

# Spatially disaggregate analysis of housing quality, urban services, and social demographics in South Asia: A case study of Rawalpindi, Pakistan

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## Outline

- Local versus national indicators of human development and municipal governance
- Lack of local (disaggregate) indicators in developing countries
  - Devolution of power and local governance
  - Need for better information for effective municipal governance
- Use of GIS for urban planning & better municipal governance
- Developing GIS for Rawalpindi
  - Digitizing paper-based maps and linking with census data
- Descriptive Analysis
- Spatial Analysis of development indicators & service delivery
- Linking education attainment with housing conditions and municipal service delivery




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## Descriptive Statistics

Development Indicator	Mean	Min	Max
Male to female ratio	1.14	1.01	2.08
Percent of formal dwellings	95.35	74.28	99.94
Percent of informal dwellings	2.98	0.06	20.37
Percent of semi-formal dwellings	1.80	0.05	15.75
Percent of households with sanitation	62.09	9.10	94.51
Percent of households with potable water	68.34	0.65	93.38
Percent of households with electricity	98.60	89.71	100.00
Self-proclaimed literate (percent)	76.58	37.10	95.90
Adult female w/ G5 edu %	42.93	20.51	57.14
Adult male w/ G5 edu %	46.80	21.21	61.43
Adult female w/ G10 edu %	39.25	7.17	90.89
Adult male w/ G10 edu %	49.75	12.14	92.79
Population Density (Pers/sq km)	31122	1337	111309




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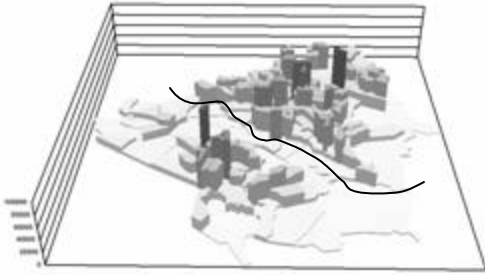
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### Population Density



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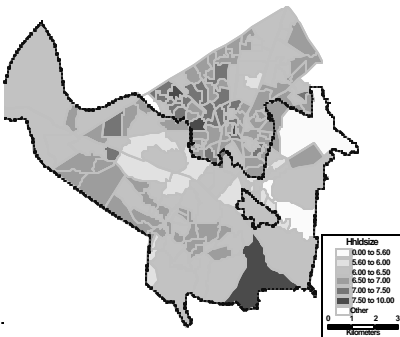
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### Average Household Size



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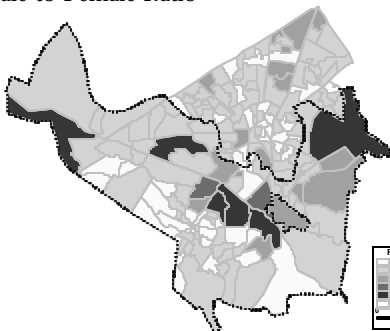
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### Male to Female Ratio



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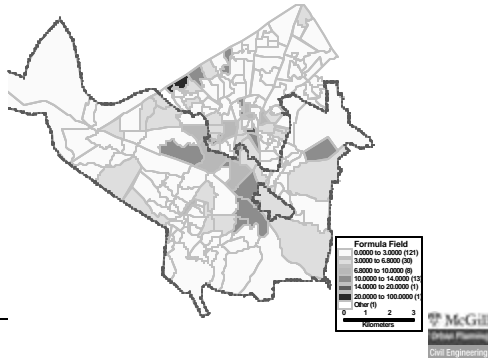
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### Distribution of Informal Settlements




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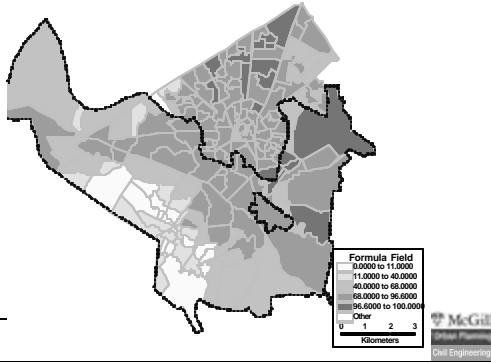
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### Households with Access to Potable Water




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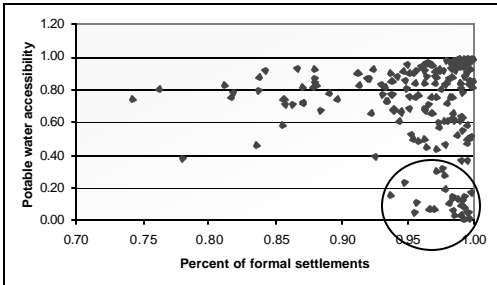
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### Correlation Between Housing Quality & Water




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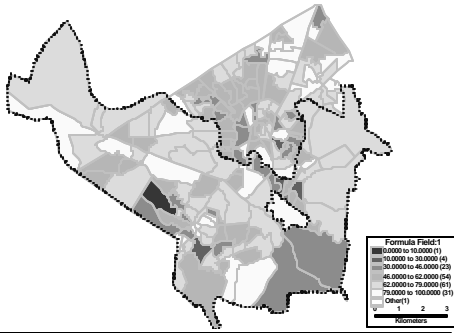
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### Households With Access to Sanitation




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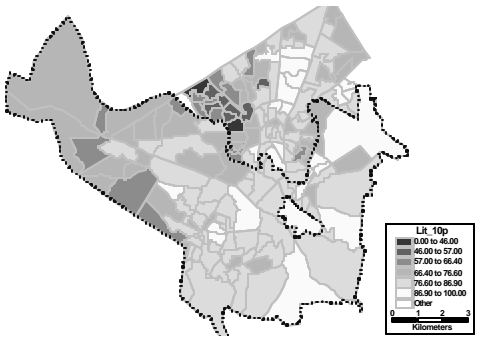
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### Distribution of Literate Population (10+ years)




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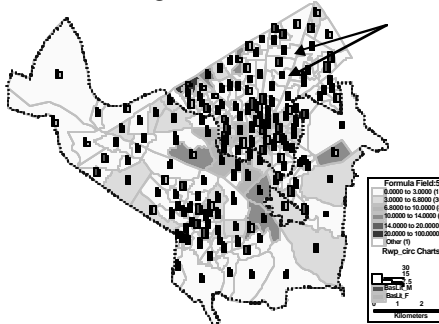
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### Informal Housing and Grade 5 Education




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## Municipal Corporation versus Cantonment

- Cantonments are a legacy of the British Raj
  - A senior military officer heads the Cantonment Board
  - Members are elected, but have limited autonomy
  - Rawalpindi Cantonment is also the military headquarter
- Municipal Corporation is an elected body headed by a Mayor
- The myth of Cantonments being better governed than the municipal corporation!
- Some comparisons

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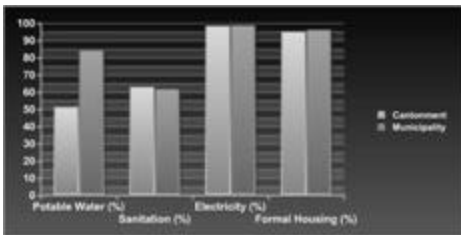
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## Municipal Service Delivery Comparisons



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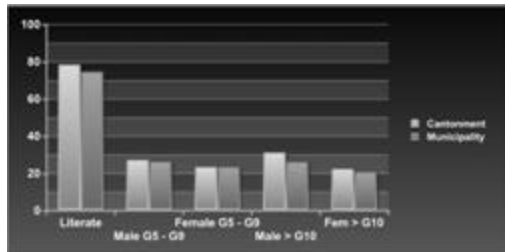
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## Literacy Comparisons



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## Educational Attainment & Housing Quality

- Housing quality is positively correlated with education attainment for males only.

Housing Conditions and Education Attainment

	g10_madt	g10_fadt	formal_p	inform_p	semif_p
g10_madt	1				
g10_fadt	0.9282	1			
formal_p	0.1767	0.0866	1		
inform_p	-0.1971	-0.0797	-0.8773	1	
semif_p	-0.0607	-0.0549	-0.6984	0.2691	1

	lit_10p	formal_p	inform_p	semif_p
lit_10p	1			
formal_p	0.1354	1		
inform_p	-0.1638	-0.8773	1	
semif_p	-0.0274	-0.6984	0.2691	1

g10\_madt/g10\_fadt: Percent of adults with at least 10 years of education  
lit\_10p: Percent of literate 10+ years old




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## Educational Attainment & Municipal Services

- Accessibility to electricity/sanitation is positively correlated with both males/females' education
- Accessibility to water is not correlated for males, but matters for females

Municipal Service Delivery and Education Attainment

	g10_madt	g10_fadt	sanit_p	water_p	elect_p
g10_madt	1				
g10_fadt	0.9181	1			
sanit_p	0.3308	0.2958	1		
water_p	-0.0081	0.1527	0.0566	1	
elect_p	0.4599	0.4677	0.1129	0.077	1

	lit_10p	sanit_p	water_p	elect_p
lit_10p	1			
sanit_p	0.3013	1		
water_p	0.0475	0.0566	1	
elect_p	0.5535	0.1129	0.077	1




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## Education Attainment & Media

- TV and newspaper are proxies for higher income and literate adults, which again serves as a proxy for higher than median income

	g10_fadt	g10_madt	lit_10p
tv_p	0.8764	0.8103	0.8231
paper_p	0.751	0.7766	0.6767
radio_p	0.572	0.6357	0.4885

	hhldsize	bdqgt_3p
g10_fadt	-0.3882	0.7771
g10_madt	-0.487	0.6855
lit_10p	-0.4633	0.5525




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## Weighted Least Squares Model (Males G10+)

Source	SS	df	MS	Number of obs = 169		
Model	46.0589912	8	5.7573739	F( 8, 160) = 81.90		
Residual	11.2477816	160	.070298635	Prob > F = 0.0000		
				R-squared = 0.8037		
				Adj R-squared = 0.7939		
				Root MSE = .26514		
Total	57.3067728	168	.341111743			

mal_mat	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
inform_p	-.012419	.0058285	-2.13	0.035	-.0239297 -.0009082
tv_p	.0230002	.0027376	8.40	0.000	.0175936 .0284068
romgt_3p	.0233486	.0030821	7.58	0.000	.0172617 .0294355
hhldsize	-.4634381	.0578596	-8.01	0.000	-.5777052 -.3491711
r_malefem	-.4816402	.1587343	-3.03	0.003	-.7951249 -.1681556
Cantt	.0604314	.059917	1.01	0.315	-.0578988 .187616
sanit_p	.0030296	.0013896	2.18	0.031	.0002853 .0057738
water_p	-.0001038	.001059	-0.10	0.922	-.0021952 .0019876
_cons	1.173165	.5245453	2.24	0.027	.1372396 2.20909



## Weighted Least Squares Model (Females G10+)

Source	SS	df	MS	Number of obs = 171		
Model	44.3331615	5	8.86663229	F( 5, 165) = 103.91		
Residual	14.079033	165	.085327473	Prob > F = 0.0000		
				R-squared = 0.7590		
				Adj R-squared = 0.7517		
				Root MSE = .29211		
Total	58.4121945	170	.343601144			

fem_mat	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
romgt_3p	.0423334	.0024091	17.57	0.000	.0375767 .0470902
hhldsize	-.3418668	.0550638	-6.21	0.000	-.4505873 -.2331463
sanit_p	.0034254	.0014526	2.36	0.020	.0005574 .0062934
water_p	.0022944	.0008154	2.81	0.005	.0006844 .0039044
elect_p	.0811471	.0156885	5.17	0.000	.050171 .1121232
_cons	-7.609906	1.622986	-4.69	0.000	-10.8144 -4.405409



## Conclusions

- Spatial distribution of development indicators suggests strong evidence of intra-urban variance
- GIS can expose urban areas with poor municipal services
  - Rawalpindi appears to be polycentric
  - Accessibility to potable water is a concern for both formal and informal settlements
  - Cantonment Board offers similar quality municipal/education services as the Municipal Corporation
- Accessibility to municipal services is positively correlated with higher female education attainment than that for males
- The WLS model shows that housing quality is positively correlated only with male education attainment
- The WLS model shows that municipal service delivery and education attainment are correlated even when income proxies are included in the models

