

Centre of Research  
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in Rural and Remote  
Primary Health Care

## CENTRE OF RESEARCH EXCELLENCE RURAL AND REMOTE PRIMARY HEALTH CARE

# ‘Rurality’ and Geographic Amenity: How they relate to rural primary care accessibility and workforce retention

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Visiting Scholar, RGC

November 20 2014



**MONASH** University  
Medicine, Nursing and Health Sciences



Broken Hill University  
Department of Rural Health



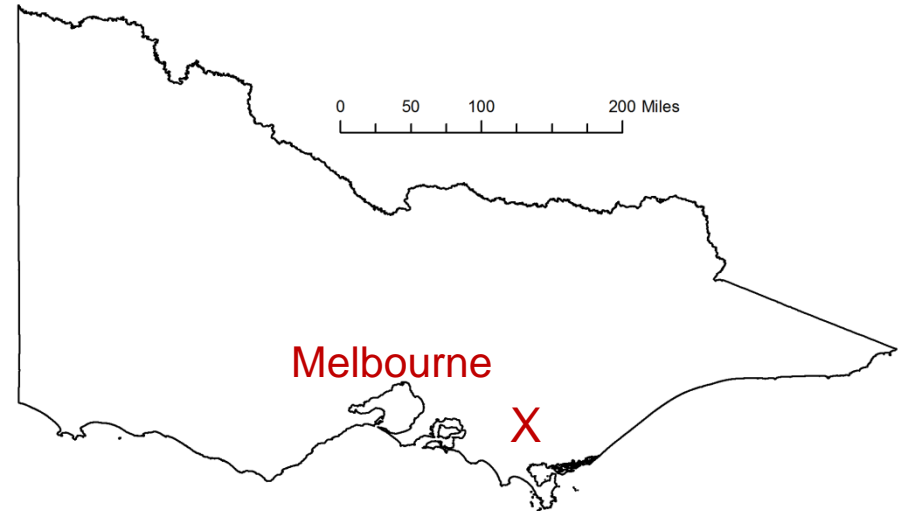
# About me

- Training: Statistics (general), IT (programming)
  - Research assistant in various health related projects
- PhD: 2008 (Australia)
  - Supervised by a geographer, rural health focus
  - Aim to better measure spatial differences of access
  - Development of the 2SFCA methodology

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# My home

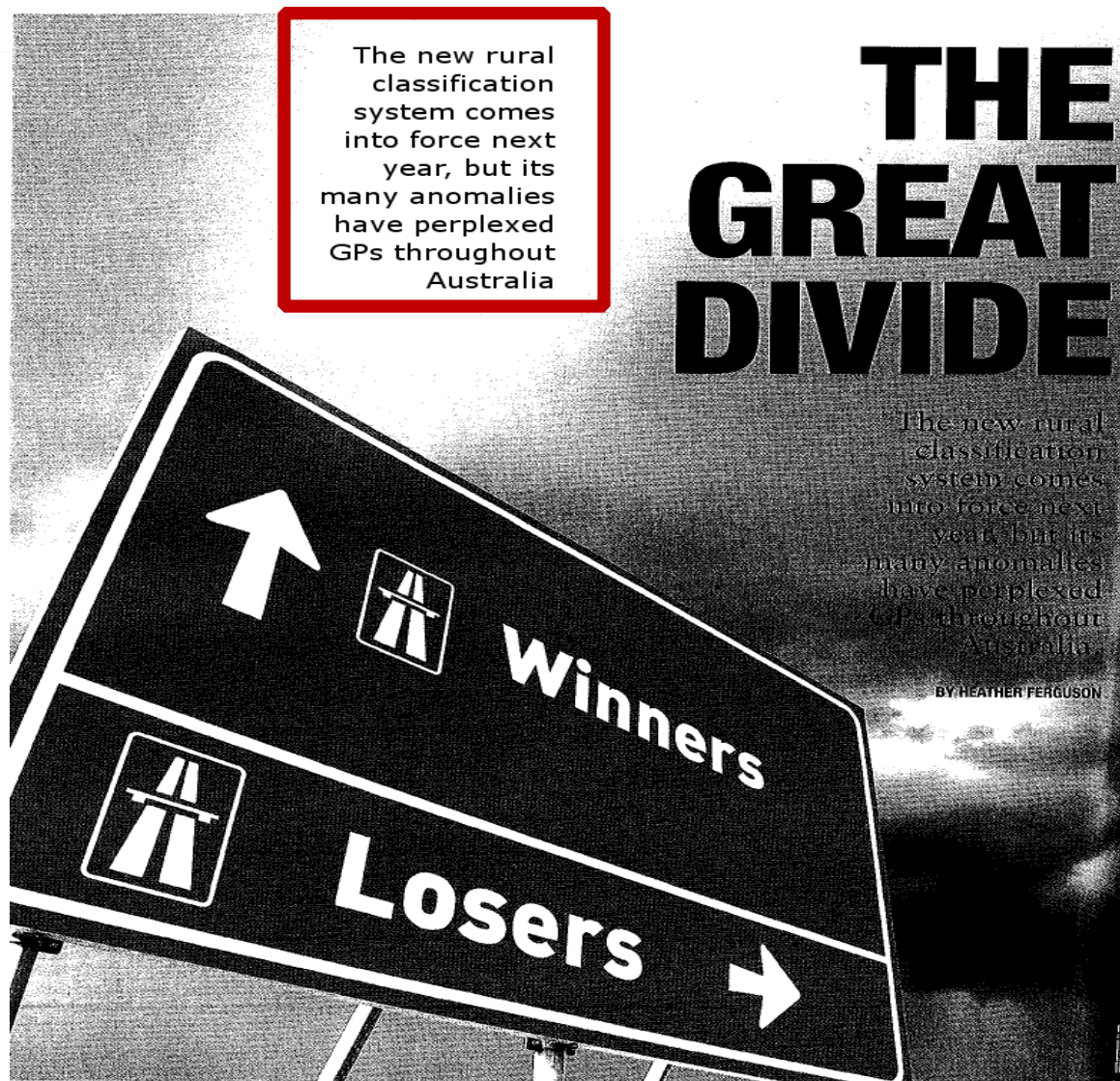


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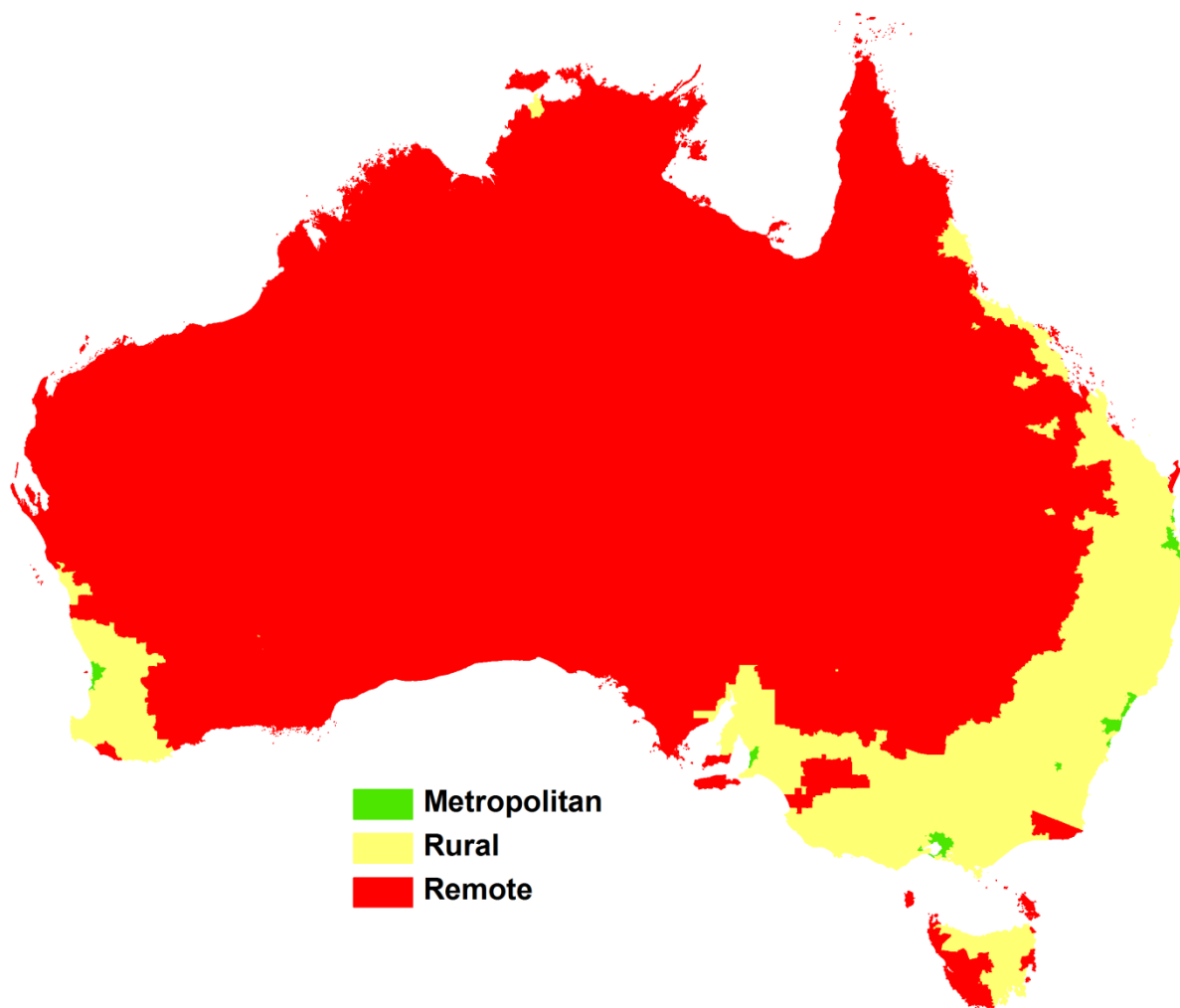
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# Australian policies...

Australian  
Doctor,  
9 Oct 2009



# Australia's population



Metropolitan =

- 69.9% population
- 0.2% area

Rural / regional =

- 27.8% population
- 13.4% area

Remote =

- 2.3% population
- 86.4% area

# Poorer health/access - rural

Compared to metropolitan residents...

- Life expectancy of rural Australians about 4 years lower and >10 years lower for Indigenous in rural
- Key lifestyle risks – e.g. smoking, obesity, alcohol, activity – higher prevalence in rural
- Rural/regional utilise 15-20% less GP services and 25-40% less specialist services
- Remote utilise 30-40% less GP services and 60-70% less specialist services

# My research theme(s)

- Chronic shortages and maldistribution of the rural health workforce
- Primary care is the system entry point
- Drivers and levers for change through health policy
- ...but poor awareness where and how to target support(s)

## Key themes:

- Improved measures of workforce shortage and accessibility
- Improved understanding of rural medical workforce supply and distribution
- Improved resource allocation via evidence-based policies



# Key project 1: MABEL

MABEL = Medicine in Australia: Balancing Employment and Life

- National longitudinal study of 15-20% of all doctors
- Yearly survey, began in 2008, currently completing Wave 7 (funding for another 2 years) with yearly retention of 80% participants
- Survey includes >80 questions, most repeated yearly
- About 3000-3500 GPs
- About 3800-4300 Specialists

<http://mabel.org.au>



# MABEL: Rural workforce

## Rural workforce supply and distribution theme:

- To better understand decisions to stay in, or leave, rural and remote areas
- To provide evidence of the effectiveness of rural medical workforce policies

## 2010 – now...

- 11 publications (e.g. professional satisfaction, rural background, rural location preferences, mandated IMGs, specialist outreach, retention incentive preferences)

AND...

# Policy change success



**Senator the Hon Fiona Nash**  
Assistant Minister for Health  
Senator for New South Wales  
Deputy Leader of the Nationals in the Senate

## **MEDIA RELEASE**

31 October 2014

**Government Announces Changes to Attract More Doctors to the Bush**

*“The Coalition Government has listened to these [previous perverse incentive] concerns, and will now introduce a new classification system, the Modified Monash Model (MMM), for the purposes of health workforce programmes.”*  
*...MMM developed by Prof John Humphreys and Dr Matthew McGrail*

# Key project 2: CRERRPHC

CRERRPHC = Centre of Research Excellence in Rural and Remote Primary Health Care

Supported by APHCRI 2011-2014

- **Stream 1:** Develop a better understanding and improved measure of access to PHC services
- **Stream 2:** Develop an evaluation framework for monitoring impact of PHC services on access and equity of health outcomes
- **Stream 3:** Develop and evaluate appropriate sustainable PHC service models in priority health areas

<https://www.crerrphc.org.au/>

# CRERRPHC: Measuring access

Key aim...to develop a national-level measure of (rural) primary care accessibility that is:

- Constructed using **smallest** possible geographical unit
- Uses **current, accurate** data and latest methodologies
- **Sensitive** to data input changes
- **Two-step floating catchment area (2SFCA) method**

# Spatial accessibility

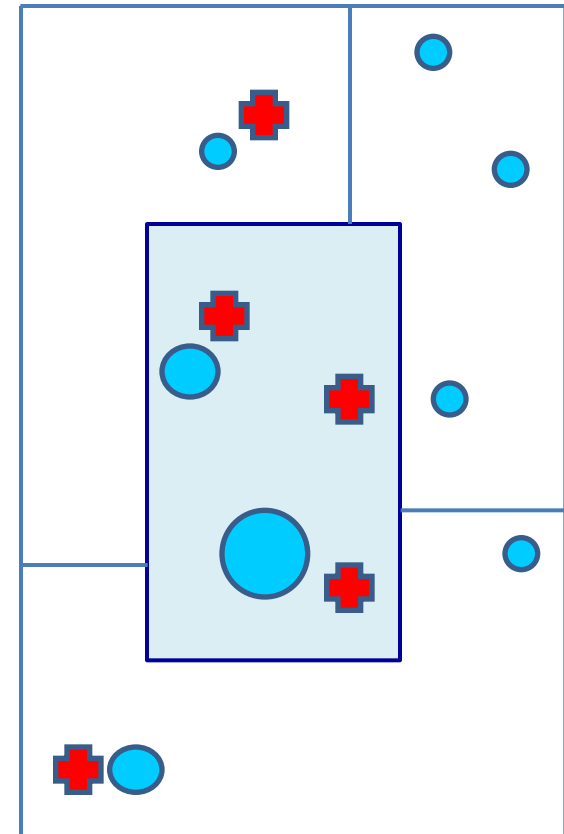
- Rural population's perspective...
  - Spatial accessibility to primary care is key
  - Must be adequate supply (volume and type) to meet community needs
  - Must be within reach (proximal)

# Provider: population ratios (PPRs)

- Provider : population ratios (PPRs) are a widely used measure of spatial accessibility in health

Key assumptions:

1. All access occurs within region boundary
2. Proximity barrier is negligible



# PPRs in (rural) health policy

PPRs have a strong appeal in health policy:

- easily understood (e.g. 1:2,000)
- easy to calculate
- In USA health policy, PPRs a component of both MUA (Medically Underserved Area) and HPSA (Health Professional Shortage Areas)
- In Australian health policy, PPRs define DWS status (District of Workforce Shortage)



# Accuracy of PPRs in health?

## Key assumptions:

1. All access occurs within region boundary

*Increasingly true as regions grow in size*

2. Proximity barrier is negligible

*Increasingly true as regions shrink in size*

Problem...conflicting issues

# The 2SFCA method

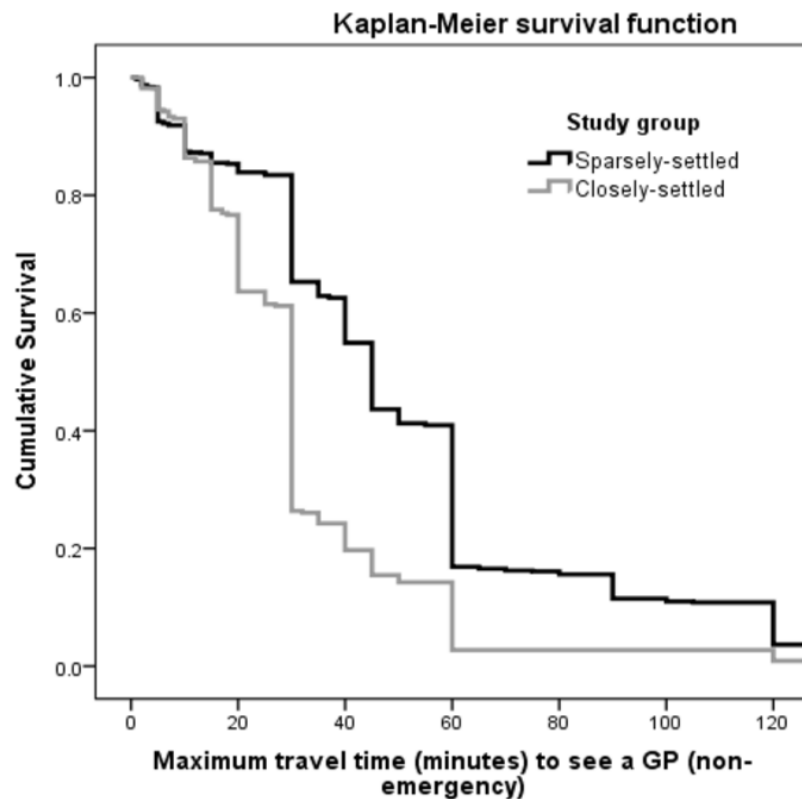
Step 1: For each service location (j) of volume  $S_j$ , determine what population size (summed  $P_k$ ) can potentially access that service (up to the catchment border =  $d_{\max}$ )

$$R_j = S_j / \sum_{k \in [d_{jk} < d_{\max}]} P_k * f(d_{jk})$$

Step 2: For each population location (i), determine what services (j) can potentially be accessed by that population (up to the catchment border =  $d_{\max}$ ), and aggregate the PPRs for these services ( $R_j$ )

$$A_i = \sum_{j \in [d_{ij} < d_{\max}]} R_j * f(d_{ij})$$

# Travel differences



*Similar shape to  
distance-decay  
functions seen  
earlier.*

	Percentiles (minutes)						
	Mean	10 <sup>th</sup>	25 <sup>th</sup>	50 <sup>th</sup>	75 <sup>th</sup>	90 <sup>th</sup>	95 <sup>th</sup>
Closely-settled (minutes)	31.9	10	20	30	35	60	60
Sparsely-settled (minutes)	54.1	10	30	45	60	120	120

# Variable rural catchments

Catchment sizes are intended to 'match' population behaviour:

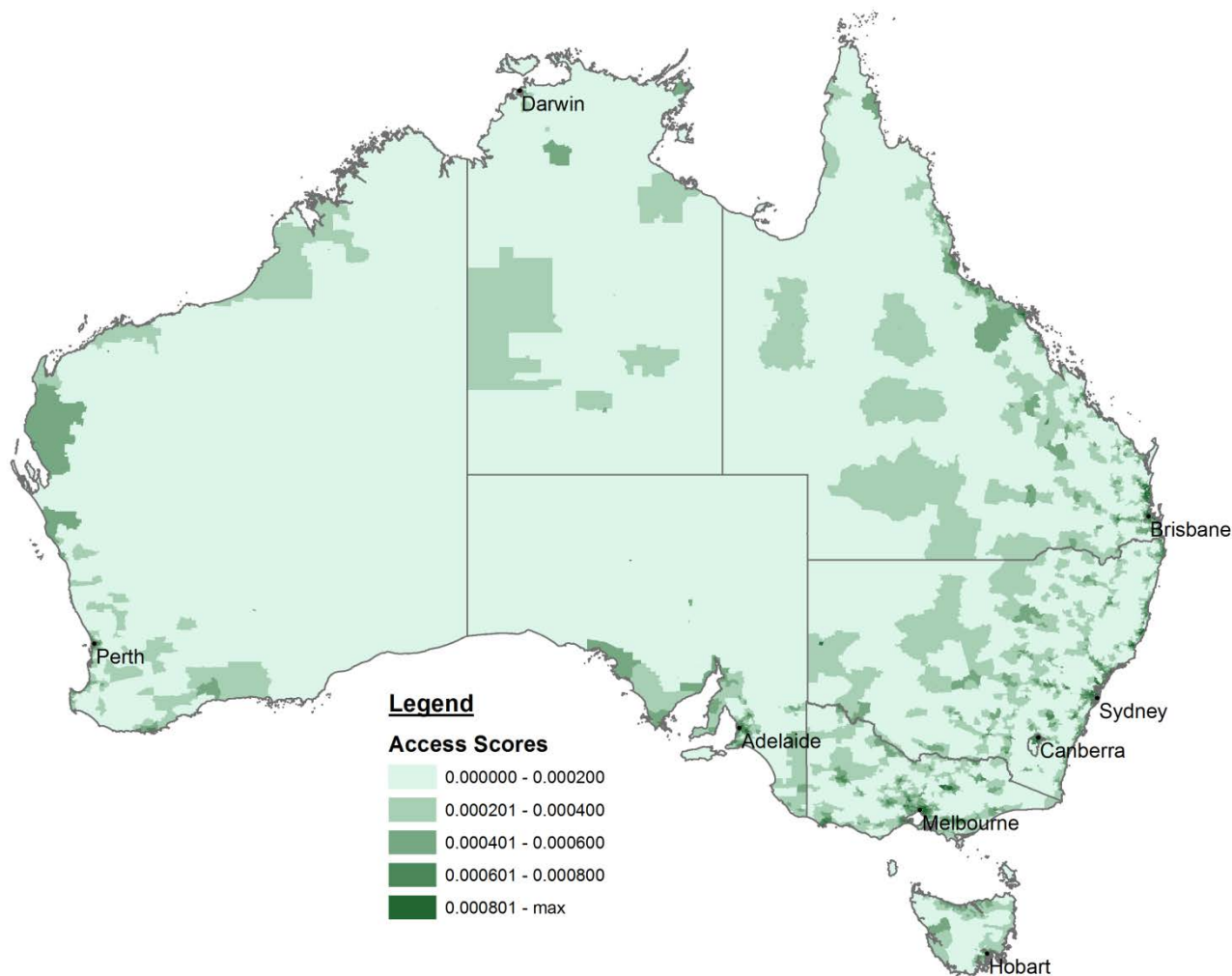
- Travel behaviour relates to population dispersion
- Service catchments grow in more dispersed settings (providing services to a wider area)
- Population catchments also grow in more dispersed settings (accepting of further travel)

*Thus, the 2SFCA method should match these traits in 'more rural' areas.*

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# National-scale - Australia



# RGC – Project 1: “Accessibility”

Starting point = accessibility for Australia (2SFCA)

Aim: To explore, using a comparison of Australia and the USA, what contributes to spatial differences of primary care accessibility in rural areas:

- ‘Rurality’
  - Place attractiveness (geographic amenity)
  - State-level policies
- 
- Expand to USA model

# 'Rurality': Australia vs USA

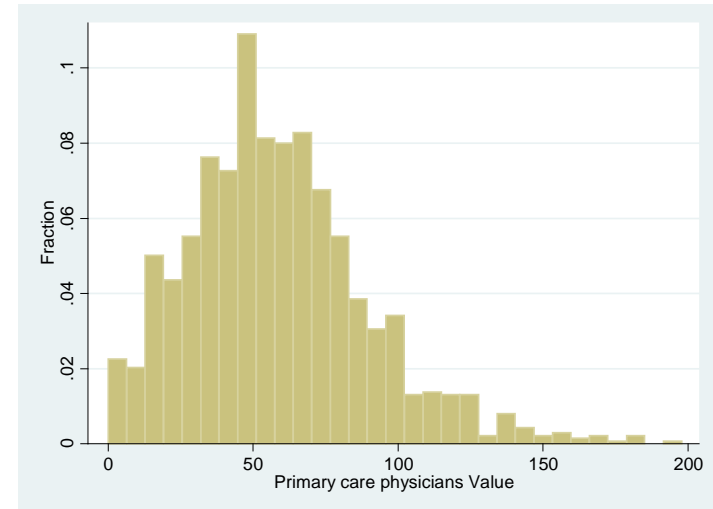
Rurality	Area (Mi <sup>2</sup> )	Population	% Area	% Population
<b>RUCC 1</b>	281,947	168,523,961	9.5%	55.0%
<b>RUCC 2-3</b>	660,936	92,341,638	22.4%	30.1%
<b>RUCC 4-5</b>	363,410	18,208,687	12.3%	5.9%
<b>RUCC 6-7</b>	1,055,028	22,898,842	35.7%	7.5%
<b>RUCC 8-9</b>	593,521	4,701,878	20.1%	1.5%
<b>Total</b>	2,954,842	306,675,006		

Remoteness	Area (Mi <sup>2</sup> )	Population	% Area	% Population
<b>ASGC-1</b>	24,527	15,064,833	0.3%	70.2%
<b>ASGC-2</b>	345,447	3,982,691	4.5%	18.6%
<b>ASGC-3</b>	1,067,865	1,952,011	13.9%	9.1%
<b>ASGC-4</b>	998,895	280,164	13.0%	1.3%
<b>ASGC-5</b>	5,250,857	176,014	68.3%	0.8%
<b>Total</b>	7,687,591	21,455,713		

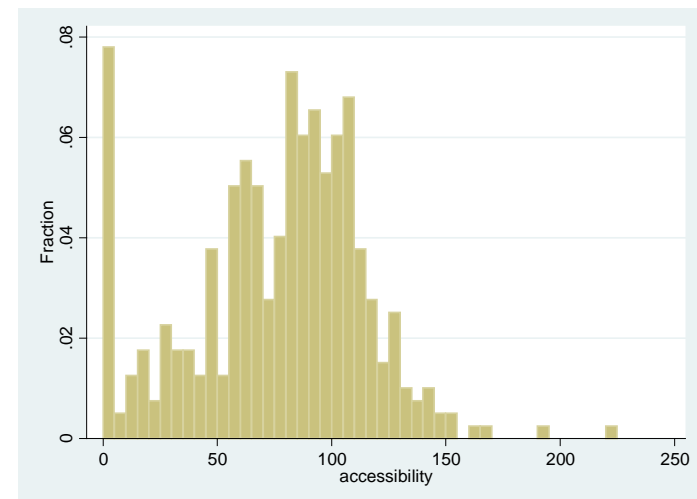


# Spatial accessibility

Despite problems of  
PPRs, only measure in  
USA (by counties)



Equivalent PPR by Local  
Government Areas (Oz)



2sfca measure by town

# Place attractiveness

## Economic:

- House price, Income, Uninsured, Exercise

## Proximity (near to) [and rurality]:

- Hospital, Metropolitan/Capital, Schools & Coastline (Aus), Work commute, Population

## Socio-demographic:

- Education, Indigenous, Unemployed, Aged 65+

## State (included, not explored):

# Analysis: Linear Regression

3\* Linear regression models (popu size weighted):

Dependent (outcome) = accessibility score for each location:

- USA – County (N=1949):  $R^2 = 0.49$
- Aus – LGA (N=397):  $R^2 = 0.40$
- Aus – Town (N=1091) [pop 500–50,000] :  $R^2 = 0.38$

Independent ('predictors') = economic, proximity / rurality, socio-demographic, state

# USA model

## Higher accessibility

- Higher house value
- More 'affluence' (exercise)
- RUCC 6/7 wrt 8/9
- RUCC 4/5 wrt 8/9
- More 65+
- More educated

## Lower accessibility

- More uninsured
  - *More income*
- Longer commute
- Adjacent to metro
- No hospital in region
- More American/Indian
- More unemployed

# Australian models

## Town-level:

### Higher accessibility

- Close to private schools
- Close to coastline
- Close to State capitals
- Larger population
- More educated
  - *Remote areas*

### Lower accessibility

- Indigenous

## Region-level:

### Higher accessibility

- Larger population
- Increased pop. Density
- Having a hospital
- Higher house value
- More 65+
  - *More unemployed*

# Results: comparison (1)

STRONG factors – higher accessibility:

- Larger town/community population

*Doctors prefer to work in larger support networks*

- Located near to a hospital

*Doctors prefer not to work in professional isolation*

- Increased house price / affluence

*Doctors prefer to work/live in 'nice' areas*

## Results: comparison (2)

MODERATE factors – higher accessibility:

- Aus: Nearby to coastline / capital city
  - *‘Nice’ areas and within reach of larger cities*
- US: More insured, US/Aus: More educated
  - *?Affluence, earning capacity*
- Aus: Few indigenous
  - *Higher prevalence in extreme remote regions*
- US/Aus: More age 65+
  - *Unsure if ‘attraction’ or just higher demand / need*



# So what?

Original aim: What contributes to spatial differences of accessibility?

These data help to unpack 'rural' coming in many different 'flavours'...and health policy / incentives need to reflect these differences.

**More of this:**



**Senator the Hon Fiona Nash**

Assistant Minister for Health

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# RGC – Project 2: “Rural retention”

Accessibility =  $f_x$  (current ‘stock’, recruitment,  
retention, mobility)

Aim: To explore, using observed USA rural  
workforce, what contributes to spatial  
differences of rural primary care retention

# Retention measures

Dataset = AMA (2000-2014, all even years), primary care, active, non-resident only

Retention = Same 'rurality' (RUCC) after 2 years (up to 7 periods per doctor).

- (1) 'Churn' or 'turnover' = volume not retained / total observed doctors (per county)
- (2) 'To less rural' = individuals who move to a more urban RUCC, but stay within rural areas
- (3) 'To urban' = individuals who move rural to urban

# Observed locations:

		Destination RUCC									
		1	2	3	4	5	6	7	8	9	Total
	1	868,710	13,066	5,264	2,270	797	1,808	960	192	211	893,278
Origin RUCC	2	12,673	296,542	3,753	1,863	550	1,560	871	201	175	318,188
	3	5,098	3,723	120,469	1,019	351	1,305	523	151	117	132,756
	4	2,112	1,875	1,029	48,067	150	530	327	49	74	54,213
	5	778	644	423	167	22,127	210	341	43	129	24,862
	6	1,881	1,694	1,510	598	221	46,372	471	116	122	52,985
	7	1,004	910	672	382	398	486	32,019	90	255	36,216
	8	205	215	166	91	40	150	91	4,585	38	5,581
	9	244	204	167	64	176	145	308	47	6,887	8,242
	<b>Total</b>	892,705	318,873	133,453	54,521	24,810	52,566	35,911	5,474	8008	1,526,321

# ‘Churn’ outcome:

## Example:

2000: 20 active doctors ... 2002: 16 stayed, 4 moved

2002: 6 new + 16 stayed = 22 active doctors

2002: 22 ... 2004: 14 stayed, 8 moved

County retention rate =

# stayers = 30 / # observed = 42 = 71%

i.e. Churn / turnover rate = 29%

# Churn: Regression results

Dependent (outcome) = 'retention' rate per rural county (N=1686).

Independent ('predictors') = county-level factors:  
accessibility, economic, proximity / rurality, socio-demographic, state.

3 strong significant area-level predictors only:

- Having a hospital in region
- Increased population size (RUCC)
- Higher accessibility value

## Churn results (2)

Accessibility: Counties already experiencing lower accessibility also see increased turnover - poorer supply and continuity of care.

No hospital: Increased turnover where doctors are more isolated and patients already have poorer access to alternative care.

Smaller urban towns: Regions with smaller critical mass and where a loss of services impacts greatest, experience higher turnover.



# Individual retention: Regression results

## All rural primary care / family physician doctors:

### Outcome 1: Mover to less rural:

- Female
  - Osteopathic
  - Young
  - IMG
  - Urban-born
- 
- Low accessibility area
  - Low income area
  - Low house value area
  - No hospital
  - Has more 65+ population
  - Has fewer African-Indian
  - Has fewer Hispanic

### Outcome 2: Mover to urban:

- Female
  - Osteopathic
  - Young
  - IMG
  - Urban-born
- 
- Low accessibility area
  - Higher income area
  - Higher house value area
  - More unemployed
  - Smaller population size
  - Adjacent to metropolitan
  - Has fewer 65+ population
  - Has more African-Indian
  - Has more Hispanic

# Individual retention: Regression results

## Young (<10 year post-residency) family physician:

### Outcome 1: Mover to less rural:

- No gender difference
  - Osteopathic
  - No IMG difference
  - No urban-born difference
- 
- Low accessibility area
  - Low house value area
  - No hospital
  - Has more 65+ population

### Outcome 2: Mover to urban:

- Female
  - No MD/DO difference
  - IMG
  - Urban-born
- 
- Low accessibility area
  - Has fewer 65+ population
  - No hospital
  - Smaller population
  - Adjacent to metropolitan

# So what?

- Significant factors include both individual-level and area-level
- Factors influencing retention of ‘young’ doctors are different – critical to future supply
- Retention of rural primary care doctors is critical to maintaining accessibility
- Health policies must target doctors working in ‘problematic’ rural settings

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# Thanks

Great experience to  
immerse myself in USA  
setting.

I intend to continue  
collaborative research  
with RGC staff for many  
years (\$s)...

