PCC Journal Club

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THURSDAY, July 22, 2021 | 1:00 PM - 2:00 PM ET

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Challenges to understanding PCP-mortality relationships

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The Effects Of Specialist Supply On Populations' Health: Assessing The Evidence

The evidence suggests that populations do not necessarily benefit from an overabundance of specialists in a geographic area.

by Barbara Starfield, Leiyu Shi, Atul Grover, and James Macinko

ABSTRACT: Analyses at the county level show lower mortality rates where there are more primary care physicians, but this is not the case for specialist supply. These findings confirm those of previous studies at the state and other levels. Increasing the supply of specialists will not improve the United States' position in population health relative to other industrialized countries, and it is likely to lead to greater disparities in health status and outcomes. Adverse effects from inappropriate or unnecessary specialist use may be responsible for the absence of relationship between specialist supply and mortality.

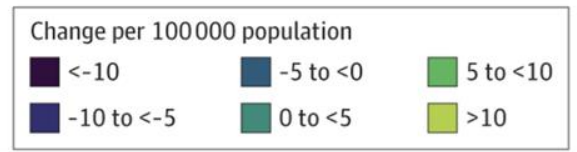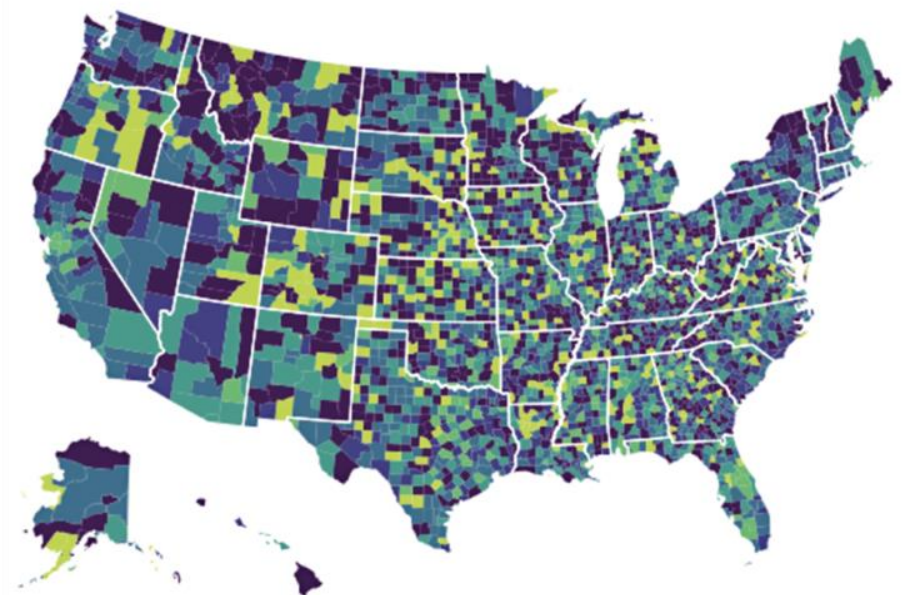**State Level Analysis:** Primary Care and Life Expectancy
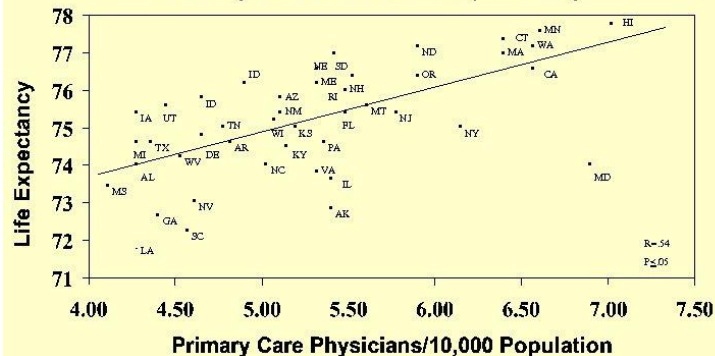
PC physicians/population positively associated with longer life expectancy.
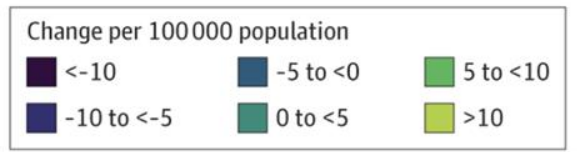
Source: Shi et al., 1999.

Starfield 03/02

A Primary care physician density

B Specialty physician density

Change per 100 000 population

- ■ <-10
- ■ -10 to <-5
- ■ -5 to <0
- ■ 0 to <5
- ■ 5 to <10
- ■ >10
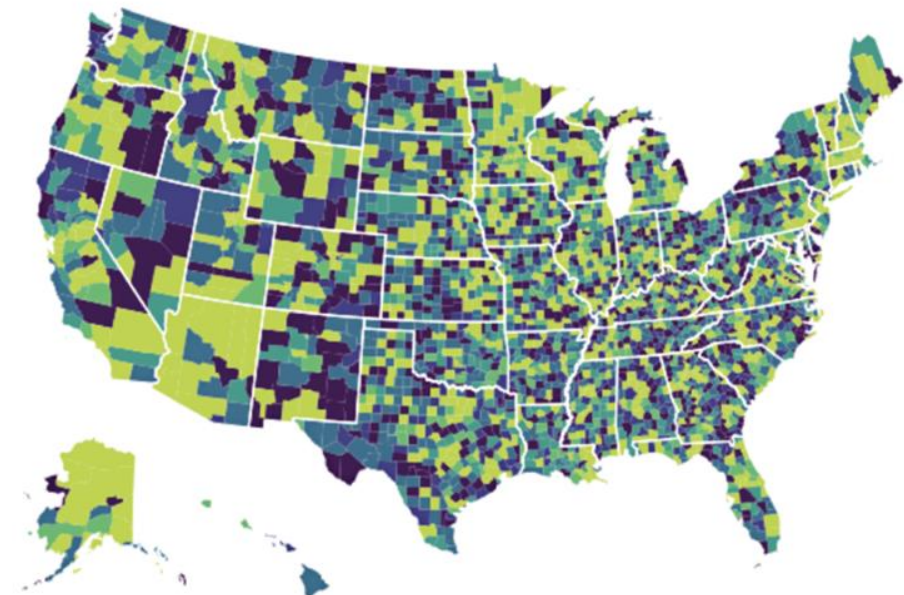
Key challenges

1. Harmful covariates travel together
2. Different PCPs, insurance quality, infrastructure across locations
3. Ecological fallacies vs individualistic fallacies

Approach #1

A mixed model empirically estimates the within- vs between-county components of variation in each outcome.

- allowing intercepts (baseline outcomes) to vary among counties
- time trends to vary across the study period
- slopes for the association between physician density and each outcome to vary among counties
- includes a fixed effect for unmeasured differences
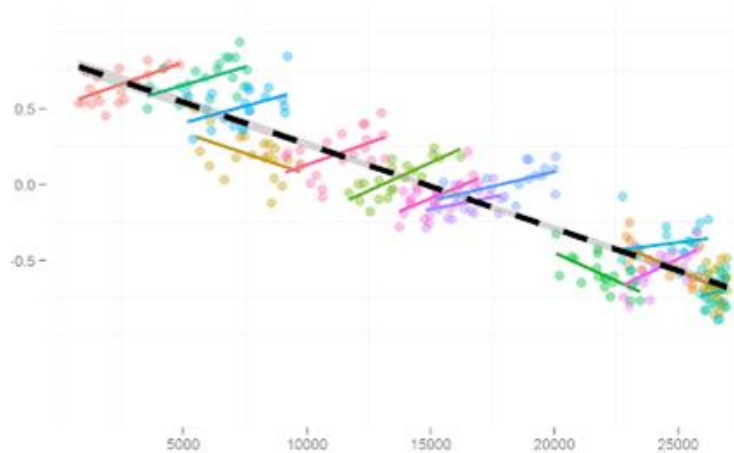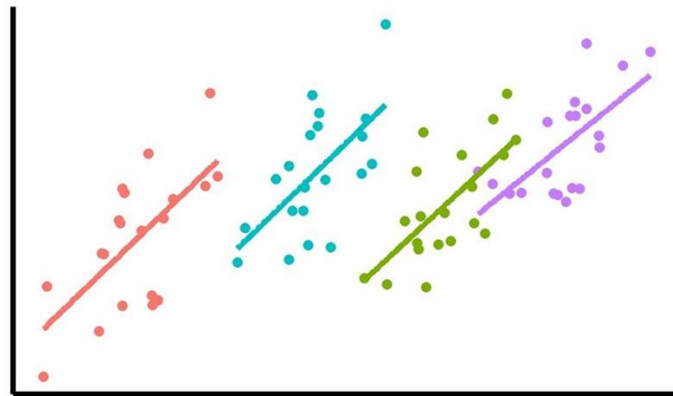
Approach #2

An instrumental variable is a factor that influences the outcome (mortality) only through its influence on the predictor variable of interest (primary care physician supply) but is not subject to reverse causality from the outcome or omitted variable bias.

Public Service Loan Forgiveness program forgives some loan payments for physicians who enter into public service, commonly nonprofit community clinics.

Although the loan forgiveness amount is fixed, the purchasing power varies widely by county.

This instrument was found to be strong (first-stage $F = 25.6$) for influencing primary care density, but not specialist density ($F = 7.2$).
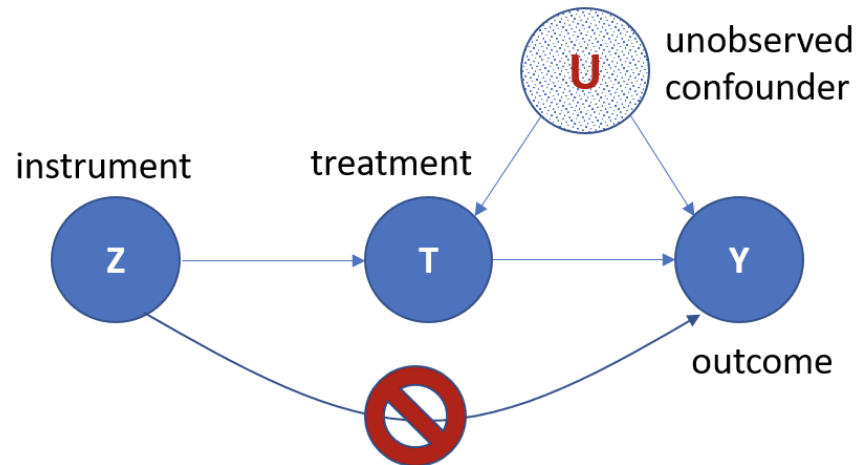
Approach #3

Individual-level claims analysis

Optum Clinformatics Data Mart, 2003 through 2016; N = 1,505,554 individuals

Estimating the Kaplan-Meier survival rate of participants, adjusted for censoring

Subgroup: individuals who moved between zip codes

Approach #4

Falsification testing

Whether unobserved factors--physicians move to desirable areas--correlated with lower mortality rates, producing false associations?

Mortality due to interpersonal violence (eg, murder)

E-value

how strong do unmeasured confounders (factors correlated with both primary care physician supply and life expectancy) need to be to explain away the association

Source	Change in Life Expectancy, (95% CI)
Model	
County mixed effects	51.5 (29.5-73.5)
PCSA mixed effects	117.3 (99.1-135.6)
HRR mixed effects	157.5 (59.7-255.5)
Geographically weighted	51.6 (7.6-95.6)
Instrumental variable	88.9 (15.6-162.2)
Individual-level regression	114.2 (94.7-133.8)

Change in Expectancy, d (95% CI)
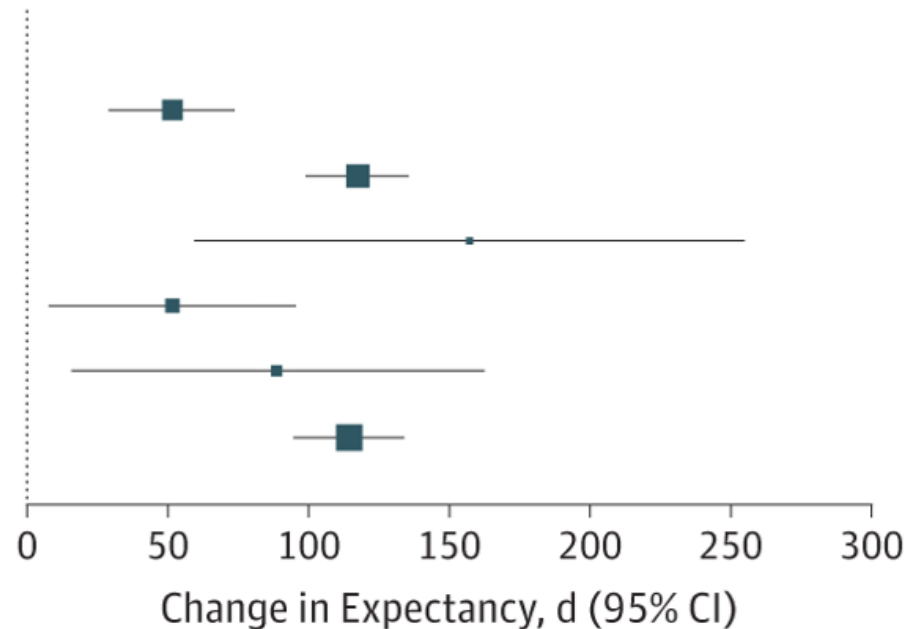
Disease and Physician Type	Change in Mortality per Million Population, (95% CI)
Cardiovascular	
Primary care	-30.4 (-52.4 to -8.4)
Cardiologist	-49.4 (-76.8 to -22.0)
Cancer	
Primary care	-23.6 (-35.0 to -12.3)
Oncologist	-14.6 (-32.2 to 3.0)
Respiratory tract	
Primary care	-8.8 (-15.3 to -2.2)
Pulmonologist	-10.5 (-20.6 to -0.4)
Infectious	
Primary care	-0.5 (-4.7 to 3.7)
Infectious diseases specialist	1.3 (-7.2 to 9.8)
Substance/injury	
Primary care	-3.2 (-8.4 to 2.1)
Psychiatrist/substance specialist	0.7 (-2.5 to 3.8)

Change in Mortality per Million Population (95% CI)

−80 −60 −40 −20 0 20
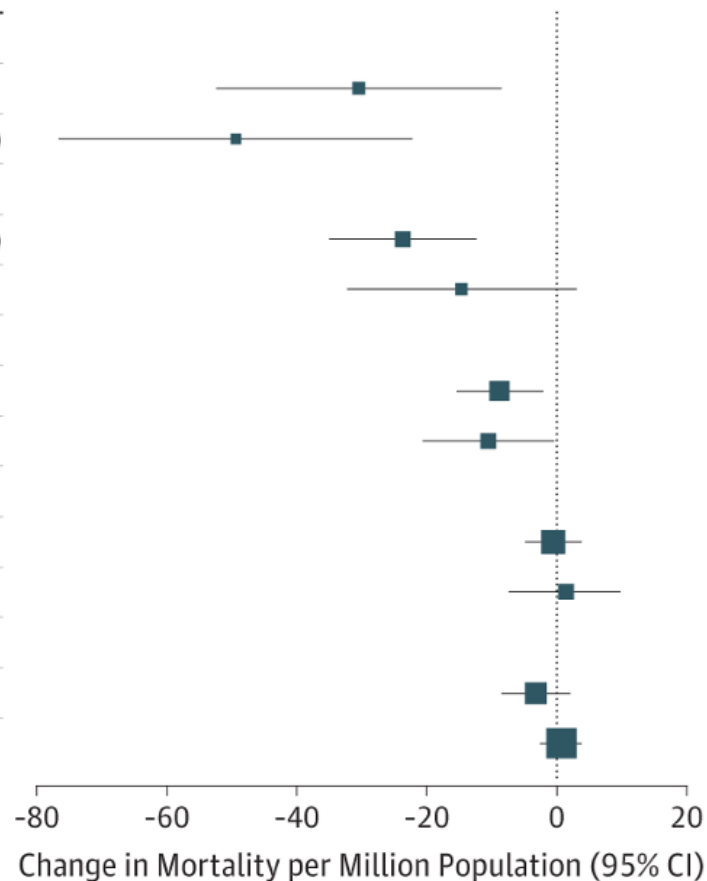
SI Figure 3: Instrumental variable regression results for cause-specific mortality.

Changes in cause-specific mortality associated with an increase in 10 primary care physicians per 100,000 people, N=3,142 US counties, 2005-2015.
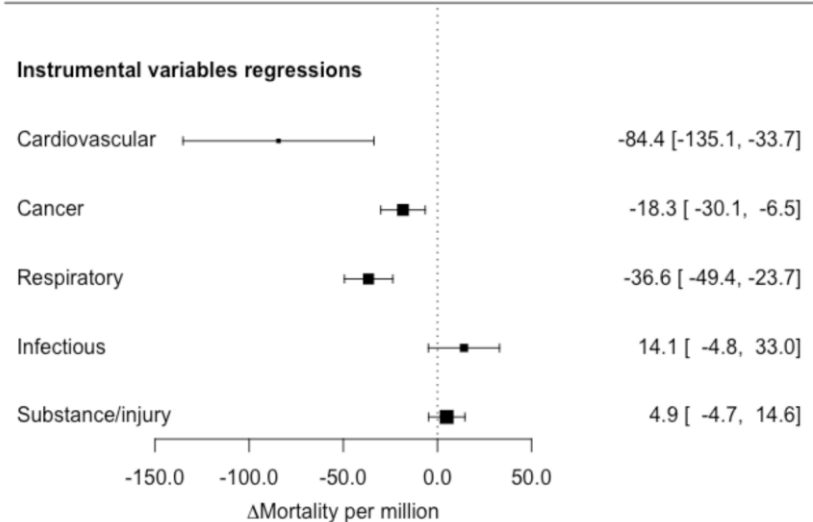
SI Figure 4: Near-far matching results for cause-specific mortality.

Changes in cause-specific mortality associated with an increase in 10 primary care physicians per 100,000 people, N=3,142 US counties, 2005-2015.
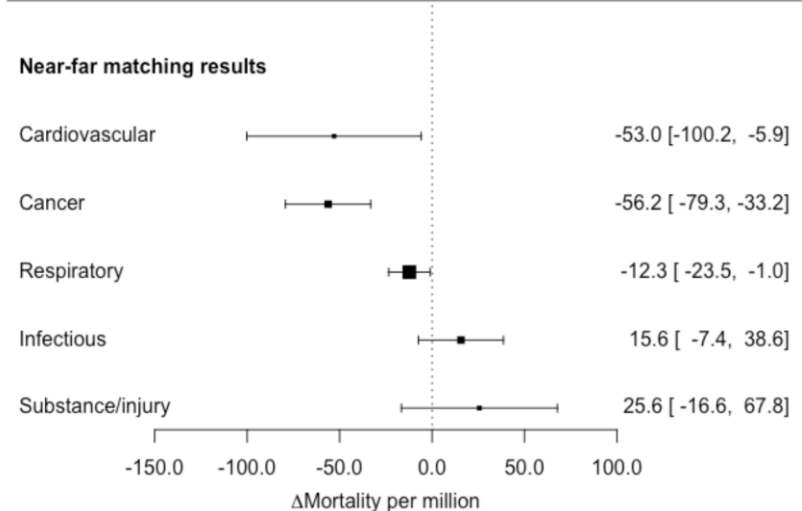
The E value for the association between primary care physician supply and life expectancy was 131.2 days.

Unmeasured confounders correlated with both primary care physician density and life expectancy would have to have associations almost as great in magnitude as the association between poverty and life expectancy to explain away the observed association between primary care physician supply and life expectancy.

Next policy steps

Payment reforms favoring public health need and whole-person care

Home- and community-based enhanced primary care management

Massachusetts "PC4U" Legislation

Rhode Island, Delaware efforts

Upstream efforts in MedEd

By Aaron Baum, Zirui Song, Bruce E. Landon, Russell S. Phillips, Asaf Bitton, and Sanjay Basu

Health Care Spending Slowed After Rhode Island Applied Affordability Standards To Commercial Insurers

ABSTRACT States are introducing regulations to slow health care spending growth, but which of these successfully reduce spending growth remains unclear. We studied Rhode Island's 2010 affordability standards, which imposed price controls—particularly inflation caps and diagnosis-based payments—on contracts between commercial insurers and hospitals and clinics and required commercial insurers to increase their spending on primary care and care coordination services. Using a difference-in-differences design, we compared spending among 38,001 commercially insured adults in Rhode Island to that among 38,001 matched adults in other states in the period 2007–16. Relative to quarterly fee-for-service (FFS) spending among the control group, quarterly FFS spending among the Rhode Island group decreased by $76 per enrollee after implementation of the policy, or a decline of 8.1 percent from 2009 spending. Quarterly non-FFS primary care coordination spending increased by $21 per enrollee. Total spending growth decreased, driven by lower prices concordant with the adoption of price controls. Quality measures were unaffected or improved. The Rhode Island experience indicates that states may be able to slow total commercial health care spending growth through price controls while maintaining quality.

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Bruce E. Landon is a professor in the Departments of Health Care Policy and of Medicine and a faculty member in the Center for Primary Care, all at Harvard

Baum, Aaron, et al. "Health care spending slowed after Rhode Island applied affordability standards to commercial insurers." *Health Affairs* 38.2 (2019): 237-245.

Appendix

Table 1. Characteristics of the Study Sample of 3142 US Counties, 2005-2015

Characteristic	Mean (95% CI)			Within-County Change, 2005 to 2015[a]
	2005	2010	2015	
Independent Predictor Variables				
Physicians per 100 000 population[b]				
Total	114.6 (0.0 to 425.7)	111.6 (0.0 to 434.9)	112.8 (0.0 to 461.3)	−1.9 (−64.0 to 67.1)
Primary care	46.6 (0.0 to 114.6)	44.0 (0.0 to 113.7)	41.4 (0.0 to 108.6)	−5.2 (−44.6 to 28.8)
Specialist	68.0 (0.0 to 326.7)	67.6 (0.0 to 327.5)	71.3 (0.0 to 356.2)	3.4 (−40.1 to 58.9)
Nonmetro area, %	67.3	73.0	73.0	5.7
Population in poverty, %[c,d]	15.3 (5.6 to 31.4)	16.8 (7.0 to 31.8)	16.3 (6.9 to 32.0)	1.0 (−4.2 to 5.6)
Median household income, 2015 $US	54 038.4 (34 370.7 to 90 744.6)	53 068.2 (34 523.4 to 87 779.4)	48 600.6 (30 622.5 to 80 641.5)	−5448 (−15 011.1 to 6711.5)
Population with less than high school education, %	17.8 (6.4 to 37.7)	15.4 (5.5 to 32.3)	13 (3.2 to 29.2)	−4.8 (−16.7 to 4.3)
Population ≥65 y, %	14.8 (7.6 to 24.1)	15.8 (8.5 to 25.2)	18.0 (10.0 to 27.9)	3.1 (−1.4 to 7.9)
Population female, %	50.3 (45.1 to 53.0)	49.8 (43.3 to 53.6)	50.0 (43.9 to 52.8)	−0.3 (−3.1 to 1.5)
Population black, %	9.0 (0.0 to 53)	9.1 (0.2 to 53.1)	9.3 (0.3 to 53.2)	0.3 (−2.7 to 3.1)
Population Hispanic, %	7.1 (0.5 to 46.9)	8.1 (0.8 to 50.4)	9.2 (0.9 to 53.6)	2.1 (−0.1 to 7.5)
Unemployment rate, %	5.6 (2.8 to 12.3)	9.4 (3.7 to 17.5)	5.7 (2.5 to 12.4)	0.1 (−2.3 to 3.1)
Uninsured among persons aged <65 y, %	25.0 (13.0 to 40.4)	18.5 (9.3 to 30.7)	12 (4.7 to 23.2)	−13.0 (−25.4 to −4.0)
Hospital beds per 100 000 population	358.6 (0.0 to 1733.0)	324.3 (0.0 to 1462.3)	294.7 (0.0 to 1336.0)	−63.2 (−592.9 to 185.9)
Medicare enrollment, %	16.3 (7.0 to 26.4)	18.3 (8.7 to 28.2)	20.6 (9.8 to 32.0)	4.3 (−1.4 to 10.6)
Geographic variation in terms of per capita medical costs, 2015, $US	8946.3 (5734.3 to 13 002.4)	9395.5 (7311.4 to 12 394.6)	9843.4 (7790.6 to 12 676.8)	898.4 (−2914.8 to 4608.3)
Adult tobacco smoking, %	17.9 (12.7 to 25.6)	21.3 (11.0 to 33.0)	21.3 (11.0 to 33.0)	3.4 (−5.9 to 12.2)
Adult obesity, %	27.5 (19.0 to 34.0)	30.7 (21.0 to 39.0)	32.1 (21.0 to 42.7)	4.5 (−3.0 to 13.0)
High pollution days, %	4.7 (0.0 to 24.3)	1.3 (0.0 to 9.3)	6.2 (0.0 to 34.6)	1.5 (−16.5 to 26.3)
Median home value 2015, $US	158 526.7 (60 822.4 to 462 389.7)	143 960.4 (63 335.6 to 371 204.1)	129 446.3 (55 081.0 to 293 371.5)	−29 080.4 (−192 909.3 to 45 054.4)
Dependent Outcome Variables				
Life expectancy at birth, age-standardized years	76.8 (72.5 to 80.5)	77.7 (73.2 to 81.5)	77.8 (72.9 to 82.0)	1.0 (0.1 to 1.9)
Age-adjusted deaths per 100 000 population				
Cancer	214.1 (162.2 to 271.7)	204.2 (149.8 to 264.1)	206.9 (148.2 to 273.6)	−7.2 (−21.9 to 8.0)
Cardiovascular disease	317.2 (215.7 to 439.7)	278.4 (185.4 to 397.2)	277.6 (179.6 to 406.6)	−39.6 (−66.6 to −12.9)
Infectious diseases	38.8 (22.2 to 63.2)	34.6 (18.3 to 58.8)	34.8 (17.0 to 61.4)	−4.0 (−9.9 to 2.7)
Respiratory tract diseases	62.3 (38.1 to 93.1)	62.1 (35.5 to 95.0)	64.2 (34.3 to 102.2)	1.8 (−7.5 to 13.7)
Substance use or injury	30.4 (16.3 to 53.8)	33.3 (17.4 to 59.8)	35.5 (17.9 to 64.7)	5.1 (−1.3 to 15.1)
Interpersonal violence	5.3 (1.6 to 15.2)	4.9 (1.5 to 14.6)	5.0 (1.6 to 14.7)	−0.3 (−1.9 to 0.7)

Table 2. Results of Mixed-Effects Regressions Associating Physician Density and County-Level Covariates With Age-Standardized Life Expectancy at Birth in 3142 US Counties, 2005-2015

Variable	Change in Age-Standardized Life Expectancy (95% CI)			
	Model 1 (Total Physician Density)	Model 2 (Primary Care Physician Density)	Model 3 (Specialist Density)	Model 4 (Primary Care Physician and Specialist Density)
Total physicians, per 100 000 population[a]	66.7 (47.5 to 85.8)	–NA	NA	NA
Covariate, per +10 physicians per 100 000[b]	88.9	NA	NA	NA
Primary care physicians, per 100 000 population	NA	31.8 (17.7 to 45.9)	NA	33.1 (19.0 to 47.3)
Covariate, per +10 physicians per 100 000[b]	NA	49.7	NA	51.5
Specialty physicians, per 100 000 population	NA	NA	23.3 (9.3 to 37.3)	20.6 (7.5 to 33.6)
Covariate, per +10 physicians per 100 000[b]	NA	NA	21.7	19.2
Metro area, change to nonmetro area, d	−54.6 (−79.8 to −29.5)	−55.8 (−81.0 to −30.7)	−51.0 (−76.5 to −25.6)	−54.2 (−79.4 to −29.0)
Population in poverty, d	−149.7 (−172.2 to −127.2)	−146.6 (−169.0 to −124.3)	−152.4 (−175.2 to −129.7)	−148.8 (−171.2 to −126.4)
Population with less than high school education, d	−59.5 (−73.5 to −45.5)	−58.1 (−71.9 to −44.3)	−59.4 (−73.5 to −45.3)	−58.1 (−72.0 to −44.3)
Female, d	−20.4 (−34.9 to −5.8)	−19.7 (−34.2 to −5.2)	−18.9 (−33.6 to −4.2)	−20.1 (−34.6 to −5.6)
Black, d	−409.4 (−448.9 to −370.0)	−406.5 (−445.8 to −367.2)	−408.6 (−448.4 to −368.8)	−411.9 (−451.2 to −372.6)
Hispanic, d	185.9 (149.9 to 221.9)	185.2 (149.3 to 221.1)	185.1 (149.0 to 221.3)	185.3 (149.4 to 221.1)
Unemployment rate, d	−13.7 (−28.2 to 0.8)	−14.1 (−28.6 to 0.3)	−15.6 (−30.2 to −0.9)	−14.1 (−28.5 to 0.4)
Hospital beds, per 100 000 population, d	−3.9 (−24.1 to 16.4)	−0.2 (−20.2 to 19.8)	−0.9 (−21.1 to 19.3)	−2.3 (−22.4 to 17.8)
Medicare enrollment, d	106.4 (81.1 to 131.7)	108.6 (83.5 to 133.7)	111.0 (85.6 to 136.4)	107.8 (82.6 to 132.9)
Per capita medical cost variation, d	4.3 (−4.5 to 13.2)	5.0 (−3.8 to 13.8)	4.8 (−4.1 to 13.8)	5.0 (−3.8 to 13.8)
Adult tobacco smoking, d	−52.8 (−63.4 to −42.3)	−52.6 (−63.1 to −42.1)	−54.0 (−64.6 to −43.4)	−52.3 (−62.8 to −41.8)
Adult obesity, d	−39.1 (−49.3 to −28.9)	−39.2 (−49.4 to −29.0)	−40.3 (−50.7 to −30.0)	−39.3 (−49.5 to −29.1)
High pollution days, d	−21.2 (−28.7 to −13.8)	−21.1 (−28.5 to −13.7)	−22.3 (−29.8 to −14.8)	−21.1 (−28.5 to −13.7)
Median home value, d	−22.0 (−42.4 to −1.6)	−22.5 (−42.7 to −2.3)	−19.9 (−40.4 to 0.7)	−23.2 (−43.5 to −3.0)

Age-Adjusted Life Expectancy, *y* vs. PCPs per 100 000 persons, *n*
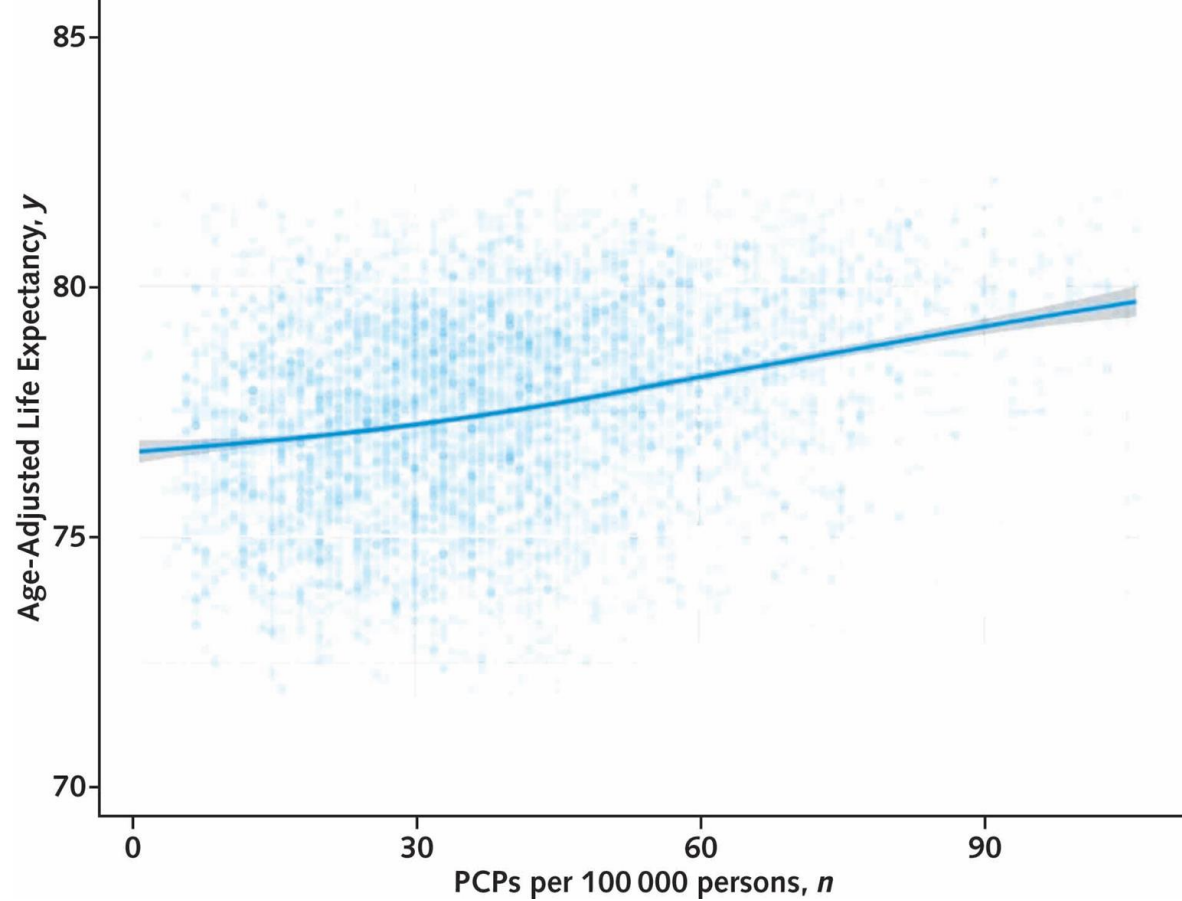
Basu S, Phillips RS, Berkowitz SA, Landon BE, Bitton A, Phillips RL. Estimated Effect on Life Expectancy of Alleviating Primary Care Shortages in the United States. Ann Intern Med. 2021 Mar 23. doi: 10.7326/M20-7381. Epub ahead of print. PMID: 33750188.

Covariate of interest	Coefficient of interaction term between primary care physician density and covariate of interest					
	Life expectancy (days)	Cancer mortality (deaths/mil.)	Cardiovascular mortality (deaths/mil.)	Infectious mortality (deaths/mil.)	Respiratory mortality (deaths/mil.)	Substance/injury mortality (deaths/mil.)
Metro area, change to non-metro area	-94.6 (-133.1, -58.0)	24.5 (4.9, 44.1)	84.7 (46.9, 122.6)	6.1 (-1.9, 14.0)	12.6 (0.8, 24.4)	0.8 (-8.9, 10.4)
Population in poverty, change from mean minus 1 SD (13.4% poverty) to mean plus 1 SD (16.4% poverty)	18.5 (-7.5, 44.5)	-31.1 (-44.2, -18.1)	1.2 (-24.6, 27.1)	-9.4 (-14.8, -4.1)	-11.8 (-19.7, -3.9)	-12.4 (-18.9, -5.9)
Population Black, change from mean minus 1 SD (1.4% Black) to mean plus 1 SD (7.9% Black)	71.2 (37.6, 104.7)	-13.5 (-29.5, 2.4)	24.5 (-6.1, 55.2)	-2.2 (-8.5, 4.1)	-13.9 (-23.4, -4.3)	6.2 (-1.4, 14.0)
Population Hispanic, change from mean minus 1 SD (2.8% Hispanic) to mean plus 1 SD (7.8% Hispanic)	70.4 (40.2, 100.5)	-4.4 (-8.3, 9.4)	-22.4 (-49.2, 4.5)	3.5 (-1.8, 8.8)	-0.2 (-8.3, 8.0)	8.3 (1.7, 14.9)

Primary Care Practices Providing a Broader Range of Services Have Lower Medicare Expenditures and Emergency Department Utilization

J Gen Intern Med. 2021 Mar 29. Epub ahead of print

Eugene C Rich MD, Senior Fellow,
Mathematica

PCC Journal Club July 2021

Background

/ **Comprehensiveness is a key element of primary care-**
- defined as the extent to which a patient's primary care provider (practitioner, practice, or team) recognizes and meets the large majority of the patient's physical and common mental health care needs"

/ **Aspects include Involvement in Patient Conditions (IPC)**
- the depth and breadth of conditions managed by the primary care practitioner (PCP)

/ **…and New Problem Management (NPM)**
- the extent to which the PCP can effectively address the many relatively common problems their patients may experience
- There are reliable and valid Medicare Claims-based measures of these two dimensions of comprehensiveness

/ **Range of services provided is a third key aspect of comprehensive primary care.**

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Practice Range of Services (ROS)

- **Starfield (and others) have focused on the range of professional services available at the primary care <u>practice site</u>**

  - IPC and NPM are features of comprehensiveness involving diagnosing new problems, planning pharmacotherapy relevant to a patient's multiple conditions

    - may be best measured as an <u>individual PCP competency</u>

  - But ability to provide key primary care services might be a <u>practice site</u>, not an individual <u>PCP</u> characteristic

Mathematica

Starfield on Practice Range of Services

- **Comprehensive care "…includes services that promote and preserve health (those that prevent disease, injury, and dysfunction), and those that promote care of illness, disability, and discomfort as long as these needs are not too uncommon for the primary care practitioner to maintain competence in dealing with them (generally occurring in at least one to two thousand people per year).**

  - **…This range of services includes (but is not limited to).."**

  - **…prevention, coaching, counseling…, care for acute and chronic illnesses and injuries, minor surgery, injections, aspiration of joints, simple dislocations, common skin problems, behavioral health and common mental health problems, and community health resources information"**

Mathematica

https://www.jhsph.edu/research/centers-and-institutes/johns-hopkins-primary-care-policy-center/pca_tools.html

Claims- based Measure of Practice ROS

- **PRACTICE-ROS measure assesses the comprehensiveness of services that a primary care practice site's primary care practitioners provided to Medicare beneficiaries during any particular year**

- **We identified illustrative services relevant to Medicare beneficiaries over age 65 that could be detected through Medicare claims**

  - (1) Immunizations;

  - (2) Counseling for common behavioral or mental health problems;

  - (3) Treatment of a minor laceration;

  - (4) Cryotherapy and/or skin excision;

  - (5) Joint or tendon injection.

  In each of these 5 categories of services we selected specific CPT codes that represented at least 0.5% of the services of this type billed by primary care practitioners in the observed practices.

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Claims-based Measure of Practice ROS (II)

- **We reviewed all the Medicare claims billed by each primary care practitioner (primary care physician, nurse practitioner or physician assistant) practicing at that site during the year**

  - A score of 5 indicated the practice site provided at least once instance of each of the 5 services during the year

  - …3 indicated the practice site provided at least one instance of each of three categories of services

  - …0 indicated that practitioners at the practice site never billed for any of these types of services during the year

Mathematica

Data Sources

Analyses conducted in the context of the evaluation of the Comprehensive Primary Care (CPC) Initiative

6050 primary care physicians, NPs, PAs, and CCNSs in 1383 CPC and comparison practices in 2013.

Practice ROS measure: Analyzed 2013 Medicare Part B claims submitted by CPC and comparison practice sites on all 1,232,940 beneficiaries seen.

Cost and utilization outcomes: Beneficiary-level outcomes using beneficiaries' 2014 Medicare claims for services received from all providers

Mathematica

Results I- Substantial variation across Practice sites

Table 1 Variation in Services Provided by Practice Sites

Variation in service categories provided (N = 1383)	Number (%)
Immunizations	1300 (94.0)
Mental health counseling	24 (1.7)
Treatment of minor lacerations	520 (37.6)
Skin biopsies and cryotherapy	999 (72.2)
Joint/tendon injection	1012 (73.2)
Variation in service category count (N = 1383)	**Number (%)**
Practice-ROS count 0	20 (1.4)
Practice-ROS count 1	224 (16.2)
Practice-ROS count 2	233 (16.9)
Practice-ROS count 3	467 (33.8)
Practice-ROS count 4	431 (31.2)
Practice-ROS count 5	8 (0.6)

Mathematica

Results II- Practice-ROS Association with Practice Characteristics

/ **Multivariate analysis**

- Practice sites with more than 50% of primary care physicians in internal medicine provide a narrower range of services than do those with more than 50% of primary care physicians in family medicine
  o marginal effect on Practice-ROS -0.68, $p < 0.001$.
- Larger practice sites with 4 or more physicians provide broader ROS than practice sites with 1-3 physicians
  o Marginal effect on Practice-ROS +0.40, $p < 0.001$.
- Practice sites with at least one NP or PA not associated with broader ROS ($p=0.12$)

Mathematica

Results III- Practice-ROS Association with Patient Outcomes

/ **Practice sites with Practice-ROS at the 75th percentile had 3.2% lower rates of ED visits (p<0.01)**

- 22 fewer ED visits per 1000 beneficiaries.

/ **Sites with Practice-ROS at the 75th percentile had 3.1% lower Medicare spending (p < 0.01)**

- $25 less monthly spending per beneficiary.

/ **No association between Practice-ROS and hospitalization rates (p = 0.119).**

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Discussion

/ **Reliable and valid claims-based measure of practice-site ROS.**

/ **When Primary Care practices provide a broader ROS their Medicare beneficiaries experience fewer ED visits and lower total Medicare spending**

/ **Practice-ROS can be readily measured using diverse data sources from Medicare claims to electronic health records.**

/ **Various strategies could help primary care practice sites provide a broader range of the services most needed by their Medicare beneficiaries.**

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Questions?

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Progress Together