease (1999-2003) males aged 25-74

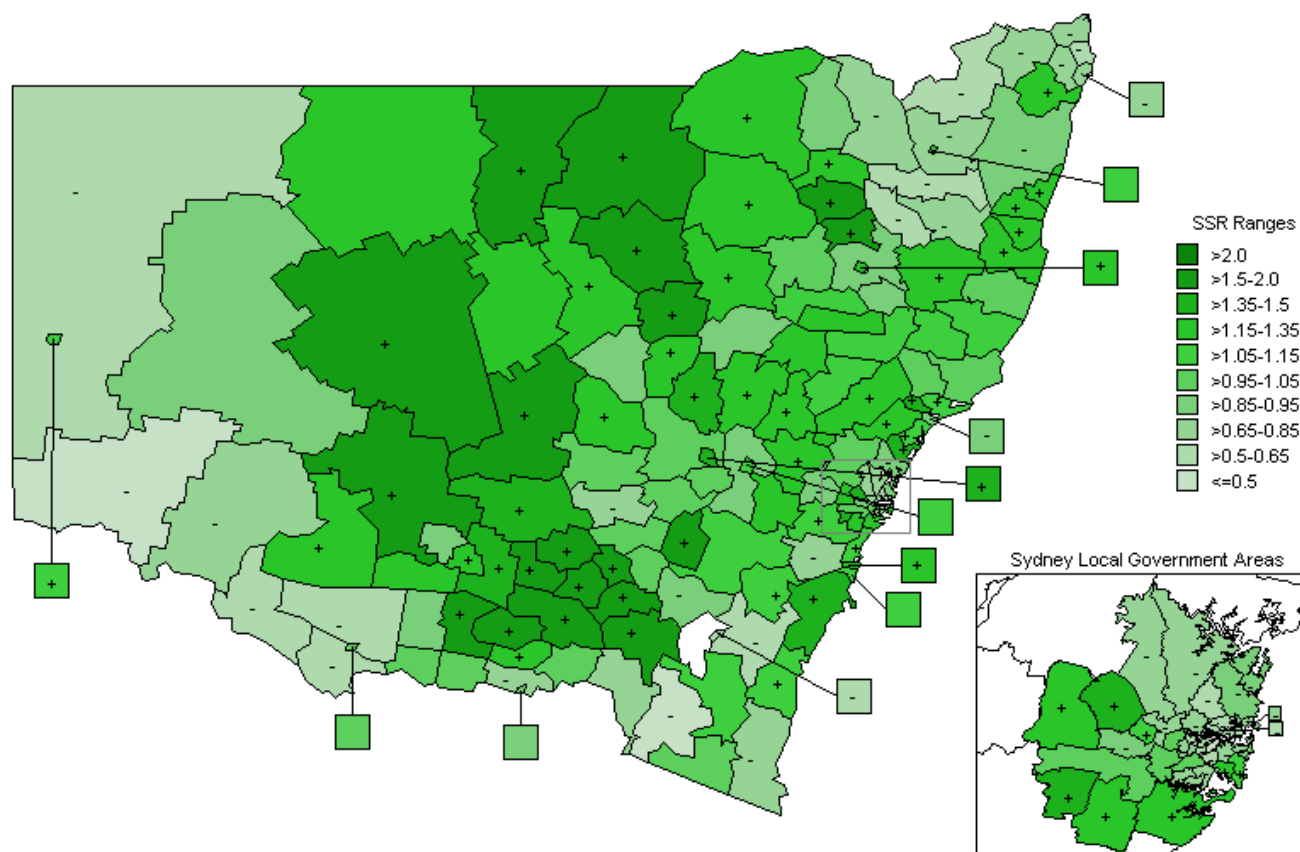


Method used for smoothing for CHO report

- Convolution, or Besag, York and Mollié (BYM) model (Besag et al 1991)
- ‘State of the art’ model for disease mapping (Lawson,2005)
- Incorporates terms that adjust for
 - General variability (‘global’, ‘overdispersion’, heterogeneity) and
 - spatial variability (‘local’, ‘spatial autocorrelation’).
- Expect both these terms involved in many indicators. Spatial component also an adjustment for confounders.

Coronary Heart Disease by LGA

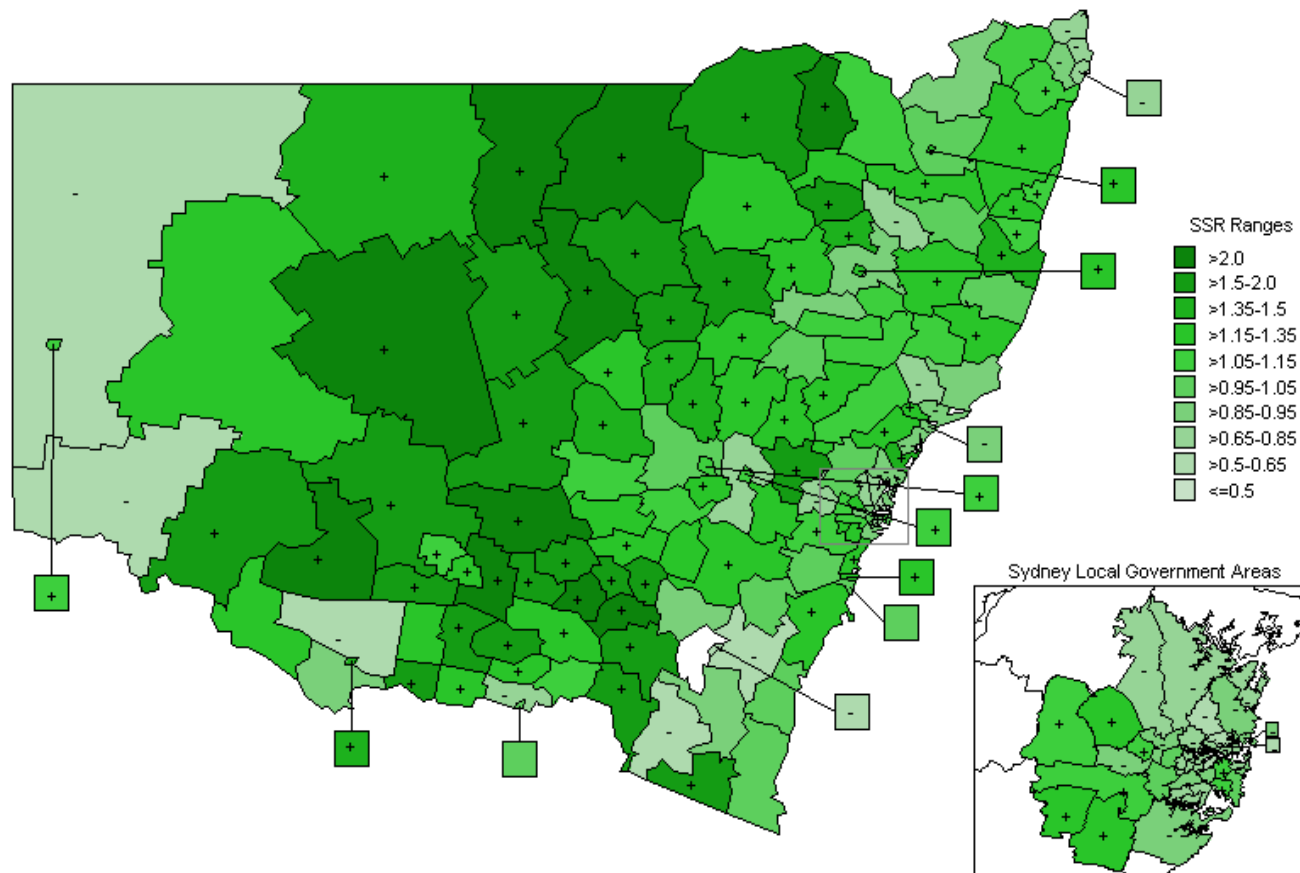
Coronary heart disease hospital separations by local government area
NSW 2003-04 to 2004-05



- Significantly lower than state average, + Significantly higher than state average

Smoking attributable hospitalisations

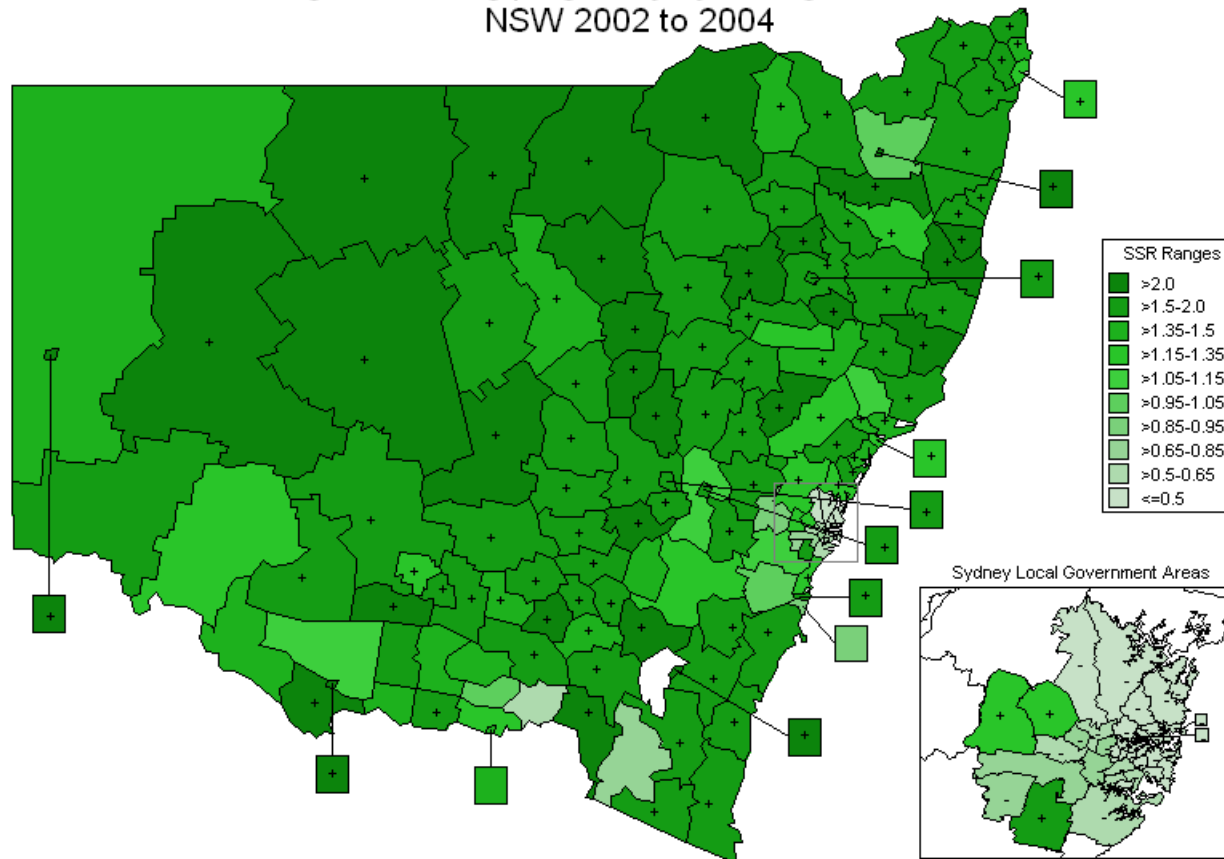
Smoking attributed hospital separations by local government area,
NSW 2003-04 to 2004-05



- Significantly lower than state average, + Significantly higher than state average

Rates of smoking in pregnancy in NSW, 2002-2004, by LGA

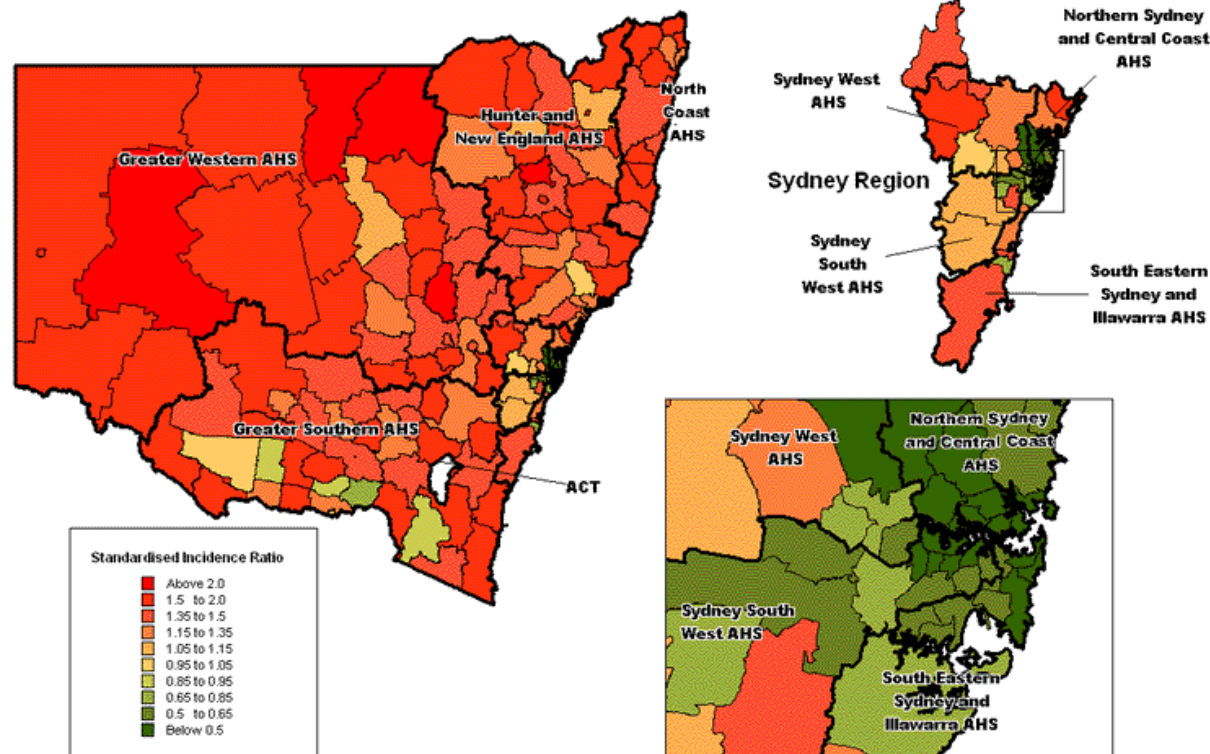
Smoking at all during pregnancy by local government area, NSW 2002 to 2004



- Significantly lower than state average, + Significantly higher than state average

Current eCHO page – based on *age-standardised rates*

Smoking at all during pregnancy by local government area,
NSW 2001 to 2003
Smoothed Standardised Incidence Ratio



Variation in rate of smoking during pregnancy

- Unique spatial distribution
- Important population health issue
- Interesting case study
- Opportunity to develop spatial analysis skills by answering the questions:
 - Does this distribution reflect variation due to socioeconomic disadvantage?
 - Is there a distinct 'Sydney' effect

Why important

- Smoking in pregnancy detrimental to baby
 - Lower birth weight
 - More likely to be premature
- Analysis could be potentially useful for health promotion
 - Target message to more focussed groups
- Health area-level analysis of little benefit

Data sources for this study

- NSW Midwives Data Collection
 - Total pregnancies during 2002–2004
 - Recorded whether a mum smoked *at all* during pregnancy and age of mum (years)
 - By SLA of residence (2004 LGA boundaries)
- 2001 Census
 - Socioeconomic status (disadvantage)
 - Proportion Indigenous

Covariates

- Age of mum (years) – average for each LGA
- SEIFA Index of Relative Social Disadvantage
 - population weighted ranks
 - 18% smoking in least disadvantaged quintile cf 27% smoking in most disadvantaged
- Sydney Metro area (1=Sydney, 0=otherwise)
 - 22% smoking in ‘urban’ cf 25% in ‘rural’
- Proportion of Aboriginal or Torres Strait Islanders in the population (%)
 - 57% smoking in Indigenous mums (cf 14% in non-Indigenous)

Modelling undertaken

- Modelling smoking prevalence
- Random effects (RE) models:
 - None (standard logistic regression!)
 - Global RE only (shrink to state mean)
 - Local RE (shrink to local mean) and global RE
- Models fitted using WinBUGS
- Model comparisons using the Deviance Information Criterion (DIC: lower values are better)

Why model random effects?

- The unit of analysis is the local government area
- Smoking prevalence is expected to have extra-binomial variation due to unmeasured covariates (heterogeneity)
- The standard logistic model, which assumes binomial variation, will under-estimate the standard errors
- We can “fix” this by modelling for the extra-binomial variation using random effects

Covariates

- To the three random effects models...
 - Include covariates on univariate basis (4 models)

Then,

- Model effect of
 - Rank of disadvantage,
 - Being in Sydney metropolitan area
and
 - % Indigenous
after adjusting for age.

Results

Univariate models of smoking:

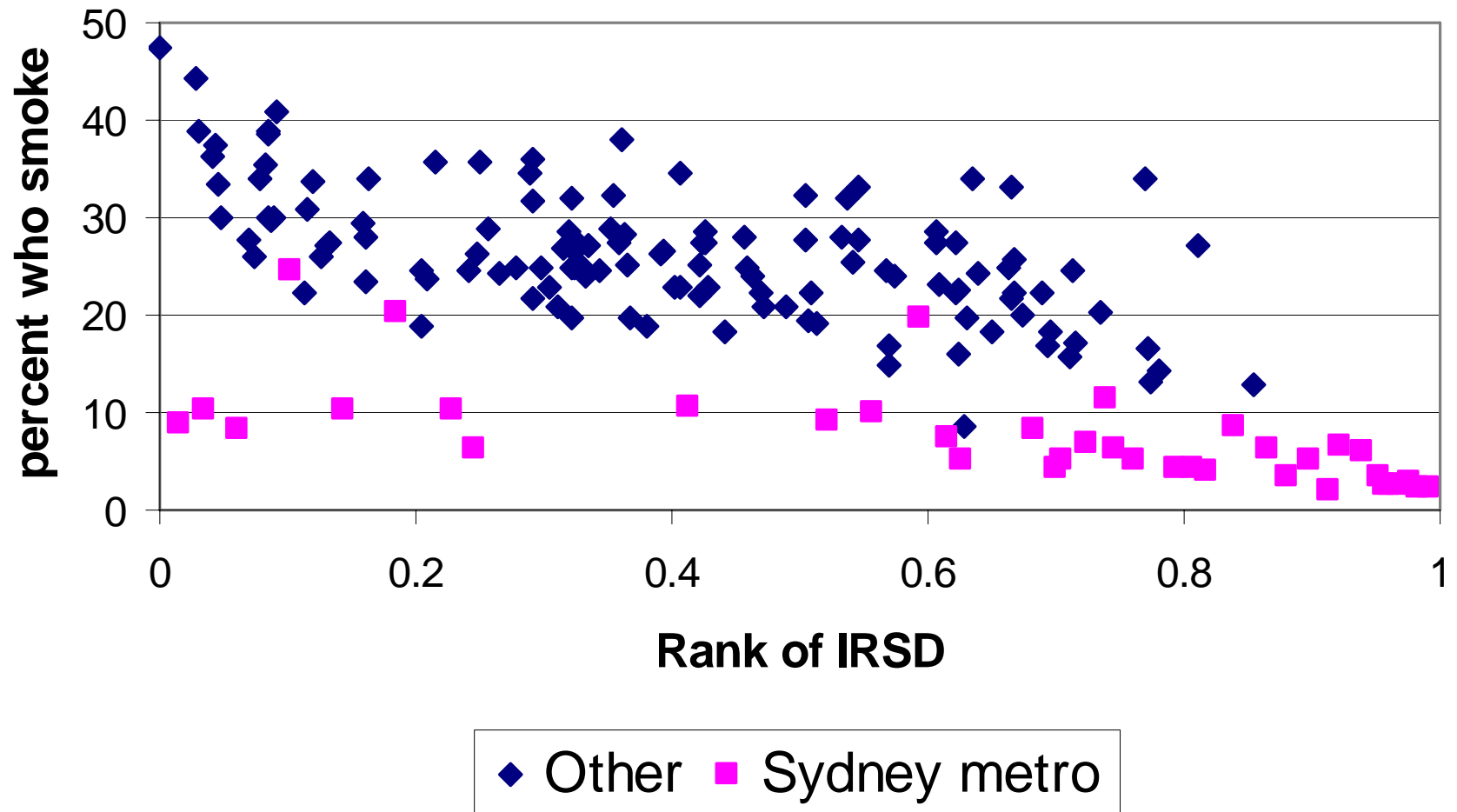
Covariate	Random effects	Log odds ratios		DIC
		Estimate	Std Error	
Mean age	None	-0.454	0.005	4356
	Global	-0.480	0.014	1293
	Local + global	-0.480	0.015	1294
Socioeconomic disadvantage	None	-1.33	0.02	12667
	Global	-2.21	0.17	1332
	Local + global	-2.30	0.14	1333
Sydney metropolitan	None	-1.05	0.01	8594
	Global	-1.69	0.09	1319
	Local + global	-1.71	0.09	1319
Percent Indigenous	None	0.114	0.002	12396
Indigenous	Global	0.056	0.008	1332
	Local + global	0.055	0.009	1333

Bivariate models of smoking, adjusted for age:

Covariate	Random effects	Log odds ratios		DIC
		Estimate	Std Error	
Socioeconomic disadvantage	None	0.69	0.03	3830
	Global	0.24	0.15	1293
	Local + global	0.19	0.12	1294
Sydney metropolitan	None	-0.53	0.01	2558
	Global	-0.68	0.05	1275
	Local + global	-0.66	0.05	1275
Percent Indigenous	None	0.022	0.002	4180
Indigenous	Global	0.003	0.004	1294
	Local + global	0.003	0.004	1294

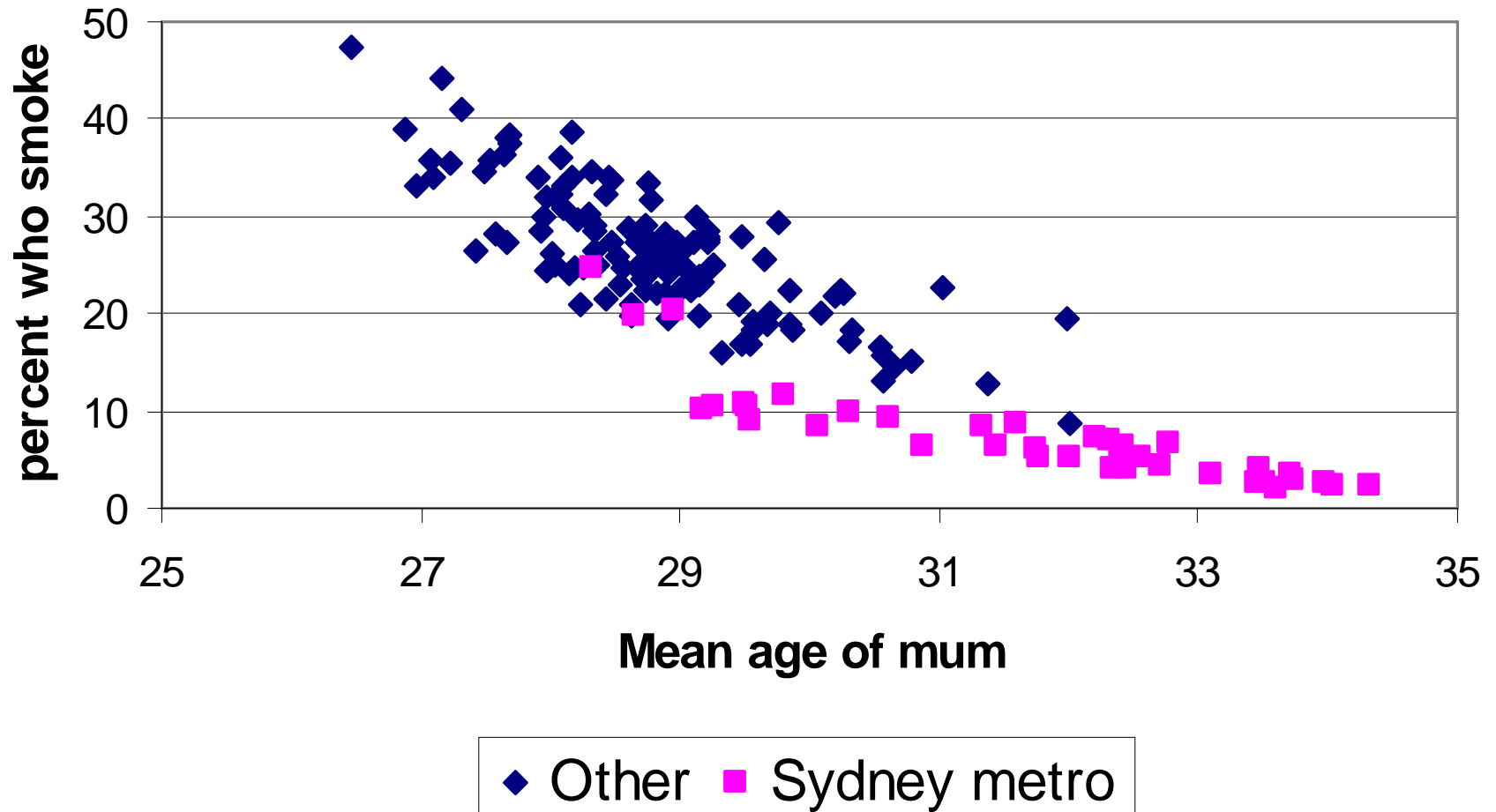
Disadvantage and smoking

IRSD rank vs % smoking



Mean age and smoking

Mean age vs % smoking



Discussion

The background of the slide is a solid blue color. Overlaid on this background is a faint, light blue graphic. This graphic consists of a central shield-like shape divided into four quadrants by a cross. In the center of the shield is a detailed silhouette of a rampant lion, facing left. Each of the four quadrants contains a seven-pointed star. The entire graphic is rendered in a lighter shade of blue than the background.

Summary of findings

- Major effect of age on the proportion of women who smoke during pregnancy
- Evidence that being outside metropolitan Sydney is also important

Reporting Bias?

- Smoking status is self reported.
- Is it possible that this result is due to selective under-reporting of smoking status in Sydney metropolitan area?
 - More Sydney mums giving socially acceptable response
- Possible, but how likely, and how to test?
 - Validity study in 1998 (94.9% agreement)
 - Results re effect of smoking based on MDC reflect other results (Wong and Bauman 1997)
 - PhD material here?...

Methods

- Important to analyse small area data using random effects models
- Bayesian modelling can be challenging
- Will be modelling using global RE only:
 - age and Indigenous status on unit record data (hierarchical model)
 - smoking in second trimester

Public health implications

- Potentially could focus interventions on supporting young mothers-to-be in non-Sydney LGAs to quit smoking
- Also beneficial to target Blacktown, Penrith and Campbelltown LGAs

Acknowledgements

- HOIST – NSW Health's data warehouse for data
- Mark Cerny
- Darren Mayne
- Alan Willmore

Questions and Comments

Appendix: Quality of MDC data for smoking

1. Mothers and Babies 1998 Validity Study (Public Health Bulletin Vol 9 No S-2, 2000)
 - For smoking in pregnancy:
 - 94.9% agreement
 - Kappa = 0.85
2. Wong and Bauman (1997) "...concordance between published epidemiological evidence and finding from the MDC data on the effects of smoking in pregnancy is clearly illustrated in table 2" (*Aust NZ J Obstet Gynaecol* **37**(2): 168)

Summary of smoking in pregnancy by LGAs, by health area

Health Area of residence	No. LGAs	Comparison with overall state			% smoking mums	
		Signif lower	same	Signif higher	Av	Range
Sydney South West	15	12	2	1	15.7	4.1 - 24.7
South Eastern Sydney & Illawarra	13	9	1	3	10.3	2.8 - 24.6
Sydney West	9	4	1	4	15.7	6.0 - 30.1
Northern Sydney & Central Coast	13	11		2	6.3	2.0 - 24.9
Hunter & New England	33		4	29	26.6	16.0 - 38.8
North Coast	12			12	25.3	19.2 - 36.4
Greater Southern	41		13	28	23.4	8.7 - 34.7
Greater Western	31		5	26	30	17.1 - 47.5

Mean age of mums and smoking

Mean age vs %smoking

