Association between Area Deprivation and Premature Cardiovascular Mortality in Korea: an ecological study

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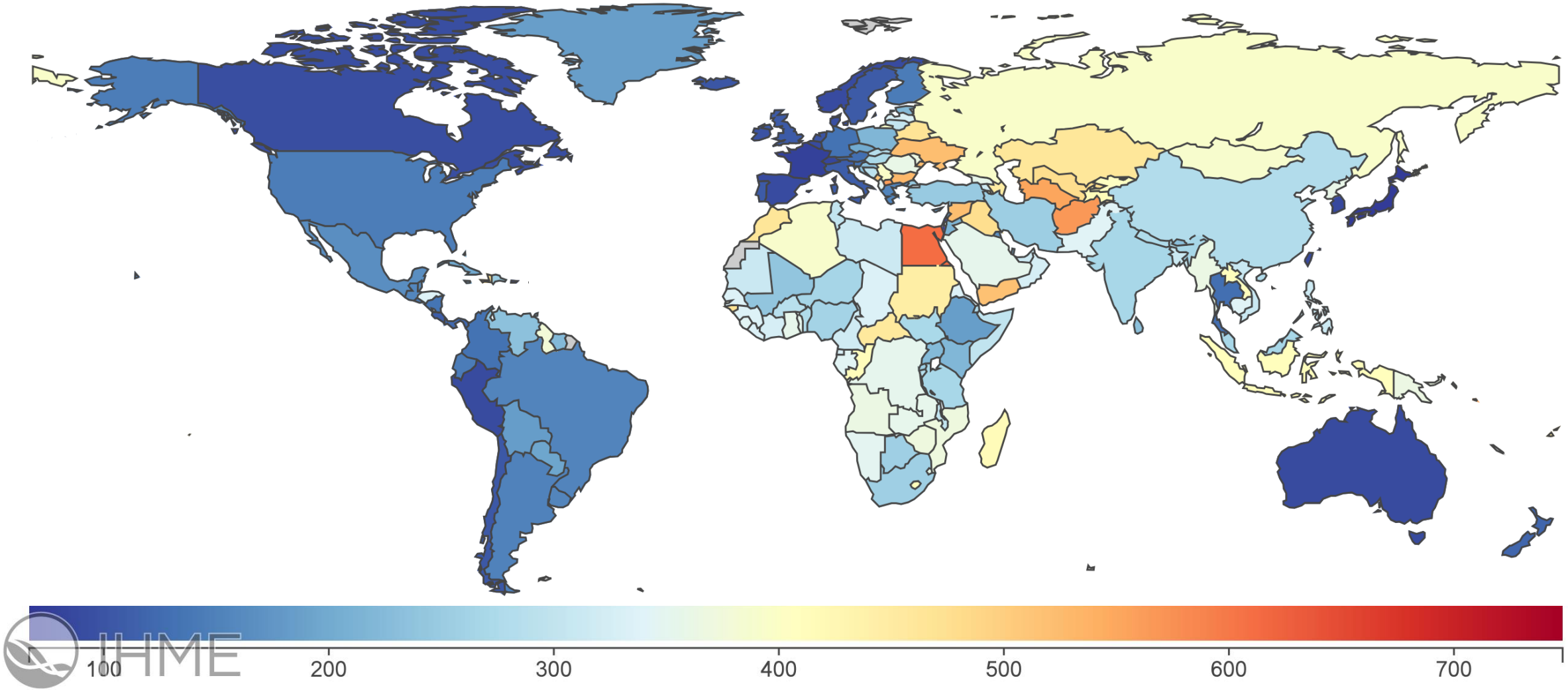
Age-standardized CVD death rates, 2021: GBD study



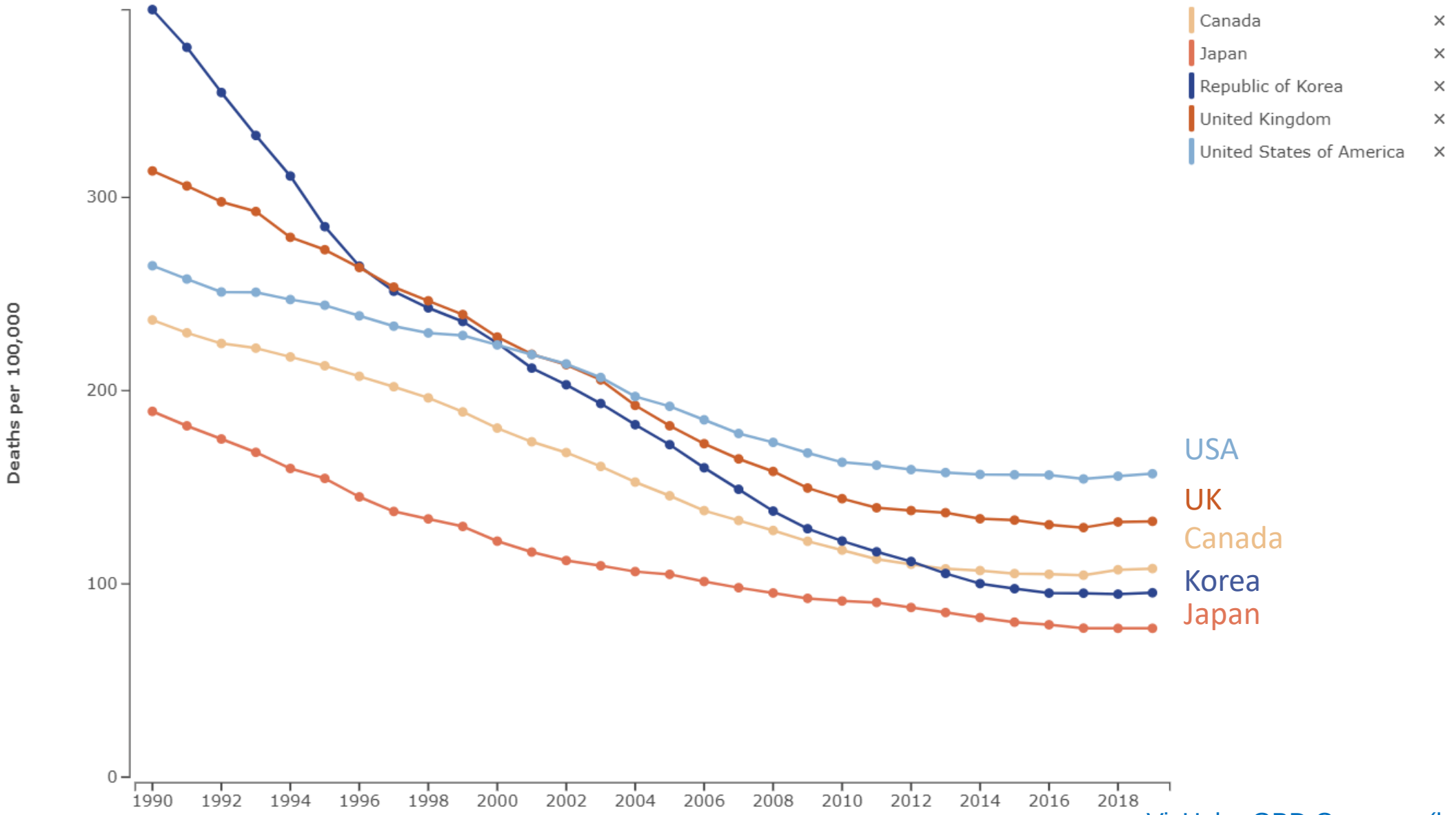
VizHub - GBD Compare (healthdata.org)

Leading causes of death in selected regions and countries.

	Global	Africa	America	Europe	Asia	China	Singapore	Japan	Korea
1	CVD	CVD	CVD	CVD	CVD	CVD	Neoplasms	Neoplasms	Neoplasms
2	Neoplasms	Respiratory infection & TB	Neoplasms	Neoplasms	Neoplasms	Neoplasms	CVD	CVD	CVD
3	Chronic respiratory	Maternal & neonatal	Diabetes and CKD	Neurological disorders	Chronic respiratory	Chronic respiratory	Respiratory infection & TB	Neurological disorders	Neurological disorders
4	Respiratory infection & TB	HIV/AIDS & STIs	Chronic respiratory	Digestive disease	Respiratory infection & TB	Neurological disorders	Neurological disorders	Respiratory infection & TB	Diabetes and CKD
5	Diabetes and CKD	Enteric infections	Neurological disorders	Chronic respiratory	Diabetes and CKD	Diabetes and CKD	Diabetes and CKD	Digestive disease	Respiratory infection & TB
6	Digestive disease	Neoplasms	Digestive disease	Diabetes and CKD	Digestive disease	Unintentional injury	Chronic respiratory	Chronic respiratory	Digestive disease
7	Neurological disorders	NTDs & malaria	Respiratory infection & TB	Respiratory infection & TB	Neurological disorders	Digestive disease	Digestive disease	Diabetes and CKD	Chronic respiratory
8	Maternal & neonatal	Digestive disease	Self-harm & violence	Unintentional injury	Unintentional injury	Transport injuries	Other non-communicable	Unintentional injury	Self-harm & violence
9	Unintentional injury	Diabetes and CKD	Unintentional injury	Self-harm & violence	Maternal & neonatal	Respiratory infection & TB	Self-harm & violence	Self-harm & violence	Unintentional injury
10	Enteric infections	Other infections	Other non-communicable	Other non-communicable	Enteric infections	Self-harm & violence	Unintentional injury	Other non-communicable	Transport injuries

Kim HC. Global Health & Medicine. 2021; 3(3):134-141.(Data source: http://www.healthdata.org/gbd/ data-visualizations)

Trends of age-standardized CVD mortalities in selected countries



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Background & Objective

CVD Burden & Social Determinants:

- Despite progress, cardiovascular disease (CVD) burden continues to rise.
- Social determinants like education, socioeconomic status, and access to healthcare significantly impact CVD risk.

Regional Socioeconomic Deprivation:

- Area-level deprivation (economy, greenness, air quality…) may increases CVD risk.
- Deprivation indices have been developed globally to measure regional disparities and inform health policies.

South Korea's Context:

- Korea has low age-standardized CVD death rates and universal healthcare with good accessibility.
- But regional disparities in CVD mortality has not been fully explored.

Study Aim:

- Association between Area Deprivation Index (ADI) and premature CVD mortality in small administrative units.
- H: Higher deprivation correlates with higher CVD mortality, with variations between urban and rural areas.

Methods

Geographical Units:

- 7 metropolitans and 9 provinces
- Further divided into 250 municipalities, administrative units

Area Deprivation Index (ADI), year 2020:

- Composite score based on 10 socioeconomic indicators
- Higher ADI indicates higher deprivation; updated every 5 years

Mortality, year 2020:

- Causes of Death Statistics (ICD-10) for adults aged 20-65
- CVD (I00–I99); Ischemic Heart Dis (I20–I25); Other Heart Dis (I00–I13, I26–I51); Cerebrovascular Dis (I60–I69)
- Directly and indirectly standardized for sex and age, using the total Korea population structure as a reference

Adjusting for Healthcare Accessibility:

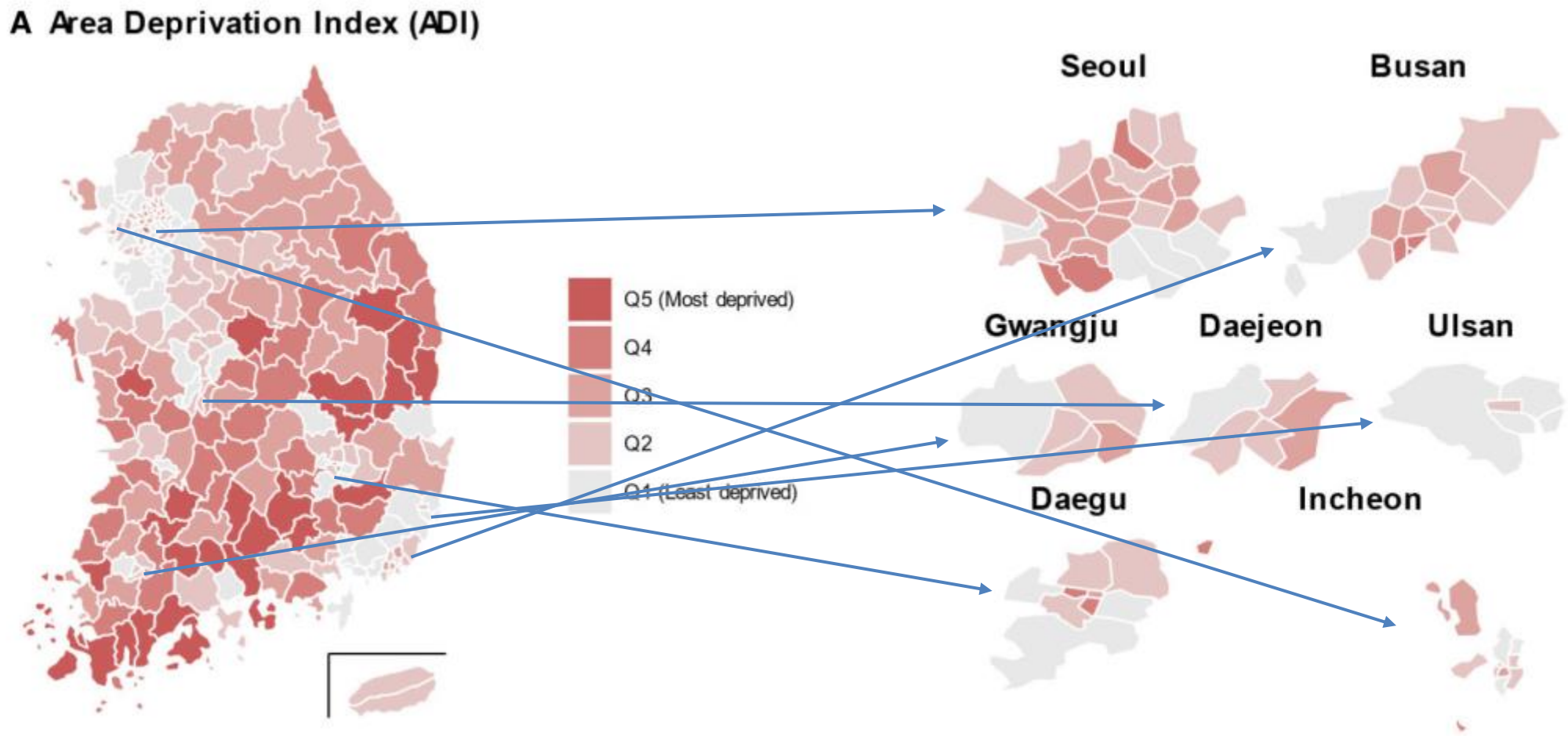
- Number of general hospitals; Number of tertiary hospitals; Land size of a municipality
- Number of hospitals (general hospitals + tertiary hospitals) divided by the size of a municipality

Statistical Analysis:

- Pearson correlation of continuous ADI and mortality
- Log-linear regression models for total CVD and its subtypes
- Stratification by metropolitan and non-metropolitan areas

Quintiles of deprivation index and standardized CVD mortality

The 250 municipalities are colored according to the quintiles of (a) deprivation index and (b) sex- and age-standardized CVD mortality.



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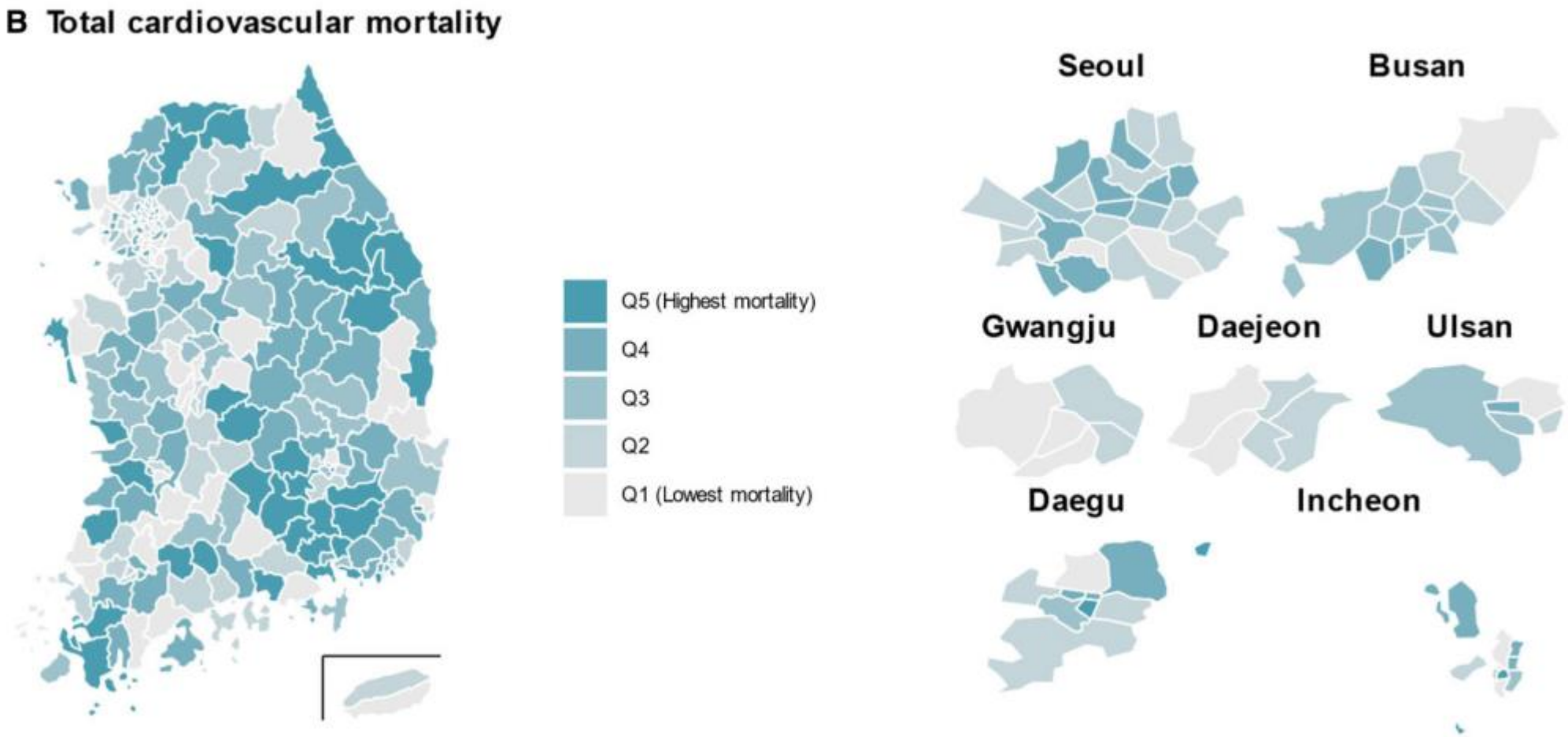

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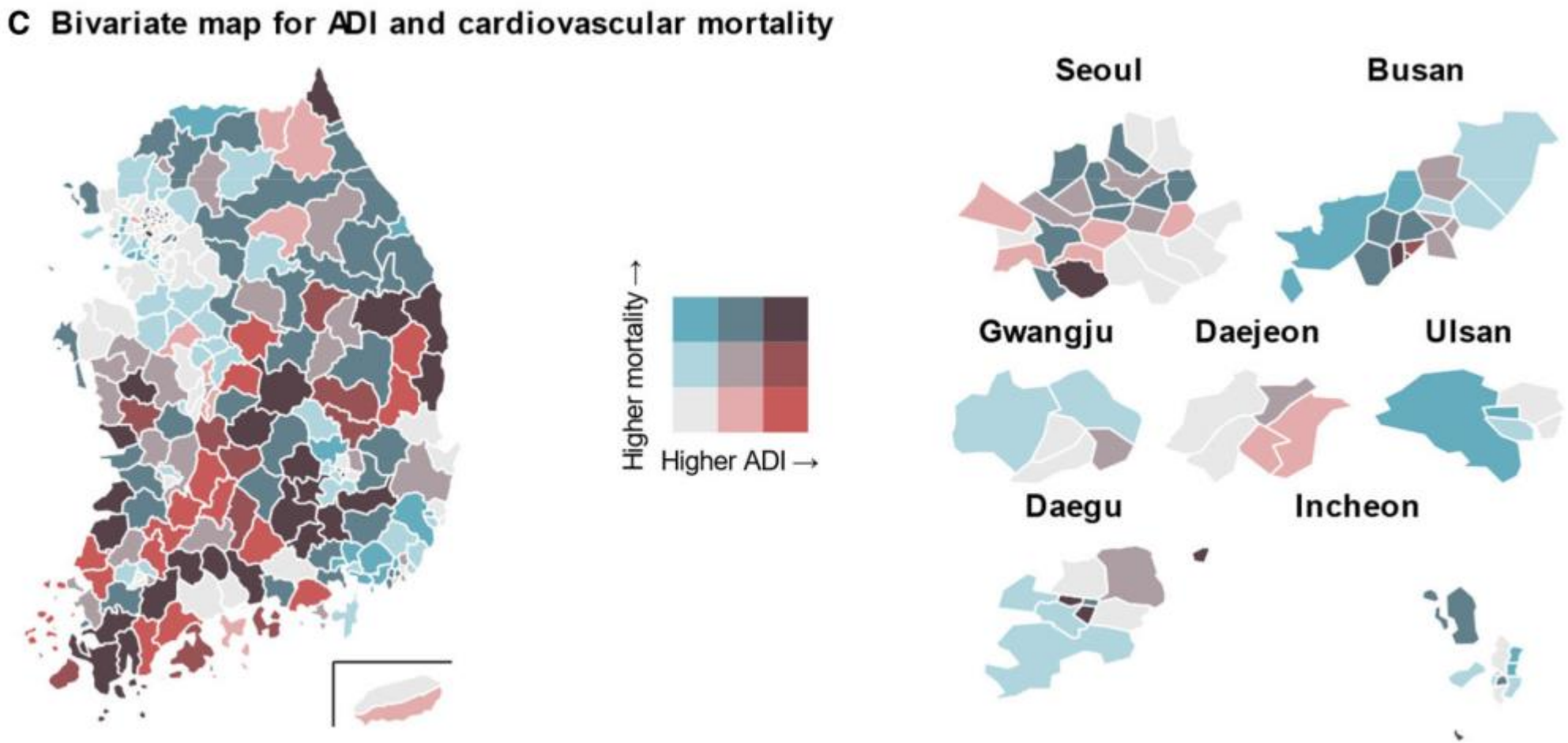

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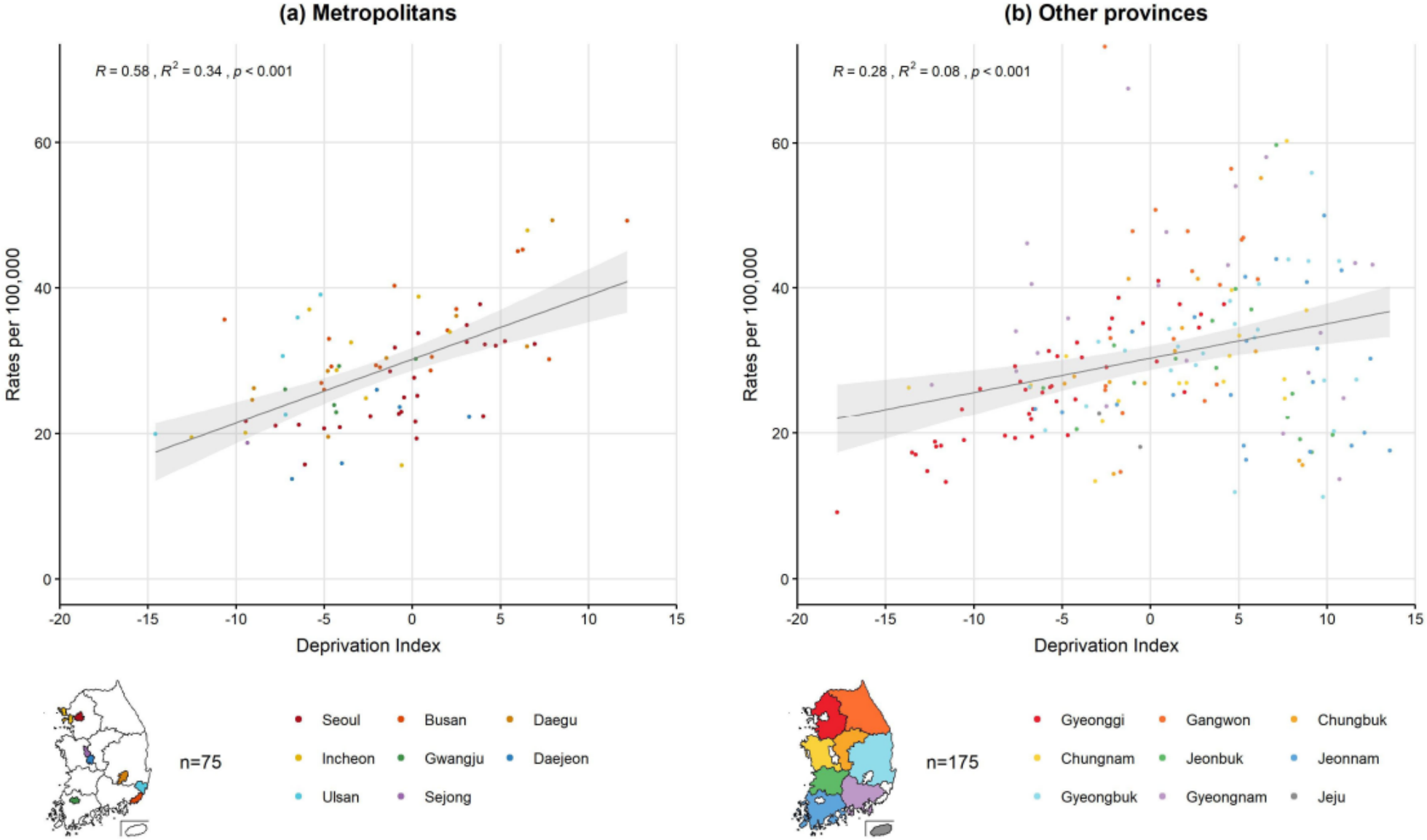
Area deprivation index and standardized CVD mortality at the municipal level



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Association between Area Deprivation Index and mortality from total CVD

Region	Unadjusted (RR, 95% CI)	Model 1 (RR, 95% CI)	Model 2 (RR, 95% CI)
All regions	**1.017 (1.011 to 1.024)**	**1.013 (1.005 to 1.022)**	**1.016 (1.009 to 1.023)**
Metropolitans	1.033 (1.023 to 1.042)	1.035 (1.025 to 1.046)	1.031 (1.020 to 1.043)
Other provinces	1.014 (1.006 to 1.022)	1.006 (0.995 to 1.017)	1.009 (1.000 to 1.019)

Model 1 was adjusted for the number of general hospitals, the number of tertiary hospitals, and the size of the municipality, in addition to standardization for sex and age.
Model 2 was adjusted for the composite variable by dividing the sum of general hospitals and tertiary hospitals by the size of the municipality.
The rate ratio (RR) is the exponentiated coefficient in log-linear regression between continuous deprivation index and sex-standardized and age-standardized mortality rate.

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Association between Area Deprivation Index and mortality from CVD subtypes

Disease Type	Region	Unadjusted (RR, 95% CI)	Model 1 (RR, 95% CI)	Model 2 (RR, 95% CI)
Ischemic heart diseases	**All regions**	**1.011 (1.000 to 1.021)**	**1.002 (0.988 to 1.016)**	**1.005 (0.994 to 1.017)**
	Metropolitans	1.021 (1.005 to 1.038)	1.023 (1.006 to 1.042)	1.025 (1.006 to 1.045)
	Other provinces	1.009 (0.996 to 1.022)	0.989 (0.970 to 1.009)	1.000 (0.983 to 1.017)
Other heart diseases	**All regions**	**1.024 (1.011 to 1.038)**	**1.023 (1.005 to 1.041)**	**1.029 (1.014 to 1.045)**
	Metropolitans	1.056 (1.033 to 1.080)	1.056 (1.030 to 1.082)	1.042 (1.018 to 1.067)
	Other provinces	1.018 (1.001 to 1.035)	1.012 (0.989 to 1.036)	1.018 (0.997 to 1.039)
Cerebrovascular diseases	**All regions**	**1.019 (1.010 to 1.027)**	**1.016 (1.005 to 1.027)**	**1.016 (1.006 to 1.025)**
	Metropolitans	1.030 (1.017 to 1.043)	1.035 (1.021 to 1.049)	1.034 (1.019 to 1.050)
	Other provinces	1.015 (1.005 to 1.026)	1.013 (0.998 to 1.029)	1.010 (0.997 to 1.024)

Model 1 was adjusted for the number of general hospitals, the number of tertiary hospitals, and the size of the municipality, in addition to standardization for sex and age.
Model 2 was adjusted for the composite variable by dividing the sum of general hospitals and tertiary hospitals by the size of the municipality.
The rate ratio (RR) is the exponentiated coefficient in log-linear regression between continuous deprivation index and sex-standardized and age-standardized mortality rate.

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Limitations

- Cross-sectional study design
- Largely dependent of secondary administrative data
- Residual confounding due to unknown/unmeasured confounders

Summary and Implications

- Even in a setting where healthcare services are geographically and systematically accessible, regional socioeconomic deprivation was significantly associated with higher CVD mortality.
- Notably, these associations were more prominent in metropolitan municipalities, implying the existence of health inequity within urban areas
- Targeted CVD prevention should address the socioeconomic gap in urban area as well as improve healthcare access in non-urban regions.

THANK YOU

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