

**Examples of some inferential studies related to health care variation  
October 2019**

**Association of variation in capacity and outcomes**

- Goodman DC, Fisher ES, Little GA, Stukel TA, Chang CH, Schoendorf KS. (2002) The relation between the availability of neonatal intensive care and neonatal mortality. *N Engl J Med.* 346(20):1538-1544. PMID 12015393
- Goodman DC, Fisher ES. (2008) Physician workforce crisis? Wrong diagnosis, wrong prescription. *N Engl J Med.* 358(16):1658-1661.  
*Links survey data to Medicare claims*
- Guttmann A, Shipman SA, Lam K, Goodman DC, Stukel TA. (2010) Primary care physician supply and children's health care use, access, and outcomes: findings from Canada. *Pediatrics.* 125(6):1119-1126.
- Chang CH, Stukel TA, Flood AB, Goodman DC. (2011) Primary care physician workforce and Medicare beneficiaries' health outcomes. *JAMA : the journal of the American Medical Association.* 305(20):2096-2104. PMID 3108147
- Nyweide DJ, Anthony DL, Chang CH, Goodman D. (2011) Seniors' perceptions of health care not closely associated with physician supply. *Health Aff (Millwood).* 30(2):219-227. PMID 3070266  
*Links survey data to Medicare claims*
- Yasaitis LC, Bynum JP, Skinner JS. (2013) Association between physician supply, local practice norms, and outpatient visit rates. *Med Care.* 51(6):524-531. PMID 3810471  
*Links survey data to Medicare claims*
- Chang CH, O'Malley AJ, Goodman DC. (2017) Association between Temporal Changes in Primary Care Workforce and Patient Outcomes. *Health Serv Res.* 52(2):634-655. PMID 35346500
- Harrison WN, Wasserman JR, Goodman DC. (2018) Regional Variation in Neonatal Intensive Care Admissions and the Relationship to Bed Supply. *J Pediatr.* 192:73-79 e74. PMID 28969888
- Cutler D, Skinner J, Stern A, Wennberg DE. (2019) Physician Beliefs and Patient Preferences: A New Look at Regional Variation in Health Care Spending *American Economic Journal: Economic Policy.* 11(1):192-221.  
*Links survey data to Medicare claims*

**Association of variation in medical spending with physician behavior, patient perceptions, quality, and outcomes**

- Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. (2003) The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care. *Ann Intern Med.* 138(4):273-287.
- Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. (2003) The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care. *Ann Intern Med.* 138(4):288-298.

Association of Sirovich BE, Gottlieb DJ, Welch HG, Fisher ES. (2005) Variation in the tendency of primary care physicians to intervene. *Arch Intern Med.* 165(19):2252-2256.  
*Links survey data to Medicare claims*

Birkmeyer JD, Gust C, Dimick JB, Birkmeyer NJ, Skinner JS. (2012) Hospital quality and the cost of inpatient surgery in the United States. *Ann Surg.* 255(1):1-5. PMID 3249383

Fowler FJ, Jr., Gallagher PM, Anthony DL, Larsen K, Skinner JS. (2008) Relationship between regional per capita Medicare expenditures and patient perceptions of quality of care. *JAMA.* 299(20):2406-2412. PMID 2438036 (added 9/6/19)

### **Association of variation in utilization with physician behavior, patient perceptions, quality, and outcomes**

Teno JM, Mor V, Ward N, Roy J, Clarridge B, Wennberg JE, Fisher ES. (2005) Bereaved family member perceptions of quality of end-of-life care in U.S. regions with high and low usage of intensive care unit care. *J Am Geriatr Soc.* 53(11):1905-1911.  
*Links survey data to Medicare claims*

Barnato AE, Herndon MB, Anthony DL, Gallagher PM, Skinner JS, Bynum JP, Fisher ES. (2007) Are regional variations in end-of-life care intensity explained by patient preferences?: A Study of the US Medicare Population. *Med Care.* 45(5):386-393. PMID 1747061  
*Links survey data to Medicare claims*

Sirovich BE, Gottlieb DJ, Welch HG, Fisher ES. (2005) Variation in the tendency of primary care physicians to intervene. *Arch Intern Med.* 165(19):2252-2256.

Sirovich BE, Gottlieb DJ, Welch HG, Fisher ES. (2006) Regional variations in health care intensity and physician perceptions of quality of care. *Ann Intern Med.* 144(9):641-649.  
*Links survey data to Medicare claims*

Sirovich B, Gallagher PM, Wennberg DE, Fisher ES. (2008) Discretionary decision making by primary care physicians and the cost of U.S. Health care. *Health Aff (Millwood).* 27(3):813-823. PMID 1838037  
*Links survey data to Medicare claims*

Brooke BS, Kraiss LW, Stone DH, Nolan B, De Martino RR, Reiber GE, Goodman DC, Cronenwett JL, Goodney PP. (2014) Improving outcomes for diabetic patients undergoing revascularization for critical limb ischemia: does the quality of outpatient diabetic care matter? *Ann Vasc Surg.* 28(7):1719-1728. PMID 2465745

Brooke BS, Stone DH, Cronenwett JL, Nolan B, DeMartino RR, MacKenzie TA, Goodman DC, Goodney PP. (2014) Early primary care provider follow-up and readmission after high-risk surgery. *JAMA Surg.* 149(8):821-828. PMID 2487962

Goodney PP, Travis LL, Brooke BS, DeMartino RR, Goodman DC, Fisher ES, Birkmeyer JD. (2014) Relationship between regional spending on vascular care and amputation rate. *JAMA Surg.* 149(1):34-42. PMID 24279246

Bekelis K, Fisher ES, Labropoulos N, Zhou W, Skinner J. (2015) Variations in the intensive use of head CT for elderly patients with hemorrhagic stroke. *Radiology*. 275(1):188-195. PMID PMC5533596

Colla CH, Morden NE, Sequist TD, Schpero WL, Rosenthal MB. (2015) Choosing wisely: prevalence and correlates of low-value health care services in the United States. *J Gen Intern Med*. 30(2):221-228. PMID PMC4314495

Parker DM, Schang L, Wasserman JR, Viles WD, Bevan G, Goodman DC. (2016) Variation in Utilization and Need for Tympanostomy Tubes across England and New England. *J Pediatr*. 179:178-184 e174. PMID PMC5530588

Newhall KA, Bekelis K, Suckow BD, Gottlieb DJ, Farber AE, Goodney PP, Skinner JS. (2017) The relationship of regional hemoglobin A1c testing and amputation rate among patients with diabetes. *Vascular*. 25(2):142-148. PMID PMC5457810

Fairfield KM, Black AW, Lucas FL, Siewers AE, Cohen MC, Healey CT, Briggs AC, Han PKJ, Wennberg JE. (2018) Behavioral Risk Factors and Regional Variation in Cardiovascular Health Care and Death. *Am J Prev Med*. 54(3):376-384

Welch HG, Skinner JS, Schroeck FR, Zhou W, Black WC. (2018) Regional Variation of Computed Tomographic Imaging in the United States and the Risk of Nephrectomy. *JAMA Internal Medicine*. 178(2):221-227. PMID PMC5838611

### **Association of variation in utilization with hospital characteristics**

Morden NE, Chang CH, Jacobson JO, Berke EM, Bynum JP, Murray KM, Goodman DC. (2012) End-of-life care for Medicare beneficiaries with cancer is highly intensive overall and varies widely. *Health Aff (Millwood)*. 31(4):786-796. PMID 3338099  
*Links survey data to Medicare claims*

Brown JR, Chang CH, Zhou W, MacKenzie TA, Malenka DJ, Goodman DC. (2014) Health system characteristics and rates of readmission after acute myocardial infarction in the United States. *J Am Heart Assoc*. 3(3):e000714. PMID 4309053

### **Miscellaneous**

Goodman DC, Stukel TA, Chang CH, Wennberg JE. (2006) End-of-life care at academic medical centers: implications for future workforce requirements. *Health Aff (Millwood)*. 25(2):521-531. PMID 16522606

Skinner J, Staiger D, Fisher ES. (2010) Looking back, moving forward. *N Engl J Med*. 362(7):569-574; discussion 574.

Kelley AS, Bollens-Lund E, Covinsky KE, Skinner JS, Morrison RS. (2018) Prospective Identification of Patients at Risk for Unwarranted Variation in Treatment. *J Palliat Med*. 21(1):44-54. PMID PMC5757079

### **Methods**

Song Y, Skinner J, Bynum J, Sutherland J, Wennberg JE, Fisher ES. (2010) Regional variations in diagnostic practices. *New England Journal of Medicine*. 363(1):45-53. PMID 2924574

Welch HG, Sharp SM, Gottlieb DJ, Skinner JS, Wennberg JE. (2011) Geographic variation in diagnosis frequency and risk of death among Medicare beneficiaries. *Jama*. 305(11):1113-1118. PMID PMC3071496

Wennberg JE, Staiger DO, Sharp SM, Gottlieb DJ, Bevan G, McPherson K, Welch HG. (2013) Observational intensity bias associated with illness adjustment: cross sectional analysis of insurance claims. *British Medical Journal*. 346:f549. PMID 3578417

### **Decision quality and preference sensitive care**

Fowler FJ, Jr., Gallagher PM, Bynum JP, Barry MJ, Lucas FL, Skinner JS. (2012) Decision-making process reported by Medicare patients who had coronary artery stenting or surgery for prostate cancer. *J Gen Intern Med*. 27(8):911-916. PMID PMC3403150  
*Links survey data to Medicare claims*

Birkmeyer JD, Reames BN, McCulloch P, Carr AJ, Campbell WB, Wennberg JE. (2013) Understanding of regional variation in the use of surgery. *Lancet*. 382(9898):1121-1129. PMID PMC4211114

Anthony DL, Herndon MB, Gallagher PM, Barnato AE, Bynum JP, Gottlieb DJ, Fisher ES, Skinner JS. (2009) How much do patients' preferences contribute to resource use? *Health Aff (Millwood)*. 28(3):864-873. PMID 2731939 (added 9/6/19)