Calculators to individualise the predicted probability of working in a rural area: an answer for the medical workforce issues in non-Metro areas?

A/Prof Srinivas Kondalsamy-Chennakesavan
Dr Bushra Nasir
Dr Remo Ostini
Prof Sarah Strasser
Prof Geoff Nicholson

Background

- Health workforce - rural areas
  - Recruitment and retention
  - WHO Review
- Medical workforce
  - Incentives/Schemes
  - HWA Data
  - Predicted oversupply of ~7000 doctors by 2030
  - Maldistribution
  - MABEL/UQMediCoS

Methods

- Design: Retrospective cohort study
- Cross-sectional survey of UQ Medical Graduates (2002-2011)
- Linked with AHPRA, sought help from HWQ/HWA and Medicare Locals; internet searches
- A website within the School of Medicine
- Surveys done online after email link, postal or telephone
- Minimum of three attempts to chase non-responders
- The UQ Behavioural and Social Sciences Ethical Review Committee approved the study

Methods (Cont)

- Information collected
  - Demographics including parents' rural background, partnership status and partner's rural background;
  - Residential history including place of birth and location during preschool, primary school, high school and post-school years and years spent in each of these locations;
  - Boarding school attendance; gap year after high school;
  - Scholarships including bonded scholarships; membership of a rural health club;
  - RCS student status, other tertiary education and postgraduate training in a rural area and
  - Location of current clinical practice and duration spent in a rural area

Methods (Cont)

- Outcomes
  - Current rural practice
  - Long-term rural practice
- Statistical methods
  - Descriptive statistics
  - Multiple logistic regression model
  - Nomogram/Prediction tool: developed from the final multiple regression model
  - Prediction accuracy assessed using concordance index and corrected for optimism using 1000 bootstrap replicates.
  - Calibration plots
- Stata for Mac (Version 14.2) and R (version 3.4.1) were used for statistical analyses

Results

Characteristic	n with responses	Mean (SD) or n (%)
Age (years)	751	33.3 (5.7)
Females	754	391 (51.9%)
Background	754	
Rural[a]		236 (31.3%)
Metro		518 (68.7%)
Duration of residence in a rural area (years)	754	
< 1		460 (61.0%)
1 to < 5		58 (7.7%)
5 to < 10		74 (9.8%)
10 to <15		120 (15.9%)
≥15		42 (5.6%)
Degree of rurality by Remoteness Area	754	
RA 2-3 (regional)		115 (15.2%)
RA 4-5 (remote)		121 (16.1%)

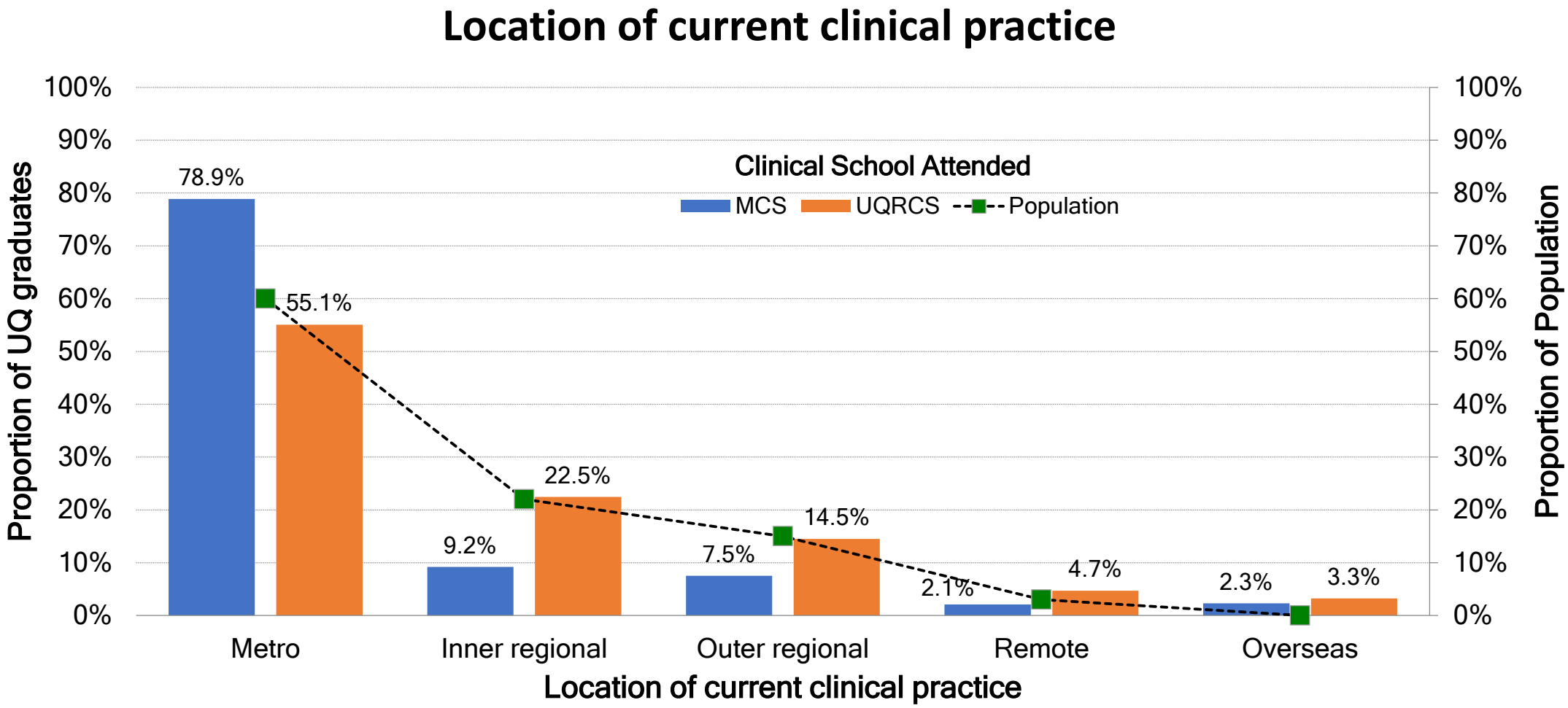
Results (Cont)

Parental rural background	N with responses	N (%)
Father	750	231 (30.8%)
Mother	741	220 (29.7%)
Partner's background	746	
Metro		413 (54.8%)
Rural		149 (19.8%)
Not applicable/single		184 (24.4%)
Boarding		
Primary school	739	6 (0.8%)
High school	738	58 (7.9%)
Medical entry pathway	729	
Domestic-Graduate		670 (91.9%)
Domestic-Undergraduate		39 (5.4%)
Domestic-Full-fee paying		20 (2.7%)

Results (Cont)

Characteristic	n with responses	n (%)
UQRCS[b] exposure (≥1 year)	754	276 (36.6%)
Year 3 only		142 (18.8%)
Year 4 only		24 (3.2%)
Both years 3 and 4		110 (14.6%)
None (MCS[c])		478 (63.4%)
Time period		
Graduated 2007-2011	754	462 (61.3%)
Current primary place of clinical practice	754	
RA2-5 (rural)		205 (27.2%)
RA2 (inner regional)		106 (14.1%)
RA3 (outer regional)		76 (10.1%)
RA4-5 (remote)		23 (3.0%)
Overseas		20 (2.6%)

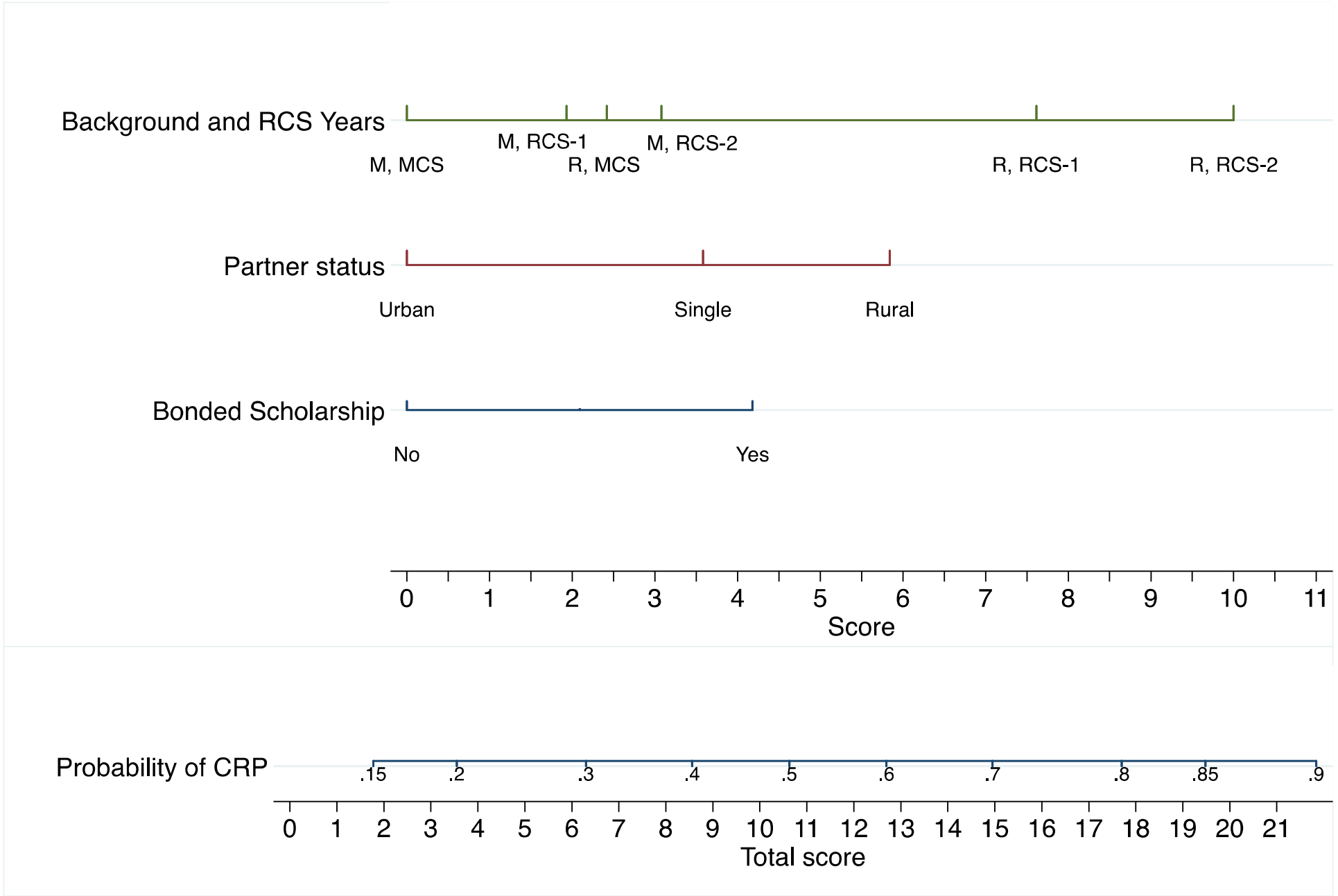
Results (Cont)



Results (Cont): Multiple logistic regression model predicting current rural practice

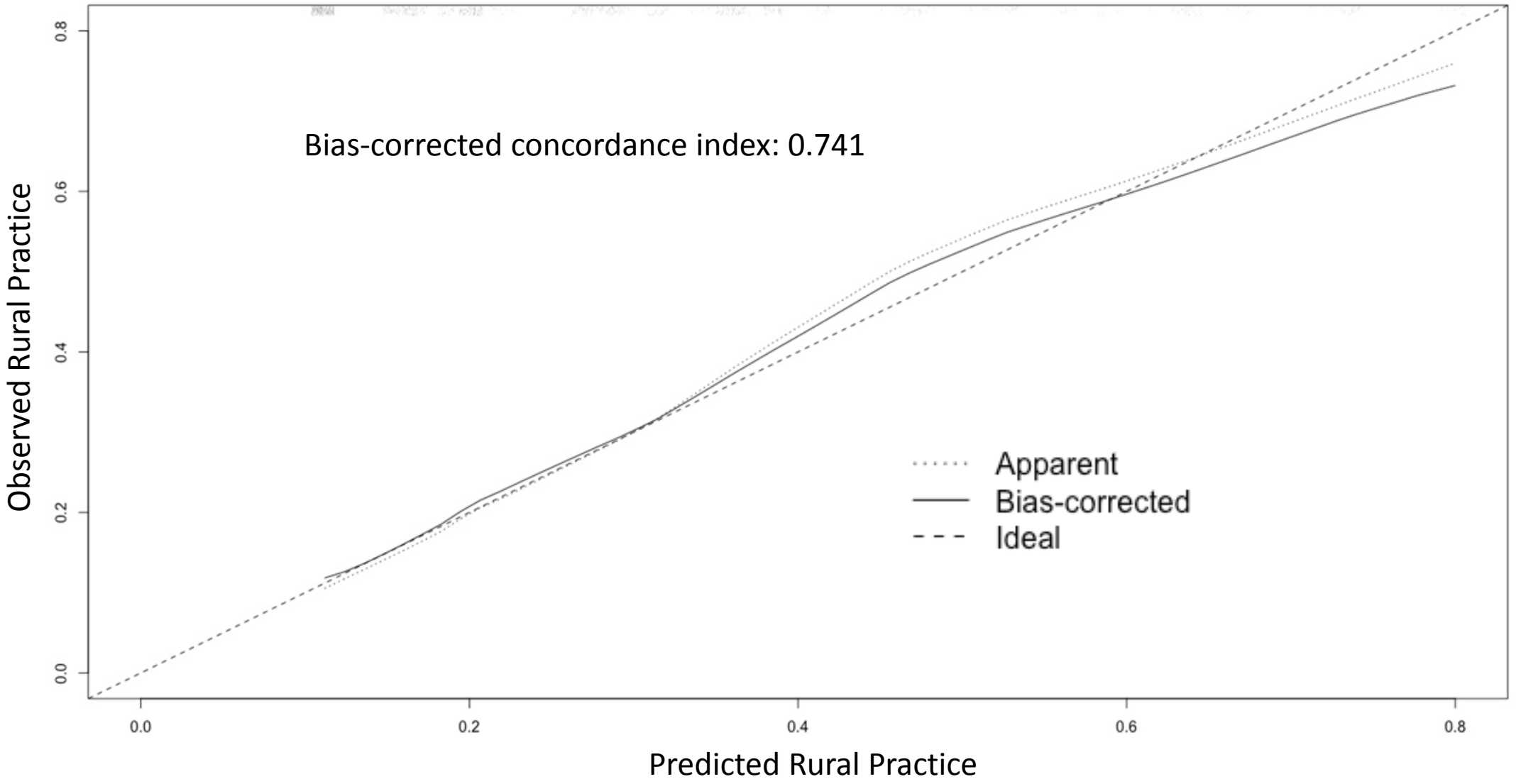
		OR	95% CI		P
Clinical School	Background				
MCS	Metro	Ref			
	Rural	1.61	0.94	2.75	0.084
UQRCS-1 year	Metro	1.46	0.85	2.51	0.172
	Rural	4.44	2.38	8.29	<0.001
UQRCS-2 years	Metro	1.83	0.91	3.67	0.090
	Rural	7.09	3.57	14.10	<0.001
Partner with Metro background		Ref			
Partner with Rural background		3.14	1.99	4.96	<0.001
Partner not applicable/Single		2.02	1.30	3.12	0.002
Bonded scholarship (Yes vs No)		2.27	1.32	3.90	0.003

Nomogram predicting current rural practice (CRP)

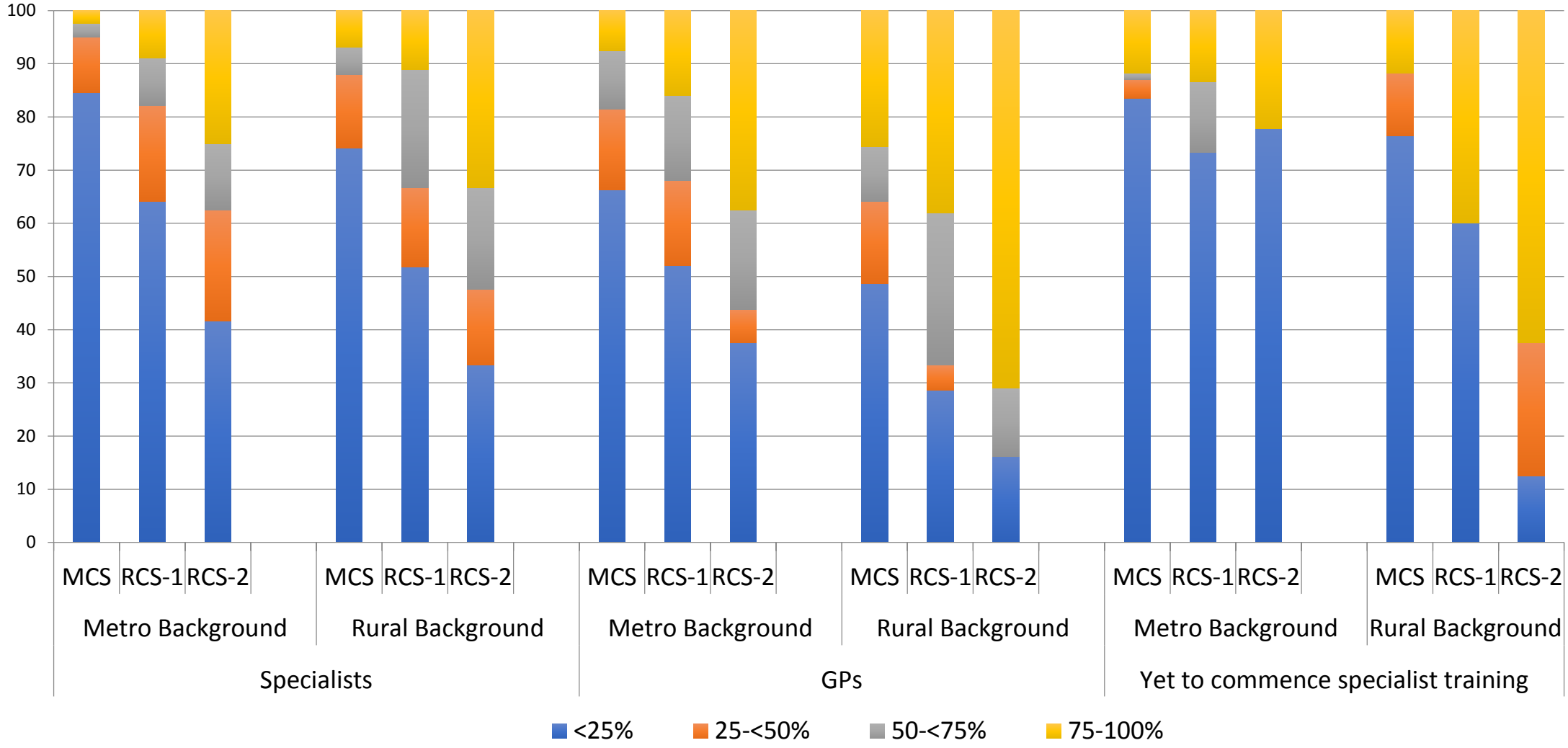


Worked Examples (Current Rural Practice)			
Characteristics	**Example 1**	**Example 2**	**Example 3**
Background	Rural	Metro	Rural
MCS/RCS	MCS	RCS 1	RCS 2
Partner	Urban	Single	Rural
Bonded Scholarship	No	Yes	Yes
Total Score	**2.5**	**9.8**	**20.1**
Predicted probability	**17%**	**45%**	**86%**

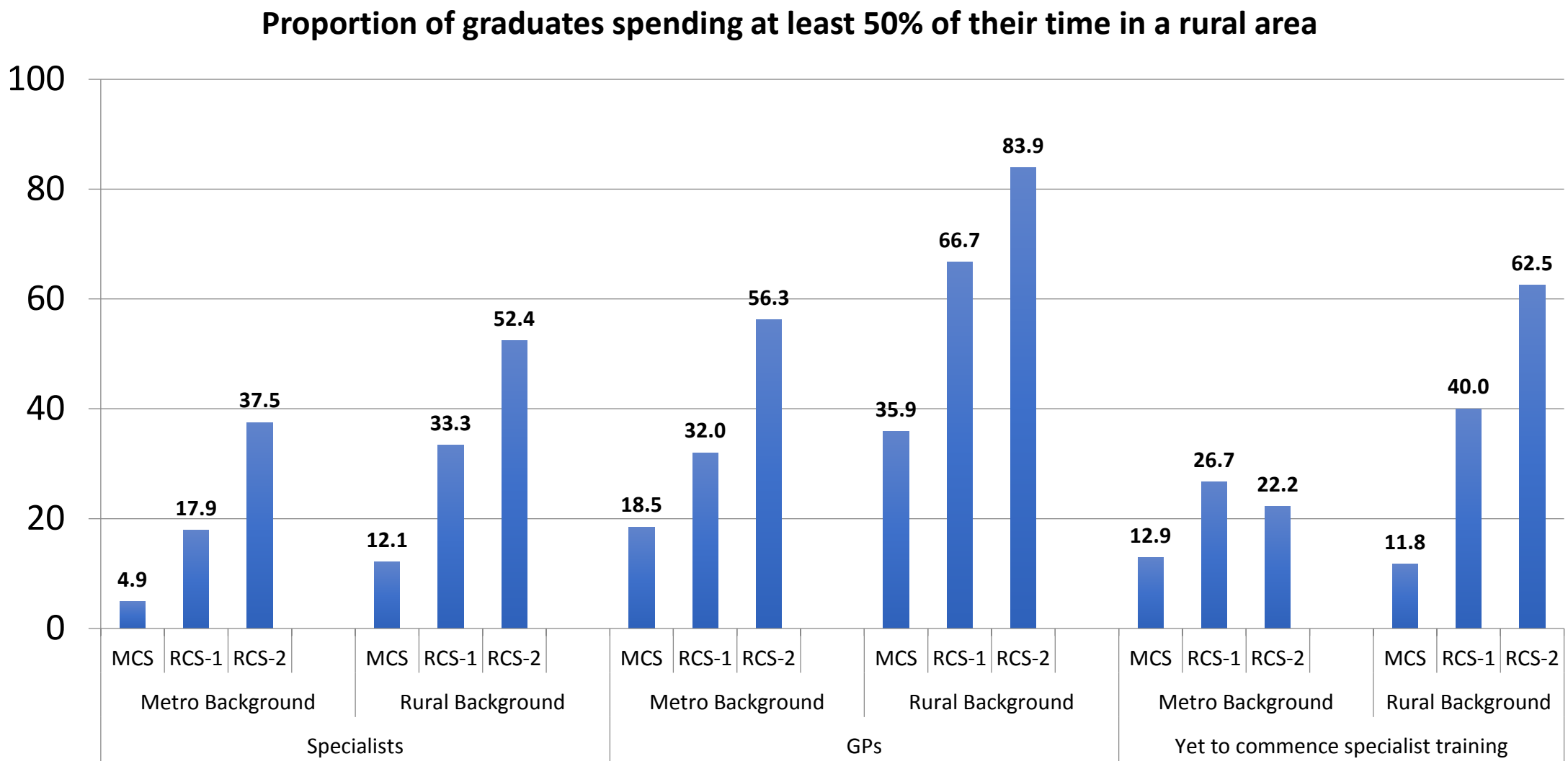
Calibration Plot



Results (Cont): Proportion of time spent in a rural area



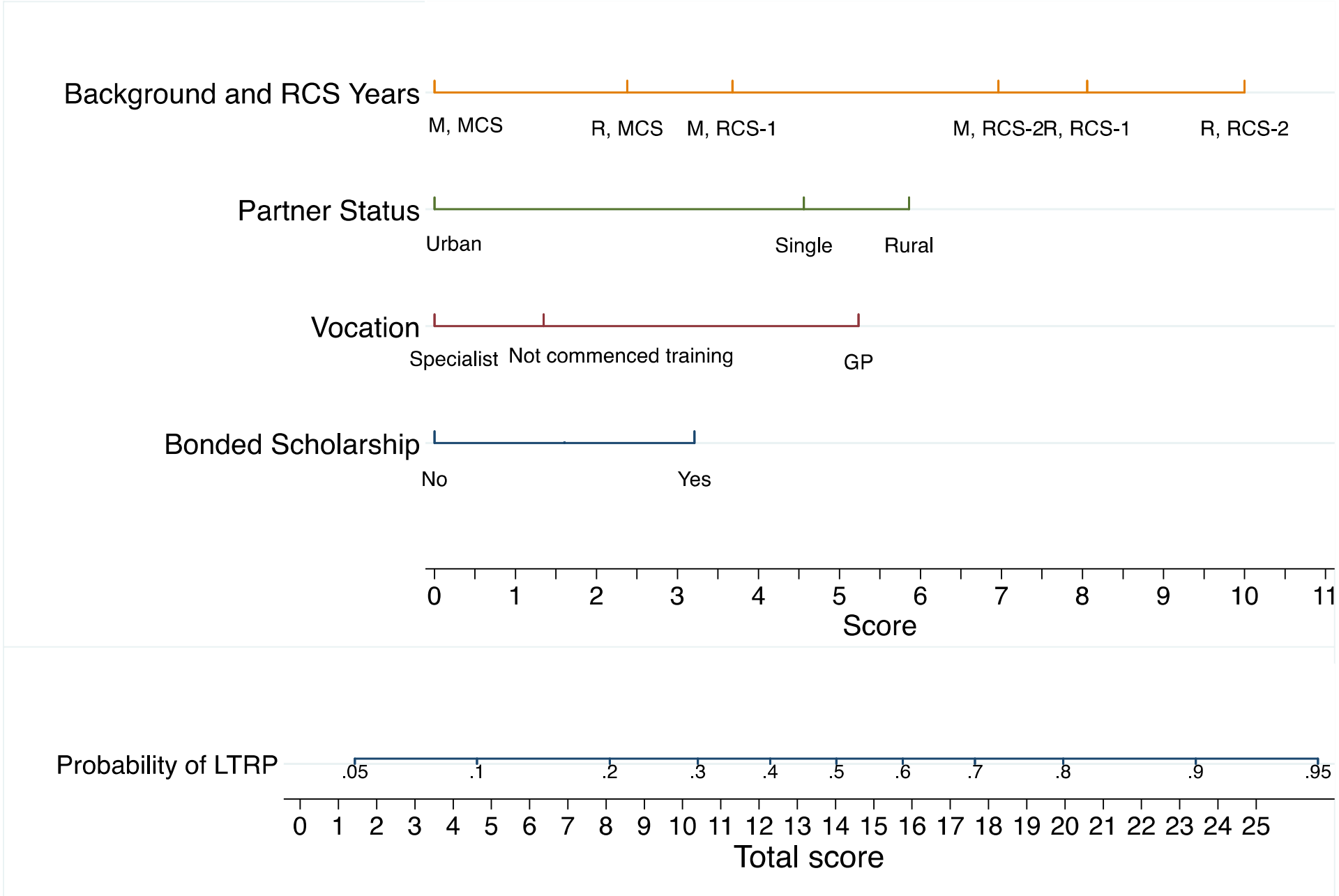
Results (Cont): LTRP



Results (Cont): Multiple regression model predicting LTRP

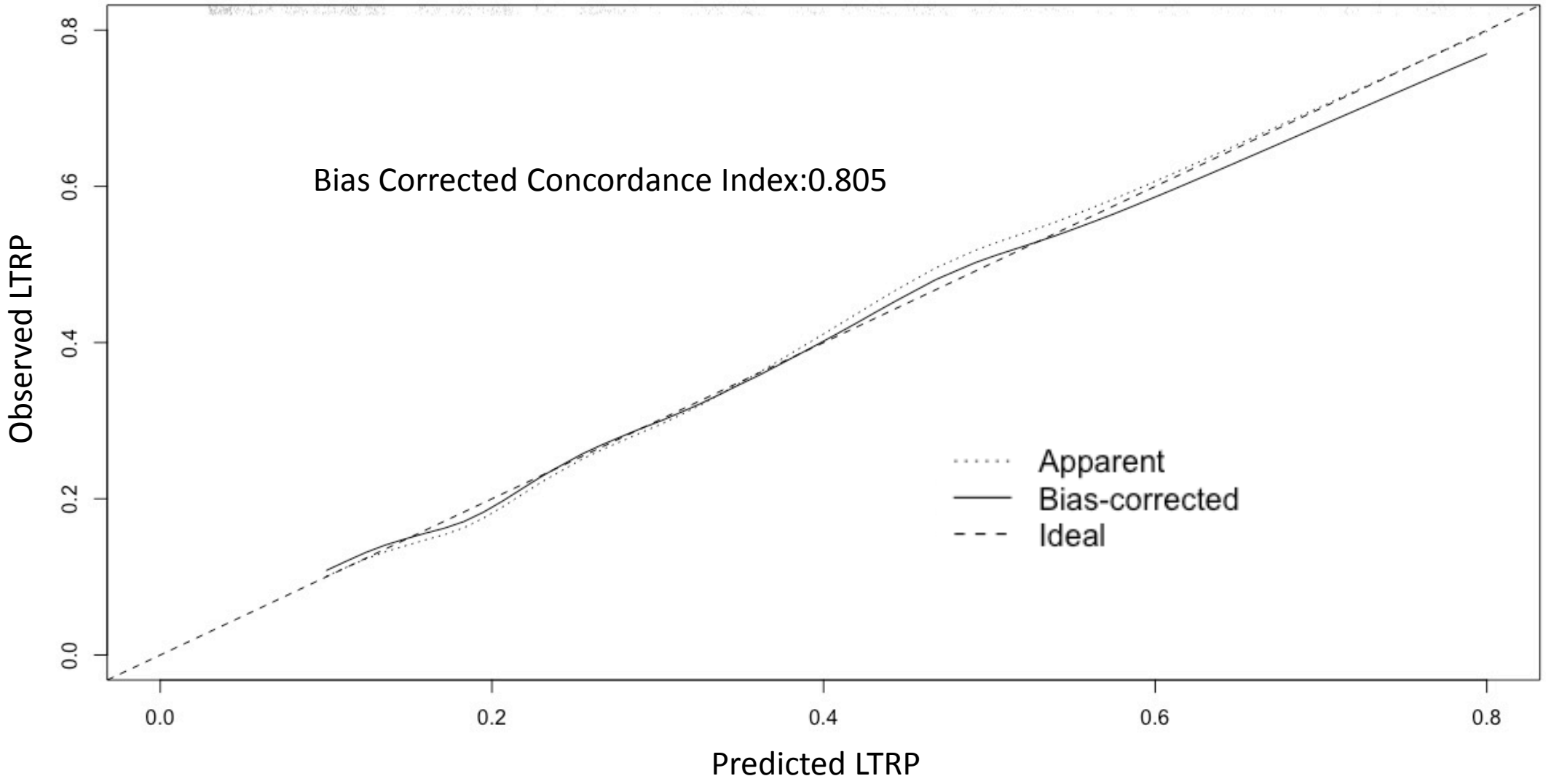
Background	Clinical School	OR	95% CI		P
Metropolitan	MCS	Ref			
	RCS-1 yr	2.36	1.28	4.38	0.006
	RCS-2 yrs	5.09	2.50	10.37	<0.001
Rural	MCS	1.74	0.93	3.26	0.08
	RCS-1 yr	6.58	3.32	13.04	<0.001
	RCS-2 yrs	10.36	4.89	21.93	<0.001
Partner					
- No partner		Ref			
- Metro background		0.34	0.21	0.57	<0.001
- Rural background		1.35	0.78	2.34	0.28
Bonded scholarship		2.12	1.19	3.79	0.01
Vocation					
- Specialist		Ref			
- Family/General practice		3.40	2.13	5.43	<0.001
- Prevocational		1.37	0.77	2.45	0.29

Nomogram predicting Long-Term Rural Practice (LTRP)



Worked Examples (LTRP)			
Characteristics	**Example 1**	**Example 2**	**Example 3**
Background	Rural	Metro	Rural
MCS/RCS	MCS	RCS 2	RCS 2
Partner	Urban	Single	Rural
Bonded Scholarship	No	Yes	Yes
Vocation	Specialist	Yet to commence VT	GP
Total Score	**2.4**	**16.1**	**24.4**
Predicted probability	**7%**	**62%**	**91%**

Calibration plot for LTRP



Discussion

- First practical tool to identify individuals likely to practice in a rural area
- Developed from a large dataset and internally validated
- Requires external validation
- Can be used for student/registrar selection for rural placements
- Targeted scholarships and specialist training positions can be offered
- Regional/Rural hospitals can choose doctors/specialists based on predicted probabilities


Thank You