Disparities in Prescribing based on Provider Density and Socio-Economic Status

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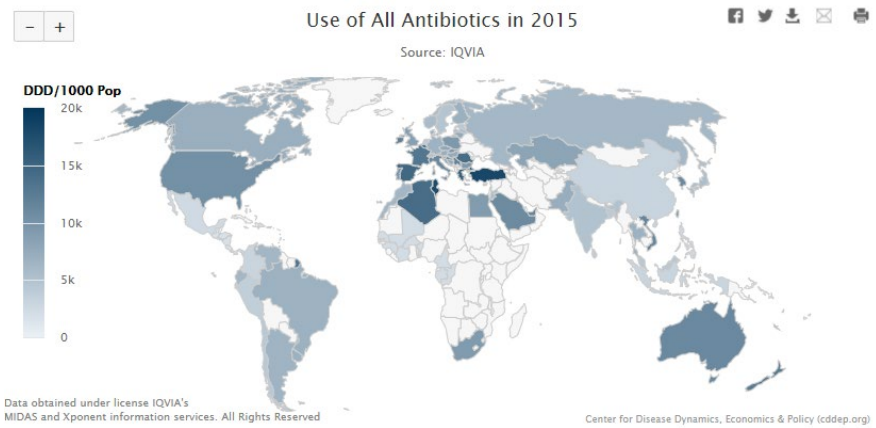
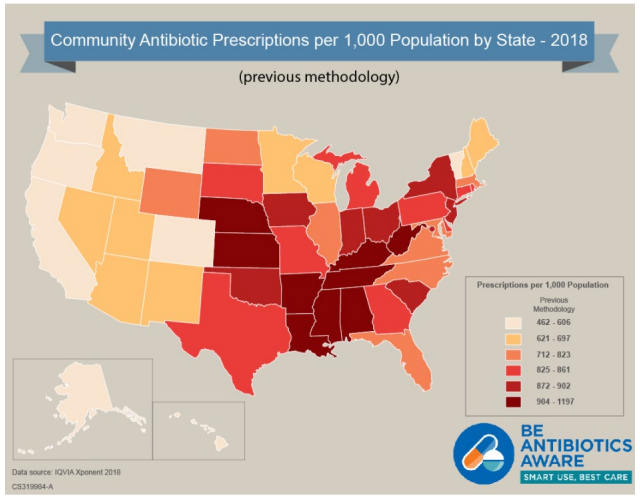
Geographic Variation in Antibiotic Prescribing

Variations in antibiotic consumption rates offers one possible explanation for variation in resistance.

Antibiotic Use

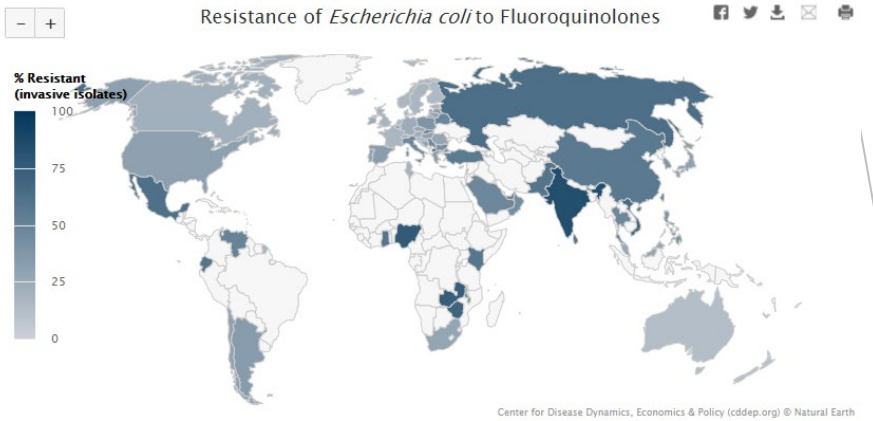


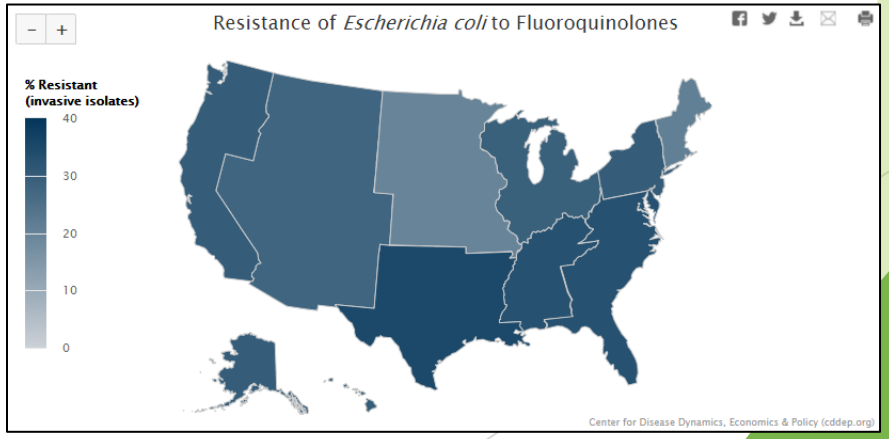
Source: resistancemap.cddep.org



https://www.cdc.gov/antibiotic-use/community/programs-measurement/state-local-activities/outpatient-antibiotic-prescriptions-US-2018.html

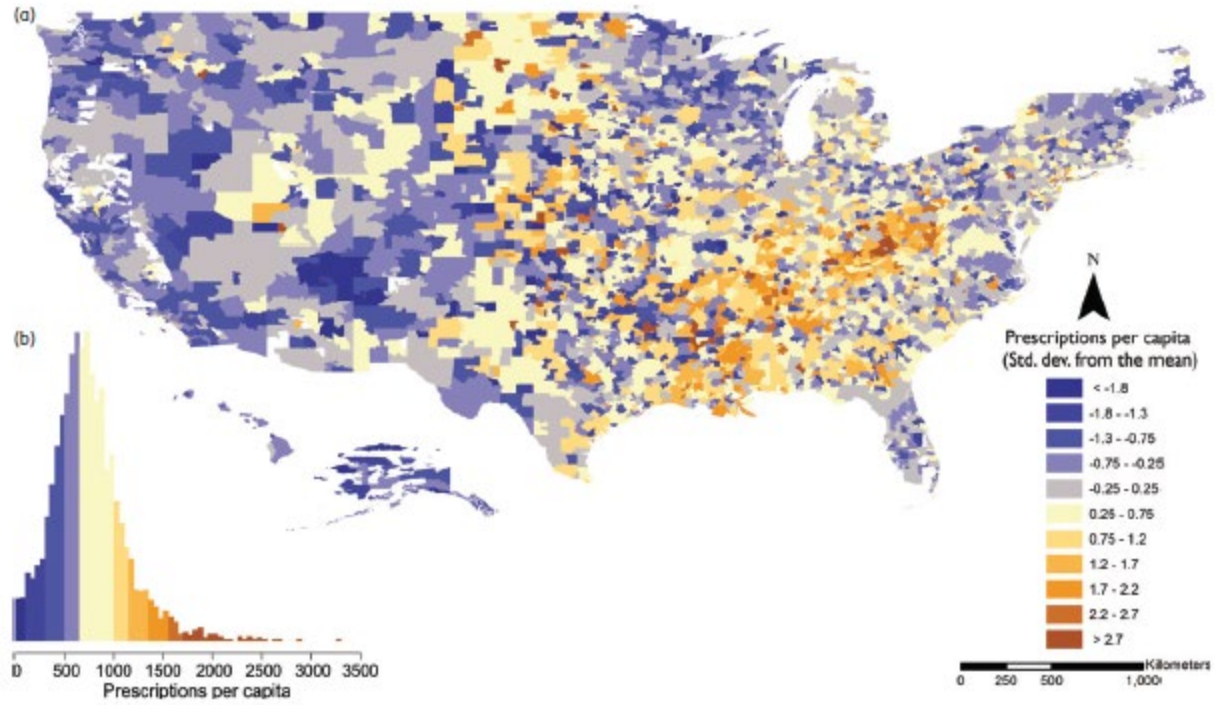
Antibiotic Resistance





Geographical Variation in Antibiotic Prescribing

Intra-state variation > Inter-state variation



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Drivers of Geographical Variation

- Socioeconomic differences (e.g. education level, financial well-being, access to health insurance, use of childcare centers)
- Structural differences (e.g. physician density, physician remuneration, antibiotic costs, and competition)
- Cultural differences (e.g. prescribing norms, patient demand).

Incentives for patients, doctors, and hospitals can affect antibiotic prescribing

Health insurance increases prescribing

Table 4. Use of oral, injected, and all antibiotics per person per year by level of family income and insurance plan

Antibiotic use and income tertile*	Free plan ($N = 1935$)		Cost-sharing plans ($N = 3830$)		Ratio of free to cost-sharing (95% confidence interval)†
	Number of antibiotics	Number per person	Number of antibiotics	Number per person	
Oral antibiotics					
Upper one-third	548	0.94	723	0.58	1.63 (1.55, 1.72)
Middle one-third	577	0.93	669	0.57	1.62 (1.53, 1.71)
Lower one-third	442	0.72	386	0.33	2.17 (1.97, 2.39)
All incomes	1670	0.85	1825	0.48	1.79 (1.72, 1.86)
Injected antibiotics					
Upper one-third	45	0.08	89	0.07	1.09 (0.77, 1.54)
Middle one-third	69	0.11	75	0.06	1.73 (1.27, 2.36)
Lower one-third	38	0.06	45	0.04	1.60 (1.05, 2.44)
All incomes	187	0.10	221	0.06	1.67 (1.39, 2.01)
All antibiotics					
Upper one-third	593	1.02	812	0.65	1.57 (1.51, 1.63)
Middle one-third	646	1.04	744	0.64	1.63 (1.57, 1.70)
Lower one-third	480	0.78	431	0.37	2.11 (1.94, 2.30)
All incomes	1857	0.96	2046	0.53	1.80 (1.75, 1.86)

*Numbers shown for income tertiles do not sum to totals because income was unknown for 138 claims on the free plan and 59 on the cost-sharing plans.
†Taylor's series 95% confidence intervals [12]; ratio and confidence intervals calculated using 8 significant digits.

Reducing the price patients pay for antibiotics increases their use, and this is more pronounced in poorer families particularly for outpatient antibiotics

Foxman et, RAND Corporation,1987

What happens when antibiotics are provided free?

Table 2: Average Percentage Change in prescriptions 1 year into the program

	Percentage Change Before and After		Diff-in-Diff
	Treatment Group	Control Group	
All Antibiotics	7.67 (0.40)	2.74 (0.31)	4.93 (0.50)
Covered Antibiotics	11.73 (0.43)	4.62 (0.31)	7.10 (0.54)
Not-covered Antibiotics	-8.75 (0.66)	-4.76 (0.39)	-3.99 (0.76)
No-equivalent Antibiotics	-4.76 (0.82)	-0.32 (0.56)	-4.44 (0.99)

Note: The changes before the program are calculated using data from November 2005 to October 2006, and the changes after the program are based on data from November 2006 to October 2007.

Source: Li and Laxminarayan, *Health Economics*, 2013

Overall increase in antibiotic prescriptions as well as substitutions to covered antibiotics from not-covered antibiotics.

Study

- Analysis of Socioeconomic drivers of prescribing in the United States
- Data: Outpatient antibiotic prescriptions (source: IQVIA)
- Census Data:
  - Demographics: Population age (<5,>65), Race
  - Health: Medicare discharges
  - Socioeconomics: Education, Unemployed, Poverty, Rural
  - **Clinician Type: Offices of physicians, Urgent/Retail clinics**
- Statistical Analysis:
  - two-way fixed-effect ordinary least squares (OLS) regression model that accounted for inherent differences in state regulations regarding prescribing as well as differences between years

Hypothesis

- Because provider and urgent/retail care clinic density are associated with higher income areas
- The presence of urgent care/retail clinics would have differential effects on provider prescribing across socioeconomic strata

Results

Table 2. OLS regression results on dependent variable prescriptions per capita

	Prescriptions per inhabitant[a]		
	clinics from census	urgent care and retail clinics	retail clinics
Offices of physicians[a]	0.35 (0.03)***	0.33 (0.04)***	0.34 (0.04)***
Clinics (NAICS 621493/621498)[a,b]	0.07 (0.01)***		
Urgent care and retail clinics[a,b]		0.09 (0.02)***	
Retail clinics[a,b]			0.01 (0.03)
Number of kidney dialysis centres[a]	0.02 (0.01)***	0.02 (0.01)***	0.02 (0.01)***
Number of general medical and surgical hospitals[a]	−0.01 (0.02)	0.02 (0.03)	0.003 (0.027)
Number of childcare centres[a]	0.03 (0.01)*	0.03 (0.01)*	0.03 (0.01)**
Difference between mean January and July temperatures	0.004 (0.003)	0.002 (0.003)	0.002 (0.003)
Percentage of population under 5	40.76 (8.75)***	40.48 (9.61)***	41.42 (9.51)***
Percentage of population under 5 squared	−278.35 (66.89)***	−269.43 (70.55)***	−275.63 (70.22)***
Percentage of population over 65[a]	0.24 (0.09)**	0.25 (0.10)**	0.24 (0.10)**
Percentage of population non-white or African–American[a]	−0.06 (0.03)**	−0.06 (0.03)**	−0.06 (0.03)**
Percentage of population African–American alone[a]	0.003 (0.017)	0.018 (0.018)	0.015 (0.018)
Medical discharges per 1000 Medicare enrollees	0.0004 (0.0002)**	0.0006 (0.0003)*	0.0005 (0.0003)*
Percentage of population 25+ with a BA or greater[a]	0.24 (0.06)***	0.25 (0.06)***	0.28 (0.07)***
Percentage unemployed	−2.11 (0.80)**	−1.61 (0.71)**	−1.56 (0.70)**
Rural	−0.12 (0.04)***	−0.14 (0.05)***	−0.14 (0.05)***
Percentage living in poverty	0.43 (0.27)	0.94 (0.32)	0.84 (0.32)**
Year (2010)[b]	−0.12 (0.04)***		
Constant	−3.95 (0.55)***	−4.19 (0.64)***	−4.23 (0.64)***
N	6862	3433	3433
R^2	0.31	0.31	0.30

Take-away: More providers/clinics per capita associated with more prescriptions per capita (supplier-induced demand)

Increase in prescriptions per capita

- Physician offices per capita: 25.9% per SD
- Clinics: 10.9% per SD
- Proportion of the population over 65: 7.4% increase per SD
- Number of childcare centers per capita: 1.8% increase per SD
- Percentage of the population with a bachelor's degree: 12.5% increase per SD
- Number of dialysis centers: 4.6% increase per SD

Decrease in prescriptions per capita

- Unemployment: 0.9% decrease per 1 percentage point increase
- Rural residence: 12% decrease
- Race (non-White/non-Black): 7.9% decrease per SD

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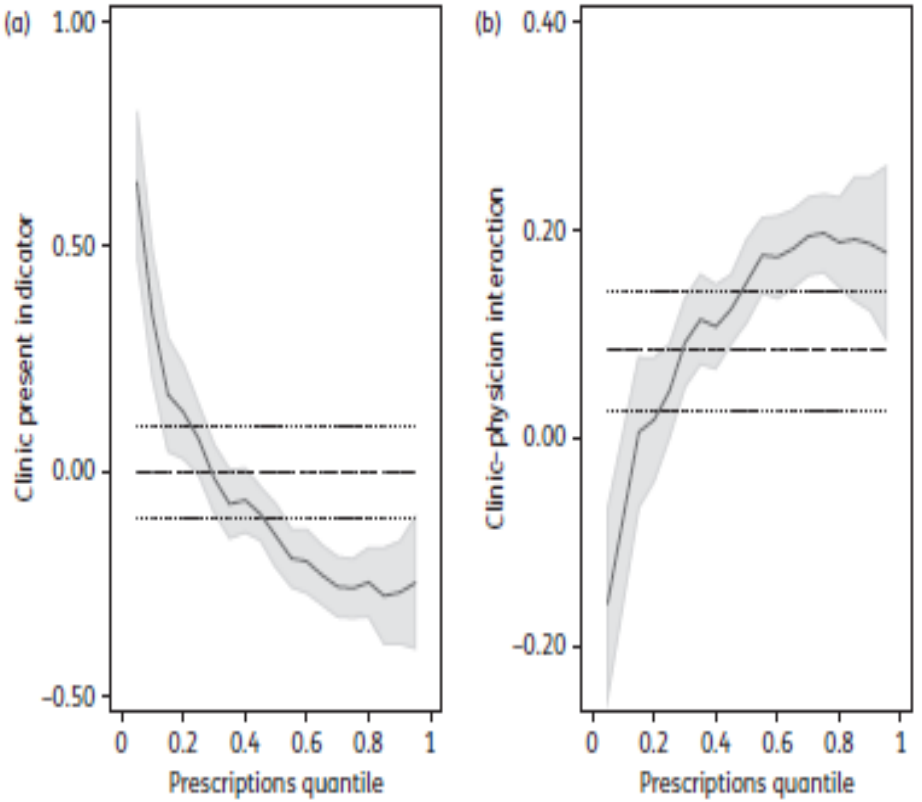
Results: Sociodemographic differences

Interaction Effect between Clinics an Number of Physicians per capita

- In poorer areas the presence of a clinic increased prescribing rates – “access”
- An increase in the number of physicians per capita increased the rate of per capita prescriptions
  - In poor areas this effect is mitigated by the presence of a clinic
  - In non-poor areas this is augmented



Thanks!

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