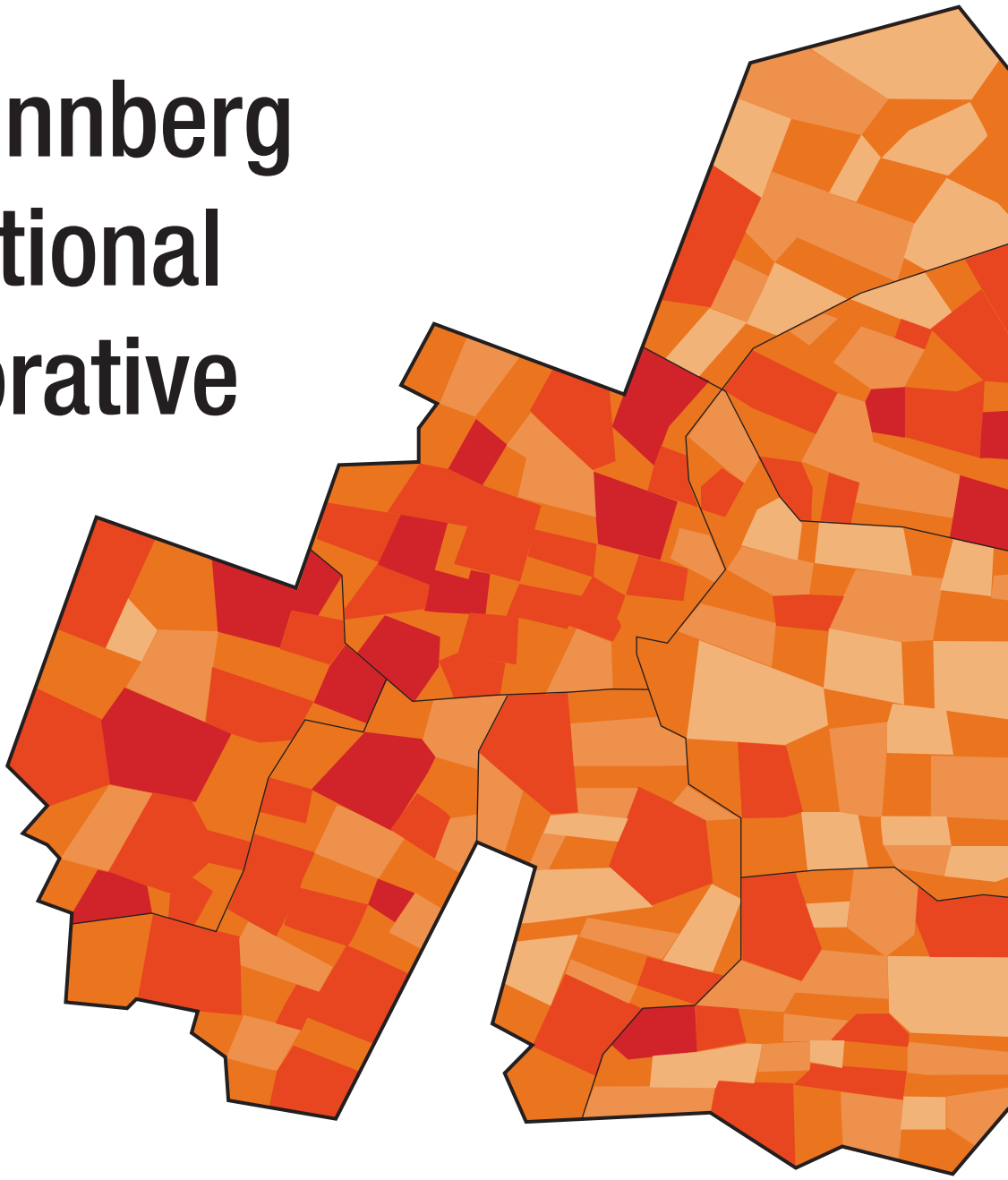
The Wennberg International Collaborative



London School of Economics and Political Science

September 14 and 15, 2010

THE DARTMOUTH INSTITUTE
FOR HEALTH POLICY & CLINICAL PRACTICE
Where Knowledge Informs Change

THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE

The Wennberg International Collaborative

London School of Economics and Political Science

September 14, 2010

206, New Academic Building, 12:30–6pm

September 15, 2010

Thai Theatre, New Academic Building, 9am–2pm

The Wennberg International Collaborative (WIC) was recently established by David Goodman of Dartmouth College and Gwyn Bevan of the London School of Economics to provide a network for investigators with active research or a high level of interest in studies of medical practice variation.

David C. Goodman, MD MS
Professor, Dartmouth College
Director, Center for Health Policy Research

Gwyn Bevan
Professor of Management Science
London School of Economics and Political Science

Acknowledgements

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The Wennberg International Collaborative
2010 Inaugural Conference

Tuesday, September 14 & Wednesday, September 15, 2010
London School of Economics, London UK

Tuesday, September 14

12:30 -2:00 PM *LSE New Academic Building, Room 104*	**Lunch**
2:00 PM *LSE New Academic Building, Room 104*	**Opening Remarks & Introductions** David Goodman *The Dartmouth Institute for Health Policy and Clinical Practice* & Gwyn Bevan *London School of Economics and Political Science*
2:15 - 3:00 PM	**Medical Care Variation Research: Historical and Methodological Overview** David Goodman *The Dartmouth Institute at Dartmouth College* *Hanover, US*
3:00 - 3:30 PM	**Health and social care use at the end of life. An analysis of administrative data from England** John Billings, *New York University* Martin Bardsley, *The Nuffield Trust for Research and Policy Studies in Health Service,* *London UK*
3:30 -4:00 PM	**Managing variation in diagnostic medical imaging to improve appropriateness and financial re-allocation** Manuela Gussoni *Scuola Superiore Sant'Anna* *Pisa, Italy*
4:00 - 4:15 PM	**Break-Tea/Coffee**
4:15 - 4:45 PM	**Stents & Zip Codes; The Geography of Cardiovascular Health Care in Switzerland** Andre Busato *University of Bern* *Bern, Switzerland*
4:45–5:15 PM	**Atlas VPM: the Quality of the Spanish National Healthcare System under scrutiny** Enrique Bernal-Delgado *Institute for Health Sciences in Aragon* *Zaragoza, Spain*
5:15– 6:00 PM	**Reactor Panel for Afternoon Presentations** Albert Mulley | *Harvard Medical School* | *Boston, US* Zynep Or | *Institute for Research and Information in Health Economics* | *Paris, France* *Gwyn Bevan, LSE, Moderator*
7:00 PM	**Reception & Dinner**

The Wennberg International Collaborative
2010 Inaugural Conference

Tuesday, September 14 & Wednesday, September 15, 2010
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Wednesday, September 15

9:00-9:30 AM *LSE New Academic Building, Room 104*	**Risk Adjustment - General Considerations** Therese Stukel *Institute for Clinical Evaluative Sciences* *Toronto, Canada*
9:30-10:00 AM	**Measuring Variation across Regions or Providers?** David Goodman *The Dartmouth Institute at Dartmouth College* *Hanover, US*
10:00–10:30 PM	**Understanding variation in surgical outcomes: Rethinking the calculus of quality** Justin Dimick *University of Michigan* *Ann Arbor, US*
10:30-11:00 AM	**Break - Tea & Coffee Break**
11:00-12:00 PM	**Panel Discussion** Klim McPherson | *University of Oxford* | *Oxford, UK* Jacqueline Mueller-Nordhorn | *Institute of Social Medicine* | *Berlin, Germany* *David Goodman, Dartmouth, Moderator*
12:00-1:00 PM	**Future of WIC & Meetings** Gwyn Bevan | *London School of Economics* | *London, UK* David Goodman | *The Dartmouth Institute for Health Policy and Clinical Research* | *Hanover, US*
1:00-2:15 PM	**Lunch**

Wennberg International Collaborative – Conference Report

Introduction

The cost and quality of health care are international concerns. Medical expenditures have grown more rapidly than inflation in many developed nations in recent years, bringing into question the long-term sustainability of health care systems. At the same time, it has become increasingly clear that there are sharp differences across countries, regions, and even neighboring cities and hospitals in the amount and quality of care provided. In the United States, for example, researchers have found that patients in some parts of the country receive far more intensive—and expensive—care than patients elsewhere, without necessarily experiencing better outcomes. The study of this type of variation in the supply of medical resources and the delivery and outcomes of care has the potential to slow the growth of spending while improving the quality of care.

In September 2010, researchers from Europe, North America, and Australia gathered in London for the inaugural meeting of the Wennberg International Collaborative, a community of scholars interested in examining unwarranted variations in health care. The group was established by Gwyn Bevan of the London School of Economics and Political Science and David Goodman of the Dartmouth Institute for Health Policy and Clinical Practice, and it is named for John Wennberg, whose pioneering work helped create the field of variations research. The goals of the Collaborative include sharing research findings from around the world, facilitating the discussion of methodologies used in this field, and increasing international awareness of the challenges posed to health care systems by these variations. Over the course of the two-day conference, a few common themes emerged:

First, despite differences in the organization of health care, unwarranted variations appear to be ubiquitous. Whether a system is public or private, and whether providers are paid a salary or through fee-for-service, no single country has found a remedy for unwarranted variations.

Second, the methodologies of variations research are inherently complex and subject to debate. Difficulties can arise when determining how to adjust studies to account for differences in patient populations, when such adjustments are necessary, and which statistical methods are best suited

to variations research.

Third, opposition to the study of unwarranted variations is widespread. Many of those involved in health care, from physicians to policymakers to patients, may be wary of the questions posed by variations researchers, leading to difficulties in obtaining funding and in implementing remedies suggested by the findings.

This report summarizes the work presented at the conference, including an overview of the history of variations research, case studies from a number of countries, and discussions of some of the methodological issues facing the field.

A brief history of variations research

Although it is only within the past few decades that the study of unwarranted variations has become of widespread interest, the origins of the field are much older. In 1938, English researcher J. Alison Glover published an article in the *Proceedings of the Royal Society of Medicine* in which he documented the variation in the incidence of tonsillectomy among schoolchildren. He reported that in 1936, on average, 1.7 percent of English children between the ages of five and fourteen had their tonsils removed surgically, but the rate in some areas of the country was more than three times the average, whereas in other areas it was significantly below the average. He pointed out that these differences had important implications, as it was estimated that at least 85 children died each year from complications suffered during a tonsillectomy. If tonsillectomies were in some cases being performed unnecessarily, perhaps some of those deaths could have been avoided.

Glover's study was largely overlooked at the time, but it gained recognition later in the century with renewed interest in the study of unwarranted variations in health care. In the late 1960s and early 1970s, John Wennberg and colleague Alan Gittelsohn took a close look at the delivery of health care in the state of Vermont. They found that the utilization of health care resources in this small, rural, and demographically homogeneous state varied widely, with no apparent medical explanation. Their conclusions were met with disbelief by the medical community, and no medical journal would accept their paper. It was finally published in 1973 in the scientific

journal *Science*.

Despite resistance to Wennberg's efforts, the field grew over the next decade, with other researchers, including some from Canada and England, carrying out related studies. In 1988, Wennberg founded the Center for Evaluative Clinical Sciences at Dartmouth (now the Dartmouth Institute for Health Policy and Clinical Practice). From there, he and other researchers released a series of reports on unwarranted variations in American health care. In these reports, published as the Dartmouth Atlas of Health Care, Wennberg established a few useful concepts for understanding unwarranted variations. He investigated the causes and consequences of variations in different types of treatments, dividing medical care into three categories:

-Effective care: Care that is known to be effective, such as the use of beta blockers in heart-attack patients. Research has shown that effective care is often underused.

-Preference-sensitive care: Treatments for conditions with a number of possible options, each of which has its own risks and benefits. In these situations, there is no single best option, making it essential that patients take an active role in deciding the course of treatment.

-Supply-sensitive care: Care that varies depending on the local supply of resources. In areas with more resources, such as specialists or hospital beds, more supply-sensitive care tends to be delivered, leading to unnecessarily intensive care.

An abundance of studies from the past decade has expanded the scope of the field, often challenging basic assumptions about health care. As a result, one constant in the study of unwarranted variations has been vocal criticism of the field. Still, awareness of the importance of variations research has grown, as evidenced by the work of those gathered at the Wennberg International Collaborative conference.

Case Studies of Variations Research

End-of-life care in England

In England, 64 percent of people die in a hospital, despite the preferences of most people to spend their final days at home. Given the high cost of end-of-life care, the disparity between patients' preferences and their treatment raises questions about potentially unnecessary spending and contributes to the sense that the quality of end-of-life care is not as high as it should be.

Martin Bardsley, the head of research at the Nuffield Trust in London, discussed a recent study of end-of-life care in England. The study examined a cohort of people who died from 2005 to 2008, looking at regional variation in hospital admissions and total bed days in the last 12 and 24 months of life, and in the percentage of people who died in the hospital. One consideration was deciding how to adjust the data. Age and gender were two obvious factors to consider, but others were more difficult. The research team settled on adjusting based on wealth and a number of diagnostic groups.

An important finding of the research was that members of ethnic minorities are more likely to receive more intensive care at the end of life than white patients. This disparity remained even after adjusting the data for confounding variables. It is unclear whether this finding is the result of differences in access to care, discrimination, cultural values, or some combination of those factors.

The use of diagnostic imaging in Italy

Providers in the Tuscany region of Italy make greater use of diagnostic imaging than providers in much of the rest of the country. In part as a result, typical wait times for a CT scan or an MRI now exceed 60 days. Manuela Gussoni, a doctoral student in economics at the University of Pisa, conducted a study of variation in the use of these imaging services across Tuscany's individual districts to assess whether some of the use of diagnostic imaging may be medically unnecessary.

In 2009, rates of combined CT and MRI ranged across districts from about 50 to more than 170 per 1,000 residents. This variation does not appear to be the result of differences in the public–private composition of the districts. Nor is it the case that there is a substitution effect—regions with a high rate of MRI do not necessarily have lower CT rates. There are, however, some uses of CT and MRI that account for much of the overall variation. Therefore, addressing provider

practices in use of imaging in these specific fields may address much of the problem.

Gussoni and her colleagues estimated that medically inappropriate diagnostic imaging resulted in the unnecessary expenditure of about 12 million Euros (or about US$16 million) in 2009. They plan to share their findings with focus groups of physicians to try to identify best practices and minimize future variations.

Cardiovascular care in Switzerland

In terms of per capita spending, Switzerland has one of the most expensive health care systems in the world. Citizens have universal coverage and providers are paid primarily on a fee-for-service basis. Each of the country's 26 cantons has, in effect, its own health system, leading to fragmentation that has been estimated to cost the country 4.5 billion Swiss Francs (about US$4.6 billion), or roughly one percent of gross domestic product (GDP).

André Busato, a professor of clinical epidemiology at the University of Bern, examined variation in cardiovascular care among the cantons. He divided the country into 86 health service areas, which ranged in population from 1,588 to more than 450,000 and in number of hospitals from one to 21.

Both the supply and utilization of medical resources varied significantly by area. The number of hospital beds per 1,000 population ranged from 0.9 to 11.4. Overall, there was 2.6-fold variation in hospitalization rates for cardiovascular disease from 2003 to 2007, with much greater variation for some specific conditions. The rate of hospitalizations for coronary artery bypass surgery, for example, was 6.77 times higher in the health service area with the highest rate than the area with the lowest rate. The rate of percutaneous cardiovascular procedures was 11.56 times higher in the area with the highest rate than in the area with the lowest rate.

Some of this variation can be explained by medical factors, such as differences in the health of local populations, but much of it is unwarranted variation, possibly caused by financial incentives and a lack of adherence to clinical guidelines. Despite the significant variation, there has been little interest among physicians, research institutions, and policymakers, making it

difficult to obtain funding for further research and to publish in peer-reviewed journals.

Access and outcomes in Spain

Spain's National Health Service is decentralized, with each of the country's regional governments responsible for providing health care in its region. There is universal health coverage that is, for the most part, free. General practitioners act as gate-keepers, determining when patients should have access to specialists. Health care providers are public servants and are paid by salary.

Enrique Bernal-Delgado is one of several researchers working as part of the Health Service's Atlas of Variations in Medical Practice (Atlas VPM) to examine a number of questions related to unwarranted variations. Goals of Atlas VPM include assessing whether access to appropriate diagnostic and surgical procedure depends on where a person lives, examining how much the likelihood of experiencing an adverse event varies by region, and figuring out the costs and possible benefits of providing more-intensive care.

Thus far, Atlas VPM has published six studies that document extensive variation in medical practice, taking both a hospital-based and population-based approach. Rates of procedures such as cesarean sections and prostatectomy vary widely. Overall, rates of prostatectomies have risen in recent years, despite a lack of evidence supporting the effectiveness of the procedure in increasing survival. There are also variations in access to care. Women in lower-income communities, for example, are less likely to receive conservative mastectomies than women in wealthier communities, despite the fact that it is the first choice of treatment. Rates of adverse events, such as catheter-related infections, vary widely by hospital and provider.

Methodological Matters

The question of causation

One goal of research on unwarranted variations is to identify causes of such variation. For example, studies in the United States have shown that in regions with a higher supply of cardiologists, patients make more visits to see a cardiologist, raising the essential question of whether the high supply causes the high rate of visits. Thérèse Stukel, a senior scientist and vice

president of research at the Institute for Clinical Evaluative Sciences in Toronto, discussed some of the methodological issues involved in making such inferences.

Randomized controlled trials are regarded as the "gold standard" in determining causation, but they are often not possible to undertake in variations research. As a result, addressing causation requires researchers to adjust their data to take into account factors such as differences in the health of patient populations. Failure to adjust adequately may lead to spurious conclusions about the causes of unwarranted variations.

One step in proper risk-adjustment is measuring potentially confounding variables, such as levels of chronic disease. Studies attempting to assess causation should first identify such variables and determine whether they can be measured and controlled for. It is not always the case, however, that more adjustment leads to more accurate inferences. When studying variation in the use of interventions that are known to be effective, such as annual eye exams for patients with diabetes, there is no need to adjust for varying levels of illness or for age, race, or gender because virtually all patients should receive such treatments.

The scale of research

The examination of unwarranted variations requires careful thought about the geographic unit of study. Dividing an area into fewer large regions allows easier national comparisons and helps ensure that there will generally be less difference in the case mix between different regions. Using a larger number of small areas makes it possible to assess more accurately the performance of local health systems, hospitals, or providers, but it also requires consideration of differing levels of illness and how many people within a geographic region actually receive their care elsewhere.

David Goodman described the development of the units of study used by the Dartmouth Atlas of Health Care. Atlas researchers have divided the country into 306 hospital referral regions (HRRs) based on where people receive tertiary care. A map of spending or health care intensity at the HRR level cannot be used to assess individual providers, but it is a good tool for making broad comparisons and for explaining the significance of unwarranted variations to policymakers

and the public.

For studies at the primary care level, Atlas researchers broke the country into more than 6,500 primary care service areas, most of which are quite small in terms of geographic area, enabling them to study issues such as how the local supply of primary care providers affects patient outcomes. Different scales will be appropriate depending on the type of research.

Risk adjustment and surgical outcomes

With about 100,000 operative deaths occurring each year in the United States, the study of variation in surgical outcomes has become a pressing issue. Some states and physician organizations have begun to measure surgical performance. One example is the National Surgical Quality Improvement Program (NSQIP), which has more than 250 participating hospitals.

It is clear that surgical outcomes are not equally distributed among providers, but assessing the performance of individual hospitals or surgical teams requires taking into account factors outside of providers' control. Justin Dimick, a general surgeon and a researcher at the University of Michigan Center for Health Care Outcomes and Policy has studied how best to risk-adjust surgical performance data. He has found that there is little evidence that the severity of illness for patients undergoing the same procedure varies significantly, meaning that some studies may be overadjusting. A study of hospital mortality rates among patients in New York State undergoing cardiac surgery reported that there is a correlation of 0.95 between the unadjusted and adjusted mortality rates. It may therefore be possible to focus risk-adjustment on a few important variables rather than taking into account many, less significant factors.

Random error, however, may be underemphasized in many studies of surgical outcomes. Chance can skew such studies, particularly when dealing with small sample sizes. Dimick examined hospitals that had zero mortalities from certain procedures over a three-year period to see if those hospitals would also have lower than average mortality in subsequent years. In four of the five procedures examined, operative mortality in the ~~"z~~ero-mortality" hospitals was the same in subsequent years as the national average. For the fifth procedure, pancreatic cancer resection,

mortality was actually higher at the ~~"z~~ero-mortality" hospitals.

Another potential methodological problem in surgical-outcomes studies is that assessing the quality of care is more complicated than it is often depicted. One study, for example, showed that the rate of major complications resulting from surgery explain less of the variation in colectomy outcomes than the failure to rescue patients once they develop a complication. Therefore, it is not always the development of the complication itself that causes variation in mortality rates. The hospital's success at treating patients who develop such a complication can also play a significant role.

Challenges facing the field

In the United States, opponents of research on health care variations have been outspoken in their criticisms since John Wennberg began his research four decades ago. Researchers around the world have found similar challenges in taking up this research in their own countries. Conference participants noted a number of reasons for this opposition.

The financial self-interest of those in the medical industry who benefit from the overuse of health care may explain some of this opposition, but it is certainly not the only factor. Patients may be reluctant to accept the fact that for some conditions there is no single best treatment. Physicians may feel that their authority will be undermined if they acknowledge that their preferences regarding some treatments are not determined solely by medical science. Policymakers may not want to address the difficult political issues raised by the unequal distribution and delivery of health care resources. Finally, given the public's faith in modern medicine, it can be difficult to persuade people that there is such as thing as too much health care.

Overcoming this opposition is an important part of variations research. Doing so will require the effective communication of research findings to providers, policymakers, and patients. One explanation for the progress that has been made in raising awareness of unwarranted explanations in the United States is that physicians themselves have always played a central role in conducting and disseminating the research. There has also been a concerted effort to disseminate research findings to the public through publications such as the Dartmouth Atlas and

by attracting attention from media sources.

The Future of the Wennberg International Collaborative

There is clearly much to be learned from international collaboration on variations research. The challenges involved in carrying out variations research—from obtaining funding for the work to developing optimal methodologies—make collaboration an important part of advancing the field. Examining differences in the delivery of health care within individual countries has yielded surprising and important findings, and international comparisons may provide additional insights into how to provide the most effective and efficient health care possible. Future gatherings of the Wennberg International Collaborative will address the difficulties researchers in the field face and seek to create accepted methodologies, adding an authoritative international voice to the effort to improve health care through the study of one of the most pressing problems facing health care systems around the world.

ATTENDEES

Dr. Martin Bardsley | *Head of Research at the Nuffield Trust*

Martin has over 20 years experience in health services research and analysis. He joined the Nuffield Trust in September 2008 to lead a team undertaking a quantitative research programme. This work includes projects aimed at developing the methods and applications of predictive risk models in case finding or for resource allocation. The team also undertake a number of longitudinal evaluations of complex interventions using data linkage and statistical matching techniques. These include national evaluations such as work on the Whole System Demonstrator trial of telehealth and telecare, Integrated Care pilots and Partnerships for Older People Projects (POPP). The team has also undertaken studies of health and social care use at the end of life, emergency hospital care and trends in ambulatory care sensitive conditions.

Martin's previous work history includes:

Head of Screening and Surveillance at the Healthcare Commission where he led work on developing and implementing innovative approaches to the use of information in support of risk based regulation. This included new approaches to integrating multiple data sources to target inspections, and continuous monitoring of adverse events.

Running a project that looked at public health issues across the whole of London. The Health of Londoners Project (a precursor to the London Health Observatory) undertook a range of London-wide analyses looking at the critical determinants of health on behalf of all London's health authorities. The project published the first public health report for Greater London.

Studies of the applications of outcome measurement to inform heaths services management. This included work to collect multidimensional outcome measures in a acute hospital settings, as well work on regional health planning and contracting based on outcomes.

Analysis of case mix measurement – and the potential applications of emerging patient classification schemes in health service management and finding.

Selected Publications

Ian Blunt, Martin Bardsley and Jennifer Dixon. *Trends in emergency admissions in England 2004-2009: is greater efficiency breeding inefficiency?. Nuffield Trust. July 2010.*

Bardsley M, Spiegelhalter DJ, Blunt I, Chitnis X, Roberts A, Bharania S. Using routine intelligence to target inspection of healthcare providers in England. *Quality and Safety in Healthcare, 2009*; 18: 189-194

Majeed A, Bardsley M, Morgan D, O'Sullivan C, Bindman A. Cross-sectional study of primary care groups in London: measures of socio-economic and health status, and association with hospital admission rates. *British Medical Journal 2000,321:1057-1060*

Bardsley M, Barker M, Bhan A, Farrow S, Gill M, Jacobson B & Morgan D. *The Health of Londoners: a public health report for London.* The Health of Londoners Project. Kings Fund, 1998.

Bardsley M, Coles J. Practical experiences in auditing patient outcomes. *Quality and Safety in Healthcare* 1992;1:124-130

Bardsley M, Coles JM & Jenkins L. (Eds.) *DRGs and healthcare: the management of case mix*. 2nd Edition, October 1989.

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Enrique Bernal-Delgado MD PhD | *Senior Health Services Researcher*

Background

-Medical Doctor, Public Health and Preventive Medicine Specialist.

-Doctorate studies in Sociology, PhD grade in Medicine.

-Master in Health Economics.

-Involved in the Spanish 2001 Healthcare devolution process as Head of Advisors of the Regional Minister for Health and Consumers in Aragon.

-Associate Visiting Professor in the Centre for Evaluative Clinical Sciences at Dartmouth Medical School (USA)

Current scientific activity

-Senior Health Services Researcher in the Health Services Research and Health Policy Unit at the Institute for Health Sciences in Aragon (Spain).

-Scientific Coordinator of the Variations in Medical Practice Network in Spain (www.atlasvpm.org).

-Scientific Director of the ECHO project, a 7th framework program research initiative on Variations in medical practice and outcomes in Europe.

-Research topics of interest are: Variations in Medical Practice and underlying causes, Performance measurement and Knowledge brokering

Other activities of interest are:

- Chief Editor of the Atlas of Variations in Medical Practice (www.atlasvpm.org)
- Member of the board of directors of the Spanish Public Health Association, launching the Health Services Research Section.
- Former president of the Spanish Health Economics Association

Selected Publications

García-Armesto S, Abadía Taira MB, Durán A, **Bernal-Delgado E**. Spain. Health System review. Health Systems in transition 2010; 12(4): 1–240 European Observatory of Health systems 2010

Ibáñez B, Librero J, **Bernal-Delgado E**, Peiró S, López-Valcarcel BG, Martínez N, Aizpuru F. Is there much variation in variation? Revisiting statistics of small area variation in health services research. **BMC Health Serv Res**. 2009; 9:60.

Román R, Comas M, Mar J, **Bernal E**, Jiménez-Puente A, Gutiérrez-Moreno S, Castells J, and the IRYSS Network Modelling Group Geographical variations in the benefit of applying a prioritization system for cataract surgery in different regions of Spain. **BMC Health Services Research** 2008; 8(1):32

Hoffmeister L, Roman R, Comas M, Cots F, **Bernal E**, Castells X Time-trend and variations in the proportion of second-eye cataract surgery. **BMC Health Services Research** 2007, 7:53-2

Bynum J, **Bernal E**, Gottlieb D, Fisher ES. Assigning Ambulatory Patients and their Physicians to Hospitals: A Method for Obtaining Population-Based Hospital Performance Measurements **Health Services Research** 2007 42 (1p1), 45–62.

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Gwyn Bevan | *Professor of Management Science*

Gwyn Bevan is Professor of Management Science in Department of Management Research and an associate of LSE Health at the London School of Economics and Political Science. He has worked as an academic at Warwick Business School and in Medical Schools in London and Bristol. He has also worked in industry, consulting, the Treasury, and for the Commission for Health Improvement (CHI). His current research includes studies of outcomes of the natural experiment of different policies in UK countries for the NHS and schools following devolution; and the SyMPOSE (Systems Modelling for Performance Optimisation and Service Equity) project funded by the Health foundation, which is a programme of collaborative research with NHS purchasers that aims to reduce expenditure with least harm to the health of their populations and without widening inequalities in health.

Selected Publications

Connolly S, Bevan G, Mays N. Funding and Performance of Healthcare Systems in the Four Countries of the UK before and after Devolution. London: the Nuffield Trust, 2010.

Bevan, G. Approaches and impacts of different systems of assessing hospital performance. Journal of Comparative Policy Analysis, 2010, 12(1 & 2): 33- 56.

Bevan, G. The search for a proportionate care law by formula funding in the English NHS. Financial Accountability and Management, 2009, 25(1): 391-410.

Bevan G, Hollinghurst S, Benton P, Spark V, Sanderson H, Franklin D. Using information on variation in rates of supply to question professional discretion in public services. Financial Accountability and Management, 2004; 20(1): 1-17.

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John Billings | *Associate Professor and Director of the Center for Health and Public Service Research*

John Billings, Associate Professor of Health Policy and Public Service teacher in the area of health policy. He is principal investigator on numerous projects to assess the performance of the safety net for vulnerable populations and to understand the nature and extent of barriers to optimal health for vulnerable populations. Much of his work has involved analysis of patterns of hospital admission and emergency room visits as a mechanism to evaluate access barriers to outpatient care and to assess the performance of the ambulatory care delivery system. He has also examined the characteristics of high cost Medicaid patients in to help in designing interventions to improve care and outcomes for these patients. Parallel work in the United Kingdom has involved creating an algorithm for the National Health Service to identify patients at risk of future hospital admissions and designing interventions to improve care for these high risk patients. As a founding member and board chair of the Foundation for Informed Decision Making, Professor Billings is helping to provide patients with a clearer mechanism for understanding and making informed decisions about a variety of available treatments. Professor Billings received his J.D. from the University of California (Berkeley).

Selected Publications

Billings J, Mijanovich T. Improving the Management of Care for High Cost Medicaid Patients. *Health Affairs.* 26 no 6 (2007) 1643-1655.

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Billings J. Management Matters: Strengthening the research base to help improve performance of safety net providers. Health Care Management Review. Oct-Dec 2003; 28, 4.

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Elisabeth Bryan | *Manager of Special Projects, The Dartmouth Institute for Health Policy and Clinical Practice, Center for Health Policy Research*

Elisabeth began her career in the health care working with Developmentally Disabled adults in 1999. Graduating in 2003 from University of NH with a degree in Social Work, Elisabeth continued on to work for a government contracted agency as a case manager for the terminally ill and elderly populations. Her motivation to make changes in the health care system has driven her choices and her move to The Dartmouth Institute of Health Policy and Clinical research where she currently holds the position of Manager of Special Projects. In 2010 she started a masters degree in public health and will be following her interests in improving health care from a policy perspective.

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André Busato Prof. Dr. M.Sc | *Professor for Clinical Epidemiology, University o Bern, Switzerland*

André Busato is professor for clinical epidemiology at the University of Bern, Switzerland. He received a doctoral degree as a veterinary surgeon from the University of Bern in 1990, a MSc in epidemiology from the University of Guelph, Canada in 1995, and the Venia Docendi (habilitation thesis) in clinical epidemiology from the University Bern in 2001.

Until 1992 he worked as a large animal surgeon with additional research activities in basic medical science, which included nutrition pathology and endocrinology. Research projects from 1992 until 2001 were aimed at production diseases in livestock and zoonoses with implications on human health. Further projects included the validation of diagnostic procedures for COPD in horses.

After moving from veterinary to human epidemiology in 2001, he extended the scope of his scientific activities to outcomes research, health technology assessments and health services research. He conducted a nationwide study aimed at the evaluation of efficacy, effectiveness and economic efficiency of complementary medicine in Swiss primary care. His current research activities are mainly focused on the analysis of spatial-temporal variation in supply and demand of resources in ambulatory and hospital care. The purpose is to disentangle sources of variation justified by effective medical needs of populations from sources of variation that cannot be explained by the underlying incidence of diseases.

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Bob Darin | *Senior Vice President, Global Analytics, Health Dialog & Acting Managing Director for Bupa Health Dialog*

Bob Darin has 16 years experience in health care analytics and operations management. Since January 2009, he serves as Senior Vice President, Global Analytics, for Health Dialog, and he currently is Acting Managing Director, Bupa Health Dialog, based in London. In these roles he has overall responsibility for Health Dialog's subsidiary serving the English NHS. He also has responsibility for Health Dialog's analytic operations and services in Australia, Spain, and France, and is currently overseeing a project measuring unwarranted variation in hospital services in Australia. In previous work at Health Dialog, Darin also served 4 years as Senior Vice President of Client Operations from 2003 to 2006. Darin's prior executive experience include his most recent position as Vice President and General Manager of MediQual Services, a business unit of Cardinal Health, from 2006-2008. His other management experience includes positions at Health Benchmarks, Inc. and Blue Cross and Blue Shield Association. He holds an honors MBA in analytic finance from the University of Chicago Graduate School of Business, and he received a *magna cum laude* degree in economics from Harvard College.

Selected Publications

Johannes RS. Peng MM. Darin R. Diagnosis Related Group Perturbation: A New Twist on the Economics of Hospital-Acquired Infection? *The American Journal of Medical Quality.* 24(1):71-3, 2009 Jan-Feb.

Gandra SR, Lawrence LW, Parasuraman BM, Darin RM, Sherman JJ, Wall JL. Total and Component Health Care Costs in a Non-Medicare HMO Population of Patients With and Without Type 2 Diabetes and With and Without Macrovascular Disease. *The Journal of Managed Care Pharmacy,* 12(7):546-54, 2006 Sep.

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William Davenhall | *Global Manager, Health and Human Services, ESRI*

Bill Davenhall has served as the Health and Human Services Solutions Manager at ESRI, the world's largest GIS software developer, since 1997. Bill's experience in health and human services spans nearly four decades and includes executive leadership of hospitals, health and social service research organizations, and healthcare data companies. Bill is a frequent author and international speaker on the subject of the application and use of geographical information for solving complex human health challenges and improving health. Bill holds a Masters Degree (with a concentration in Medical Behavioral Science) from the University of Kentucky and was awarded an NIMH Traineeship in conjunction with his work at the University of Kentucky Medical Center. Bill has also served on various governmental and non-governmental boards in higher education, national research councils, and health related trade associations.

Selected Publications

Khan OA, Davenhall W, Ali M, Castillo-Salgado C, Vazquez-Prokopec G, Kitron U, Soares Magalha RJ, Clements ACA. Geographical information systems and tropical medicine. Annals of Tropical Medicine & Parasitology 2010; 104 (4).

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Judith de Jong PhD, MSc | *Programme Coordinator, Health care system and governance at the Netherlands Institute for Health Services Research (NIVEL) and scientific coordinator of the Academic Collaborative Research Centre*

J.D. (Judith) de Jong (1976), PhD, MSc is Programme coordinator, Health care system and governance at the Netherlands Institute for Health Services Research (NIVEL) and scientific coordinator of the Academic Collaborative Research Centre, a cooperation between the Open University, an insurance company and NIVEL.

She has graduated in Science and Policy at Utrecht University, the Netherlands. In 2008 she defended her PhD thesis 'Explaining medical practice variation. Social organization and institutional mechanisms' (cum laude) at Utrecht University, the Netherlands. Her research topics and publications include health care system reform, medical practice variations, comparative health systems research, and consumer experiences on health care. She is vice president of the EUPHA section on Health Services Research and member of the editorial staff Journal "Tijdschrift Gezondheidswetenschappen" (TSG).

Selected publications

Jong JD de, Groenewegen PP, Spreeuwenberg P, Schellevis F, Westert GP. Do guidelines create uniformity in medical practice? Soc Sci Med 2009.

Jong, J.D. de; Brink-Muinen, A. van den; Groenewegen, P.P. The Dutch health insurance reform: switching between insurers. A comparison between the general population and the chronically ill and disabled. BMC Health Services Research, 2008; 8 (58).

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Jong JD de, Westert GP, Noetscher ChM, Groenewegen PP. Does managed care make a difference? Physicians' length of stay decisions under managed and non-managed care. BMC Health Services Research 2004; 4 (3).

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Justin B. Dimick, MD, MPH | *Assistant Professor of Surgery, University of Michigan*

Dr. Dimick is a general surgeon and health services researcher at the University of Michigan. He is a graduate of Cornell University and Johns Hopkins Medical School. He completed his general surgery residency at the University of Michigan and spent two years at Dartmouth completing a fellowship in outcomes research. In 2007, he joined the faculty as at the University of Michigan where he practices minimally invasive surgery.

Dr Dimick's research focuses on understanding and reducing variations in surgical outcomes. With funding from the Agency for Healthcare Research and Quality (AHRQ) and the National Institutes of Health (NIH), his current research aims to develop better measures for assessing hospital quality with surgery. He has more than 100 peer reviewed peer reviewed publications on topics in surgical outcomes, quality measurement, and health policy.

Dr Dimick serves as a consultant to many organizations on issues related to quality measurement, including the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) and the Michigan Bariatric Quality Collaborative (MBSC). He is also the lead consultant to The Leapfrog Group for their Evidence-Based Hospital Referral Program. He currently serves on the Executive Council of the Association of Academic Surgeons (AAS), the Executive Committee of the Surgical Outcomes Club, and the Editorial Board for *Archives of Surgery*.

Selected Publications

Dimick JB, Welch HG, Birkmeyer JD. Surgical mortality as an indicator of hospital quality: The problem with small sample size. JAMA 2004;292: 847-851.

Ghaferi AA, Birkmeyer JD, Dimick JB. Variation in hospital mortality associated with inpatient surgery. N Engl J Med 2009;361:1368-1375.

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Amos Esty | *Writer and Editor for Dartmouth Atlas publications, Managing Editor of Dartmouth Medicine magazine*

Amos Esty is a writer and editor for Dartmouth Atlas publications and the managing editor of Dartmouth Medicine magazine. He has worked previously as a freelance writer and editor and as an assistant editor at American Scientist magazine. He has written on a range of medical and scientific topics, from the physician workforce to circadian rhythms to archaeology.

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Sandra García-Armesto MD, MSc PH, MSc HEco, PhD | *ARAI+D senior researcher at the Health Services Research and Health Policy Unit at the Institute for Health Sciences in Aragón (I+CS)*

Dr. Sandra García-Armesto is an ARAI+D senior researcher at the Health Services Research and Health Policy Unit at the Institute for Health Sciences in Aragón (I+CS). Prior to joining the I+CS, she was health economist and policy analyst at the OECD Health Division headquarters, head of the Observatory of Madrid Health System (Regional Health Ministry), professor at the Public Health School of the Autonomous University of Madrid and health services researcher at the Institute of Health Carlos III (Spanish Ministry of Health). She has done substantive work in coordinating different lines within the OECD Health Care Quality Indicators Project. Health systems performance assessment constitutes her main line of work, both for international comparisons and national benchmarking across Spanish Autonomous Communities. She has also contributed as an expert in several European Commission Working Parties (indicators, patient safety, health systems) and liaison commissions between OECD, WHO and the European Commission.

Selected Publications

García-Armesto S, Abadía Taira MB, Durán A, Bernal-Delgado E. Spain. Health System review. Health Systems in transition 2010; 12(4): 1–240 European Observatory of Health systems 2010

Veillard J, Garcia-Armesto S, Kadandale S, Klazinga NS. Peformance Measurement for Health system Improvement: experiences, challenges and prospects. Chapter 5.6. International Health System Comparisons: from measurement challenge to management tool. Editors: Smith PC, Mossialos E, Papanicolas I, Leatherman S. WHO Europe. WHO Ministerial Conference on Health systems. Cambridge University Press 2009

Garcia-Armesto S, Medeiros H, Wei L. Information Availability for Measuring and Comparing Quality of Mental Health Care across OECD Countries. OECD Health technical papers n 20. 2008

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Garcia Armesto S, Kelley E, Wei L. Health Care Quality Indicators project. Patient safety data systems in the OECD: A report of a joint Irish Department of Health-OECD Conference. OECD Health occassional papers. 2007

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Jonathon Gray | *Director of 1000 Lives Campaign in Wales, Professor of Healthcare Improvement at Cardiff University*

Currently Jonathon's post is as joint Director of 1000 Lives Campaign in Wales, Director of Healthcare Improvement, Public Health Wales, and Professor of Healthcare Improvement at Cardiff University. In October 2010 Jonathon will be taking up a new role as Director for Health Improvement and Innovation in Counties Manakau District Health Board New Zealand, and as The Stevenson Professor of Health Improvement and Innovation at Auckland University.

Jonathon graduated in Medicine from Dundee University in 1988, where he also gained a PhD in molecular genetics. Over the following years Jonathon specialized in clinical genetics, and more recently achieved a defined specialist training in Public Health. As a Consultant in Clinical Genetics, he developed a specialist national service for people concerned about a family history of cancer.

After four years as Clinical Director for the all-Wales Genetics Service, Jonathon spent a year as a Health Foundation Fellow in the Institute of Healthcare Improvement and at the same time, took the Harvard Masters of Public Health. In 2006, he was appointed as Director of Healthcare Improvement at the Wales Centre for Health and in 2008 as Professor of Healthcare improvement at Cardiff University.

Selected Publications

Gray JR, Berwick DM. Peering into the chasm: Improving the quality of clinical genetic services. Am J Med Genet Part C Semin Med Genet. 2009;151C:173-174.

Zellerino BC, Milligan SA, Gray JR, Brooks R. Identification and Prioritization of quality indicators in clinical genetics: an international survey. Am J Med Genet Part C Semin Med Genet. 2009;151C:179-190.

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David C Goodman MD MS| *Professor Pediatrics and of Health Policy, Director, Center for Health Policy Research, Co-PI Dartmouth Atlas of Health Care*

David C. Goodman is Professor of Pediatrics and of Health Policy at The Dartmouth Institute for Health Policy and Clinical Practice, in Hanover, New Hampshire; Director of the Center for Health Policy Research; and Co-Principal Investigator, The Dartmouth Atlas of Health Care. Dr. Goodman's primary research interest is in variation of health workforce supply and its relation to health outcomes. In the past two decades Dr. Goodman has also led numerous studies on variation in the effectiveness and efficiency of health care, including neonatology, pediatrics hospital and asthma care, and medical care in Medicare beneficiaries. His research papers and editorials on this topic have been published in the New England Journal of Medicine, the Journal of the American Medical Association, Health Affairs, Pediatrics, and The New York Times.

Dr. Goodman is one of the founding investigators of *The Dartmouth Atlas of Health Care.* He currently leads Dartmouth Atlas projects examining variation in end of life cancer care, post hospital discharge care, and regional hospital and physician capacity. Dr. Goodman also directs the overall operations of the Atlas team. Dr. Goodman is a member and recent member of the editorial boards of the journals *Health Services Research* and *Pediatrics.* He is also a member of the Institute of Medicine *Committee on the Future of Nursing.*

Dr. Goodman received his medical degree from the State University of New York Upstate Medical Center and his master's degree in medical care epidemiology from Dartmouth College. He served his residency in pediatrics at The Johns Hopkins Hospital in Baltimore, Maryland, and then practiced as a National Health Services Corps physician in a rural underserved area of New Hampshire. After joining the Dartmouth faculty in 1988, he undertook allergy and clinical immunology training. He recently stepped down as Chief of the Section of Allergy and Clinical Immunology, a position he held for a number of years.

Selected Publications

Goodman DC, Fisher ES, Little GA, Stukel TA, Chang C, Schoendorf, KS. The relation between the availability of neonatal intensive care and neonatal mortality. *The New England Journal of Medicine* 2002; 346: 1538-1544.

Goodman DC, Mick S, Bott D, Chang CH, Carretta H, Marth N. Primary care service areas: A new tool for the evaluation of primary care services, *Health Services Research,* 2003;38:187-309.

Goodman DC, Stukel TA, Chiang-hua Chang, Wennberg JE. End-of-Life Care at Academic Medical Centers: Implications for Future Workforce Requirements. *Health Affairs* 2006; 25(2): 521-531.

Goodman DC, Grumbach K. Does Having More Physicians Lead to Better Health System Performance? *JAMA* 2008; 299:335-337.

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Jostein Grytten| *Professor, Division of Community Dentistry, University of Oslo*

Jostein Grytten has worked with research questions related to funding and distribution of health services. The main focus of the research has been on how competition, incentives and different types of contract influence the availability, cost and effectiveness of health services. A specific research question has been how physicians and dentists should be remunerated in order to ensure that they do not provide either too little or too much treatment.

Selected Papers

Grytten J, Sørensen R. Practice variation and physician-specific effects. Journal of Health Economics 2003, 22: 403-18.

Grytten J, Sørensen RJ. 2007. Busy Physicians. Journal of Health Economics 2008; 27: 510-18.

Grytten J. Sørensen R. Primary physician services – List size and primary physicians' service production. Journal of Health Economics 2007; 26: 721-41.

Grytten J, Sørensen R. Patient choice and access to primary physician services in Norway. Health Economics, Policy and Law 2009; 4:11-27

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Manuela Gussoni | *PhD Student*

In December 2004, Manuela Gussoni received Degree in Political Science at the University of Pisa (Italy) and will be defending her PhD thesis in Economics in September 2010. The title of her PhD thesis is "The determinants of R&D cooperation: Evidence from the manufacturing and the service sector in Europe".

In 2005, Manuela worked at the Laboratory of Economics and Management (LEM) of the Scuola Superiore Sant'Anna in Pisa. In 2006 she was awarded a scholarship to attend PhD courses at the Doctoral School of Economics and Management "Leonardo Fibonacci" of the University of Pisa .

Since October 2009, Manuela Gussoni has been working at the Health and Management Laboratory (MeS Lab.) of the Scuola Superiore Sant'Anna in Pisa where she has started studying variation in medical practice with regard to Diagnostic Imaging procedures.

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Steve Hajioff | *Public Health consultant, General Practitioner, Medical Director of Bupa Health Dialog*

Steve is a Public Health Consultant, a General Practitioner and Medical Director of Bupa Health Dialog. In this role he is responsible for ensuring the clinical appropriateness of risk model contents and outputs, overseeing the development of clinical segmentation and analytics products and quality assuring clinical insights delivered to UK clients. He also develops clinical analytics and segmentations for Health Dialog clients in Spain and Australia.

Steve is also Chairman of the Representative Body of the British Medical Association.

Steve's recent work includes:

- heading the research team for Dame Carol Black's review of the health of the working age population on behalf of the Department of Health (DH), the Department of Work and Pensions and the Health and Safety Executive
- developing the UK national prevalence modeling tools for eye diseases on behalf of a consortium of Royal Colleges and eye health organisations
- leading on several workstreams of *Informing Healthier Choices* for DH

In the past couple of years he has also led several smaller projects; including establishment of child death overview panels, needs assessments for stroke services, service appraisal for community child health and the evaluation of a cardiovascular risk tool for DH. In addition to this he has worked (and still works) regularly with the DH National Support Teams for vaccination and immunization and infant mortality. Steve worked for the Greater London Authority at its inception, developing the health impact assessment of the Mayor of London's nine statutory strategies, has worked in academic units at the London School of Hygiene and Tropical Medicine, St Bartholomew's School of Medicine and at the British Postgraduate Medical Federation. He was Medical Director of an independent sector healthcare provider in central London.

Looking beyond the UK, Steve Hajioff has done work for a variety of international organisations including WHO, UNICEF, OECD, the European Commission, the European Observatory on Health Care Systems, the European Insurance Forum, the World Bank, the Open Society Institute and the Albert Schweitzer Foundation

Selected Publications

Health needs of the Roma population in the Czech and Slovak Republics Ecohost, LSHTM. Report for the World Bank. ECOHOST, LSHTM 2000, 76pp.

Hajioff S. McKee M. The health of the Roma people: a review of the published literature. J Epidemiol Community Health. 2000 Nov;54(1 1):864-869

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Pecelj, G. and Hajioff, S. (2000) *Health Care Systems in Transition: The former Yugoslav Republic of Macedonia..* Copenhagen: European Observatory on Health Care Systems

Koupilova I, Epstein H, Holcik J, Hajioff S, McKee M. Health needs of the Roma population in the Czech and Slovak Republics. Soc Sci Med. 2001 Nov;53(9):1191-204..

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Ilir Hoxha, MD, Msc. | *Medical Doctor, researcher and consultant*

Ilir Hoxha is Medical Doctor, researcher and consultant from Kosovo. He holds a Medical Studies degree from University of Prishtina and Master of Science degree in Helath Systems Management, from London School of Hygiene and Tropical Medicine. In addition he has record of research/academic experinces at New Bulgarian University, American University in Kosovo, Dartmouth Medical School, The Dartmouth Institute for Health Policy and Clinical Practice, Technical University of Colorado and Karl Franzens University, Graz, Austria.

In addition to work with number of international organizations such as The World Bank, UNICEF, UNFPA, German Technical Cooperation, USAID, in Kosovo, he has been researcher and author in number of papers (see below).

His professional and academic interests lie in: measurement of variation in provision of health care services; health economics and evaluation of health services (i.e. assessment of impact on health, cost effective analysis, assessment of coverage, quality and access); Regulation of health care service delivery in public and private sector.

In 2009 he was awarded Fulbright Research Fellowship for the research project that aimed to explore the prospects and limitations for using Dartmouth Atlas methodology in evaluation of clinical practice performance in developing countries, using Kosovo as a case study. Currently he advises Minister of Health of Republic of Kosovo and works with Foundation for Healthy Mothers and Babies.

Selected Publications

Hoxha I, Shaipi K. *Comparative analysis of health care systems in SEE*. IQConsulting (intended audience: Kosovo Parliamentary commission for Health, Labor and Social Welfare), 2009.

Hoxha I, Bajraktari I, Kotori V. *Antenatal Care Services in Kosovo* United Nations Children's Fund (UNICEF), 2008.

Hoxha, I. (September, 2008). *Monopoly power in Tertiary Healthcare – UCCK case*. Unpublished paper presented at The Annual conference of Al-Shkenca, Tirana, Albania.

Bloom, J.D., et al., *Ethnic segregation in Kosovo's post-war health care system.* European Journal of Public Health, 2007. **17**(5): p. 430-6.

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Alfia Mangano | *Research Fellow, Dipartimento di Economia e Metodi Quantitativi, Università degli Studi di Catania (Italy), and School of Sociology and Social Policy University of Leeds (UK)*

Education

I hold a first degree in Economics from the University of Catania (Italy) and a master degree in Public Economics from the University of York, Department of Economics and Related Studies. In 2006 I was awarded the qualification of Dottore di Ricerca in Public Economics (Phd Public Economics) again from the University of Catania, Department of Economics and Quantitative Methods (DEMQ). The work I am conducting at Leeds is expected to lead to a second doctoral qualification in the near future.

Research Interests

Broadly defined, my research interests span social policy and the economics of health and health care. More specifically, I have extensively considered the financial and organizational aspects of the Italian health care system and pharmacy market regulation. Territorial variation in health care delivery and finance in Italy has been the focus of much of my work. At the moment, I am conducting further research in this area, particularly with regard to hospital care. The study of elder care policy and its impact on social care market developments in Italy and other EU countries is an additional main area of research. Particularly, I am interested in the interplay between state intervention and informal care provision within the family.

Selected Publications

2010, "Community pharmacies in the city area: evidence from an Italian province", European Planning Studies, Vol. 18, No. 3, 481-492

2010, "An analysis of the regional differences in health care utilization in Italy", Health & Place, Vol. 16, No. 2, 301-308

2009, "Assetto proprietario delle farmacie e monopolio sulla vendita dei farmaci. Regolamentazione italiana e tendenze europee" (Proprietary structure for pharmacies and monopoly on drugs dispensing. Italian regulation and European trends), Politiche sanitarie, Vol. 10, No. 1, 7-21 (with Marina Cavalieri, in Italian)

2009, "Evaluation of medical teaching and research: a comparative analysis" (with Marina Cavalieri), MPRA paper No. 16095, available on line at http://mpra.ub.unimuenchen.de/16095/

CURRENT WORK IN PROGRESS

Il finanziamento degli ospedali universitari nelle regioni italiane (Teaching hospitals funding in the Italian regions), completed working paper

The Italian decentralization of competencies over health care delivery and finance: the case

of hospital care financing, working paper in progress

Public intervention and elderly care. A comparison between England and Italy, working paper in progress

MEMBERSHIP IN PROFESSIONAL BODIES
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Klim McPherson MA, PhD, FFPH, FMedSci | *Professor*

Professor Klim McPherson is the Chair of the National Heart Forum, an alliance of health related NGOs concerned to prevent premature mortality from cardiovascular disease and other chronic conditions (www.heartforum.org.uk). He has a Visiting Professorship in the Nuffield Department of Obstetrics & Gynaecology, and is a Fellow of New College, Oxford University (www.new.ox.ac.uk). His research is in epidemiological methods and women's' health. He runs an option in Health & Disease for Oxford final year undergraduates in Human Sciences, and teaches in Obstetrics and Gynaecology on HRT and Hysterectomy decision making.

His current commitments are; Chair of the NICE CVD Population Program Development Group reporting in 2010 (http://guidance.nice.org.uk/PH25), member Expert Advisory Group on Women' Heath of MHRA and a past member of the Public Health Interventions Advisory Committee of NICE and their Heavy Menstrual Bleeding guideline development group. He has served as an expert advisor on the Advisory Council on the Misuse of Drugs.

He was Co-Author of the recent Foresight Report on Tackling Obesities - Future Choices with Government Office for Science, for which he was responsible for epidemiological modelling (http://www.foresight.gov.uk/Obesity/Obesity_final/Index.html.) This has extended to advising the US Govt. He is currently on the expert working group advising the Cross Government Strategy on obesity prevention. With the National Heart Forum he has a research group/consultancy examining the role of micro simulation in better understanding public health interventions.

He is a member of the Legal and General's Longevity Science Advisory Panel chaired by Sir Derek Wanless. He has chaired the British Breast Group, the European Public Health Association and the Society for Social Medicine among other research bodies.

Professor McPherson's other interests are coronary heart disease prevention and the causes of breast cancer, particularly the health implications of hormone replacement therapy (HRT). He has a longstanding research interest in the treatment of women with menstrual problems, particularly conservative methods of treating uterine fibroids in order to retain or enhance fertility. He has recently won a large grant to conduct a multi centre trial in the UK to compare treatments among women wishing to avoid hysterectomy. He has some 400 peer reviewed publications in academic journals. He is concerned with public health policy as it affects primary prevention of disease.

Selected publications

McPherson K, Wennberg JE, Hovind O, Clifford P. Small area variations in the use of common surgical procedures: An international comparison of New England, England and Norway. New England Journal Medicine 1982; 30: 1310-1314.

Roos NP, Wennberg JE, Malenka DJ, McPherson K, Anderson TF, Cohen MM, Ramsey E. Mortality and reoperation following open and transurethral resection of the prostate for benign prostatic hypertrophy. New Eng J Med. 1989; 320: 1120-24.

McPherson K, Downing A, Buirski D. Systematic variation in Surgical Procedures and Hospital Admission Rates. A Methodological Study. Dept Public Health & Policy LSHTM. April 1996.

McPherson K, Britton AR, Wennberg J. Are randomised controlled trials controlled? Patient preferences and unblind trials. *Journal of the Royal Society of Medicine, 1997;90:652-656*.

McPherson K, Marsh T, Brown M (2007) Tackling obesities: future choices—modelling future trends in obesity and their impact on health. Report for Foresight. Government Office of the Chief Scientist.: http://www.foresight.gov.uk.

Klim McPherson. Commentary: James Alison Glover (1874–1963). Health care variations research, then and now. IJE 2008;37:19-23

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Study of medicine (Munich, Montpellier/France) and public health (University of Cambridge, UK).

'Habilitation' in Epidemiology and Social Medicine, 2005.

Since 2008, Professor of Public Health at the Berlin School of Public Health.

Professional interests: regional variation and time trends in mortality, evidence-based public health and outcomes research.

Member of professional organisations such as the German Society of Epidemiology (DGEpi), the International Epidemiological Association (IEA) and the Germany Society of Cardiology (DGK).

Reviewer in journals including the Annals of Internal Medicine, Journal of Epidemiology and Community Health, American Journal of Epidemiology, Quality of Life Research, Stroke etc.

Selected publications

Müller-Nordhorn J, Wegscheider K, Nolte CH, Jungehülsing GJ, Rossnagel K, Reich A, Roll S, Villringer A, Willich SN. Population-based intervention to reduce prehospital delays in patients with cerebrovascular events. Arch Int Med 2009;169:1484-90

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Albert G. Mulley, Jr. M.D., M.P.P. | *Chief of the General Medicine Division and Director of the Medical Practices Evaluation Center at Massachusetts General Hospital, Associate Professor of Medicine and of Health Policy at Harvard Medical School*

Albert Mulley is Chief of the General Medicine Division and Director of the Medical Practices Evaluation Center at Massachusetts General Hospital and Associate Professor of Medicine and Associate Professor of Health Policy at Harvard Medical School where he has developed innovative approaches to patient care, medical education, and clinical research. Dr. Mulley's research has focused on the use of decision theory to support clinicians and patients in their decision-making roles; he has led in the development of shared decision making and other approaches to produce better care and better health at lower cost. This work has influenced the agendas of many public and private organizations, including those responsible for reform of health care delivery nationally and internationally. Dr. Mulley has also served on multiple committees of the Institute of Medicine of the National Academy of Sciences, of professional societies, and as a visiting professor and health policy consultant to governments and health care institutions in North America, Europe and Asia. Dr. Mulley is a founding director of the Foundation for Informed Medical Decision Making. He graduated from Dartmouth and earned M.D. and M.P.P. degrees at Harvard before doing his clinical training at the MGH. Dr. Mulley has been an overseer of Dartmouth Medical School since 1998 and a Trustee of Dartmouth College since 2004.

Selected Publications

Wennberg JE, **Mulley AG**, Hanley D et al. An assessment of prostatectomy for benign urinary tract obstruction: Geographic variations and evaluation of medical care outcomes. JAMA 1988; 259:3027-3030.

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John Newton | *Regional Director of Public Health for South Central*

John was Consultant in Public Health Medicine at the Oxford Regional Health Authority from 1993 and led a team in the University of Oxford supporting the national Clinical Standards Advisory Group in the late 1990s.

He was an academic epidemiologist at Oxford for eleven years and later became the first Director and CEO of UK Biobank, a large genetic epidemiology project based in Manchester. He has been Director of Research and Development and Assistant Medical Director at both Southampton University Hospitals NHS Trust and at the Oxford Radcliffe Hospitals NHS Trust.

He later worked for the Department of Health on public health information and intelligence and was appointed Regional Director of Public Health for South Central in December 2007. He is Honorary Professor of Public Health and Epidemiology at the University of Manchester.

Dr. Zeynep Or | *Senior Economist,* IRDES, *Institute for Research and Information in Health Economics*

Zeynep Or is a senior economist at the *Institute for research and information in health economics* (IRDES). She specialises in issues related to health system performance at the macro level, including the determinants of health outcomes, measures of health expenditure, equity and health care quality. She has been involved in a number of innovative studies in France, as well as internationally, concerning the measurement of variations in health care, health care cost and health outcomes within and across countries and the interaction between institutional and policy settings and health system performance.

Zeynep has been at IRDES since 2005 and has worked previously as a health economist and consultant for the OECD and for the French National Institute of Medical Research (INSERM). She is an active member of a number of international networks such International Health Policy Monitor, European Health Policy Group.

She has a Masters Degree in Health System Management and a PhD in Economic Analysis from Sorbonne Paris-I.

Selected Publications

Are health problems systemic? Health reforms under Beveridge and Bismarck systems, Or Zeynep, Cases C, Lisac M, K. Vrangbæk, U. Winblad, *Health Economics Policy and Law*, 2010 (5), 269-93.

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Dr Veena S Raleigh | *Senior Fellow, Policy, The King's Fund*

Veena is an epidemiologist with extensive research experience and publications in public health, health inequalities, quality and safety, and patient experience. She joined the King's Fund in April 2009, having spent 8 years at the Commission for Health Improvement and then the Healthcare Commission as a Fellow in Information Policy, working on information policy, analysis and research issues, and leading on analyses of eg patient experience data, safety indicators and inequalities. Prior to that she was a Reader at the Postgraduate Medical School, University of Surrey, and coordinated the production of indicator sets (such as the Compendium of Clinical and Health Outcome Indicators) for the Department of Health (DH). She is a member of several national committees: DH's Scientific Reference Group on Health Inequalities, the health inequalities review led by Professor Michael Marmot, DH's expert group on international quality comparisons, and was also on DH's Expert Reference Group for the Diabetes NSF. She was awarded a Fellowship of the Faculty of Public Health in 2005, and a Fellowship of the Royal Society of Medicine in 2007. Veena has worked on health and population issues in Third World countries for international agencies (Department for International Development, the World Bank, UNFPA and the Ford Foundation). Veena has an undergraduate degree in economics from Cambridge University, and an MSc and PhD in epidemiology and demography from the London School of Economics and Political Science.

Selected publications

Hussey P, Anderson G, Bertheholt JM, Feek C, Keyyey E, Osborn R, Raleigh V, Epstein A. Trends in socioeconomic disparities in health care quality in four countries. *International Journal for Quality in Health Care* 2008;:20:53-61.

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Dr. Merran Smith | *BSc, BA (Econ), MSc (Physiology), PhD (Medicine), Post Grad Dip Management*

Dr Smith commenced as the inaugural Chief Executive of Australia's Population Health Research Network in April 2009. The Network is facilitating development of population-based data linkage infrastructure within and between Australian states and territories using statutory and administrative data collections. The infrastructure is based on the very successful model established in Western Australia in 1995. The initial focus for the Population Health Research Network is on health data but several jurisdictions also include other human services data such as education, disability services and corrections in their linkage systems.

The Network has received $A 30 million from the Australian Government through the National Collaborative Research Infrastructure Strategy. Australian states and territories and academic partners are contributing a further $A 32 million in cash and in-kind to the Network.

Prior to joining the Population Health Research Network, Dr Smith was a Director in the Western Australian Department of Health. She was in charge of the Department's Health Information Centre for more than 10 years. The Centre housed Western Australia's major state-wide health data collections including the hospital morbidity, perinatal, mental health and cancer registry collections. She was responsible for establishing data linkage as a core Department of Health service during this period. She also participated in a number of significant nationally funded population health research projects.

Dr Smith has served as Chair or Member of a number of Australia's peak national health information committees. She continues to actively contribute to health information policy and strategy at state and national level, and is committed to the ongoing development and use of Australia's health information resources for health system improvement.

Selected Australian Publications

Yu, X, O'Connell, D, Gibberd, R, Smith, D, Dickman, P, Armstrong, B, 2004, 'Estimating regional variation in cancer survival: a tool for improving care', *Cancer Causes and Control*, 15: 611-618

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www.health.vic.gov.au/healthstatus see publications on Burden of Disease and Ambulatory Care Sensitive Conditions

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Thérèse Stukel | *Senior Scientist at the Institute for Clinical Evaluative Sciences (ICES) ; Professor of Biostatistics, Dartmouth Medical School; Professor of Health Policy, Management and Evaluation, University of Toronto*

Thérèse A. Stukel, PhD, is a biostatistician focusing on health services and health policy research. She was statistical director of the *Dartmouth Atlas of Health Care* from 1995 to 2003 and co-authored two influential publications on the U.S. healthcare system demonstrating that higher health care spending did not lead to better outcomes.

Her current research interests are in the analyses of observational studies, particularly the use of instrumental variables to remove unmeasured confounding and survival bias, and the effects of health system resources and organization on delivery of care and outcomes in Canada and the U.S., including international comparative studies. With the support of a national Team Grant, she is creating virtual physician-hospital networks in Ontario and evaluating their performance in managing patients with chronic disease.

She has published over 150 peer-reviewed articles in medical and statistical journals.[1-5] She was nominated Fellow of the American Statistical Association in 2007.

Selected Publications

Stukel TA, Fisher ES, Wennberg DE, et al. Analysis of observational studies in the presence of treatment selection bias: effects of invasive cardiac management on AMI survival using propensity score and instrumental variable methods. *JAMA.* 2007;297(3):278-285.

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Fisher ES, Wennberg DE, Stukel TA, et al. The implications of regional variations in Medicare spending. Part 2: health outcomes and satisfaction with care. *Ann Intern Med.* 2003;138(4):288-298.

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Enno Swart | *Dr. rer. biol. hum., Statistician*

born 1962

1981 to 1987	Studying Statistics at the Technical University of Dortmund
1987 to 1993	Department of Epidemiology, Social Medicine and Health Services Research, Hannover Medical School (Director: Prof. Dr. F.W. Schwartz)
1993	Dissertation (Dr. rer. biol. hum.) at the Hannover Medical School (methodological aspects of quality assurance for screening mammography)
Jul 1993 -	Institute für Social Medicine and Health Economics (Director: Prof. Dr. B.-P. Robra, M.P.H.); head of the department of epidemiology
1998	Certificate of epidemiology by the German Epidemiology Association
1999 -	Co-speaker of the working group 'Utilization of secondary (claims) data' of the German Society of Social Medicine and Prevention (DGSMP) and the German Society for Epidemiology (DGEpi)
2003 -	Co-speaker of the epidemiologic division of the German Society of Social Medicine and Prevention (DGSMP)

Fields of interests: epidemiology, health services research, quality management; teaching in epidemiology and health services research

Selected publications

Swart E, Robra B-P. Kleinräumige Untersuchung der Krankenhausversorgung. (engl: Small area analysis of hospital care). Gesundheitsökonomie und Qualitätsmanagement 2 (1997): 180-186

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APPENDIX

ATLAS VPM

the Healthcare Quality of the SNHS under scrutiny

Enrique Bernal-Delgado
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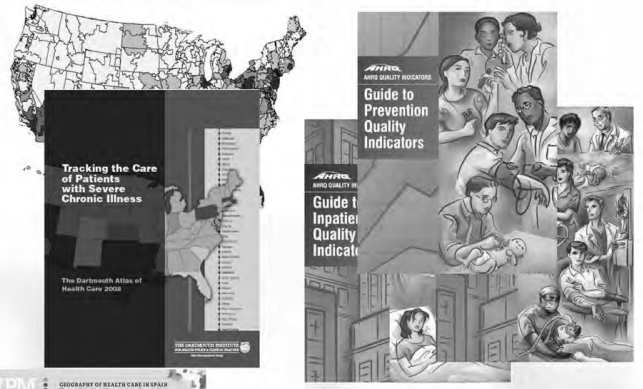
Scientific background



Who we are and what we do

- **Collaborative health services research project** which aims to describe systematic and unwarranted **variations in medical practice and healthcare outcomes**, using a **population-based** and a **hospital-specific** approach.
- … **providing insight (i.e. underlying factors analysis) for decision-makers** to make better decisions; **and** yielding relevant information for **hospital managers** to look at those underperforming quality areas.
- **… using and developing reliable methodologies**
- **…** using **several strategies for translating knowledge into practice**

The NHS in Spain

- **Totally devolved (decentralized) to the 17 regional governments** (full responsibility on funding, planning and provision)
- **Universal** and **free access** with a limited co-payment in drugs prescription; effective coverage 99%.
- **Administrative health care** areas where specialized primary care and -at least- a referral hospital: services close to the place of residency .
- **Highly qualified GPs** who act as **"gatekeepers"** (impossible to access specialized care, except for emergency services)
- **Health care professionals are public servants, paid by salary** (only a negligible part of GPs wages are based on capitation and the same is true for some specialists on fee-for-service basis)
- Hospital Providers **funding is designed as block prospective contracts "based" on the previous year** expenditure. Nothing happens if you spend more than your assigned budget

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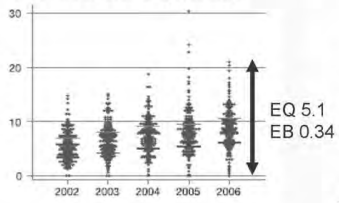
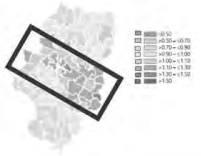
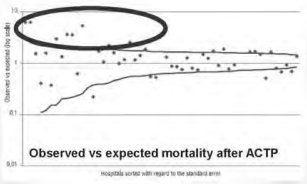
Cardiovascular ischemic disease: PTCA

PTCA Standardized rates (10,000 inh.)



ACTP vs ID Standardized utilization ratio





Observed vs expected mortality after ACTP

See appendix

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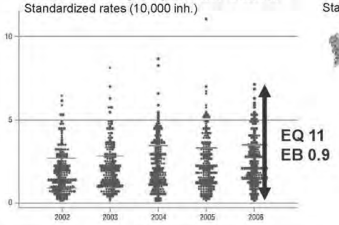
Cancer

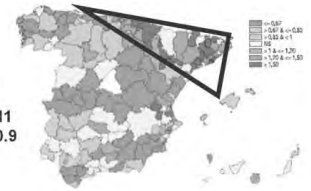
Prostatectomy in prostate cancer

Standardized rates (10,000 inh.)



Conservative mastectomy in breast cancer

Standardized utilization ratio



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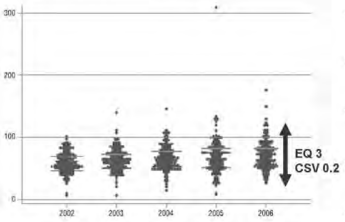
Obstetric care: c-section

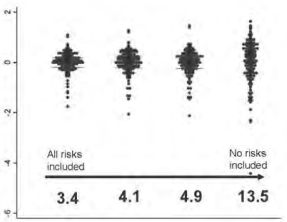
C- section at population-level

Standardized rates (10,000 inh.)



C- section at hospital-level

Adjusted risk (100 deliveries)



Red dots represents the existence of neonatal ICU

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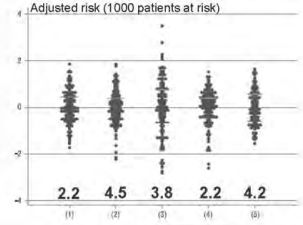
Patient Safety and Avoidable hospitalizations

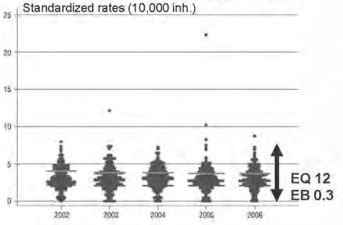
Patient safety indicators

Adjusted risk (1000 patients at risk)



Diabetes Short-term complications

Standardized rates (10,000 inh.)



1: Mortality in LM-DRG:	-0.02 (-0.03 to 0.003)
2: Decubitus Ulcer:	0.35 (0.27 to 0.45)
3: Catheter-related infections:	0.36 (0.27 to 0.55)
4: PTE – DVT:	0.10 (0.08 to 0.16)
5: Post-operative sepsis:	0.3 (0.2 to 0.5)

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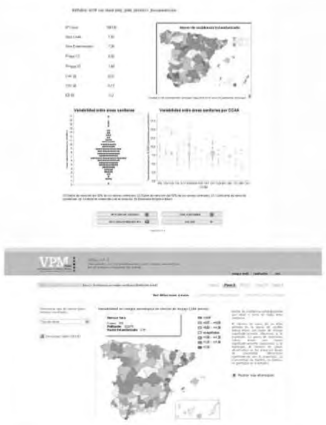
Knowledge-brokering tools



Appendix (i): basics on methodology

Geographical-based approach:	Hospital-specific approach:
Research question: Does the place of residency influence the population experience of getting effective and safe services and technologies?	**Research question:** Is the odds of getting high-quality and safe care dependant on the provider where a person is attended?
Design: ecologic w-w/o time-series	**Design:** Cross section w-w/o time-series
Setting: population living in a geographic area	**Setting:** patients at risk attended in a hospital
Main endpoints: standardized rate or standaridized utilization ratio describing hospital utilization	**Main endpoints:** adjusted risk and observed vs expected ratio, analysing events amenable to healthcare quality
Sources: Administrative data	**Sources:** Administrative data
Analysis: Small Area Analysis, deterministic or bayesian	**Analysis:** Multilevel analyses

Appendix (ii): basics on the statistics of variation

- **Objectives:**
  - To estimate the magnitude of variation
  - To determine the systematic variation (as opposed as that due to chance)
  - To control differences in, either populations or patients.
  - To estimate the existence of cluster effects
- **Statistics of variation:**
  - **Dependent on observed cases**
    - Extremal quotient (EQ) between standardized rates or adjusted risks
  - **Dependent on observed vs expected cases**
    - Systematic component of variation (SCV)
    - Empirical Bayes statistic (EB)
    - Standardized Utilization Ratio (SUR): indirect method or Bayesian technique
    - Random effect in multilevel analysis: lineal generalized or logit

Ibañez B et al. Is there much variation in variation? Revisiting statistics of small area variation in health services research **(http://www.biomedcentral.com/content/pdf/1472-6963-9-60.pdf)**

Acknowledgments:

www.atlasvpm.org

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Gobierno de Navarra
Junta de Extremadura
Junta de Galicia
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ECHO

EUROPEAN COLLABORATION HEALTHCARE OPTIMIZATION

EUROPEAN COLLABORATION FOR HEALTHCARE OPTIMIZATION

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www.echo-health.eu

VPM GEOGRAPHY OF HEALTH CARE IN SPAIN

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VPM GEOGRAPHY OF HEALTH CARE IN SPAIN

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Expected outcomes

- Using established indicators adopted by International Organizations, particularly those by AHRQ-OECD-EU, **we will provide a set of accurate performance indicators**
- Sound analysis of the actual **performance of different providers at geographical and hospital levels**
- **Methodological insight into overcoming** some of the classic hindrances for adequate performance measurements (i.e., case-mix adjusted measures, bayesian statistics, bayesian multivariate analyses, multilevel analyses, funnel plots, etc).
- A set of **web-based tools** designed to replicate methods on more specific and local problems,
- **Basis for extending** the methodological developments to other health cares systems in the EU.

VPM GEOGRAPHY OF HEALTH CARE IN SPAIN

GOBIERNO DE ARAGON

4 main deliverables

- Report on the actual quality of the information systems in the participant countries.
  - Do they allow reaching the research goals?
- Handbook on methodology
  - Detailed of the methods and techniques used in ECHO, together with best practices for their utilization
- Report on the actual performance of the healthcare systems of the participant countries
  - Using available information, a set of indicators validated for international comparison and the most robust available methodology
- Web-based analytical tools
  - To run analyses automatically using the methods developed and the more up-to-date available data

GOBIERNO DE ARAGON

Implications for decision-making across countries

- ✓ Is access to an appropriate diagnostic or surgical procedure dependant on the place a person lives?
- ✓ Are the odds of a patient suffering unneeded treatment -and having an adverse event- different regarding the provider where the person is admitted?
- ✓ Which is the cost of opportunity -for a society- of providing more services more intensively?
- ✓ Which is the marginal benefit –in health- associated to more intensity of resources compared with the neighboured area?

THE DARTMOUTH INSTITUTE
FOR HEALTH POLICY & CLINICAL PRACTICE
Where Knowledge Informs Change

UNIVERSITÄT BERN

Stents & zip codes

The geography of cardiovascular health care in Switzerland

A. Busato
B. Künzi
H. Saner
University of Bern
Switzerland

D. Likowsky
D. Goodman
The Dartmouth Institute for Health Policy and Clinical Practice

Content

- The Swiss health system
- The geography of cardiovascular health care in Switzerland
- Health services research in Switzerland

The Swiss health system

- Provides universal health coverage.
- Has widely available up do date health services.
- Mostly based on a fee for service system.

- Health care policy is fragmented into 26 different cantonal health systems including four languages with little linkage between them.
  - ⇨ Cost of 4.5 Billion Swiss Francs or 1% of the GDP for cantonal fragmentation in health care.

Health care's cost to the economy is higher than anywhere except the U.S

The geography of cardio-vascular health care in Switzerland

Research Plan

1. To document practice variation of cardiovascular procedures.
2. To describe the geographic variation of the cardiologic workforce.
3. To identify effects of demand and supply side factors related to variation.
4. To disseminate patterns and determinants of variation to physicians, patients and decision makers using web-technology.

Geographic model

- **86 utilization based health service areas** (HSA) were formed based on political communities.
- HSA formation was using on all hospitalizations for 2003-2007 in acute care hospitals.
- No restrictions were set for population size or other regional criteria.

	Mean	Median	Min	Max
Population	87332	57813	1588	482933
# hospitals	4.0	3.8	1	21
Hosp. rate / 1000	146.7	143.2	115.8	215.0
Beds/ 1000 population	4.0	3.9	0.9	11.4

Data sources

Hospitalization data 2003-2007

- Patient demographics and place of residency
- ICD10, comorbid conditions, DRG's, cost weights,
  - CVD disease: ICD10 Chapter I

Ambulatory care

- **Physicians**: Treatment data / cost weights/ prescription drugs
- **Insurance**: Invoice data / treatment- and patient volume
- **Swiss Medical Association**: Physician data

Population and Mortality data
(Swiss Federal Statistical Office)

Structure of care

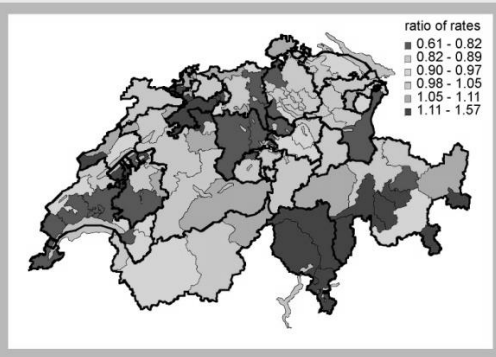
In-patient care for ICD10 chapter "I"

- 2003: 239 hospitals
- 2007: 192 hospitals (20% decrease)
- 5 University hospitals, 20% of cases (36% DRG cost weights)

Physicians workforce

- 475 Cardiologists (0.06 /1000) (2007)
  - 330 In own practice
  - 145 Hospital based
- ≈ 6900 GP's (0.91 / 1000)

Hospitalization rate for CVD
Geographic variation (2003-2007)

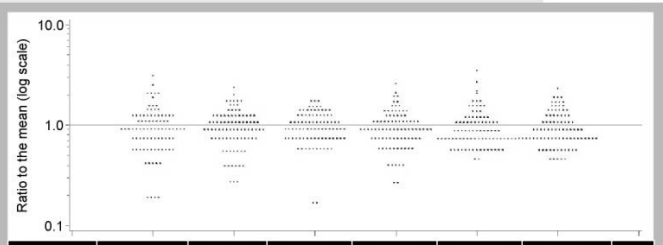


2.6-fold variation

Volume of care 2003-2007 - Rates
Major DRG groups

Category	Rate/ 1000	HILO ratio
Large cardiovascular procedures with complications and comorbid conditions	0.31	4.71
Coronary artery bypass with/without major complications and comorbid conditions	0.32	6.77
Percutaneous cardiovascular procedures with/without major complications or comorbid conditions	1.45	11.56
Valve replacement with/without major complications or comorbid conditions	0.33	3.49
Heart failure and shock	1.65	6.27
Acute myocardial infarction with or without major complication, comorbid conditions or death	0.92	4.61
All hospitalisations for CVD	15.60	2.59

Volume of care 2003-2007 – Cost weights
per 1000 population



Procedure	Large CV procedures	CAB	PCI	Valve replace-ment	Heart failure & shock	Acute myocardial infarction	
HILO ratio	20.49	10.59	11.04	10.87	7.73	5.37	

Volume of care 2003-2007
per 1000 population

Tracking Medicine
John E. Wennberg (2010)

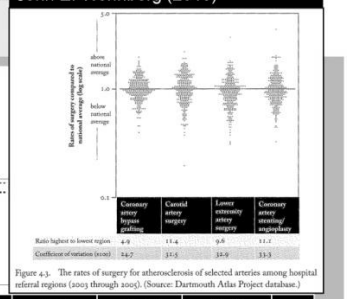
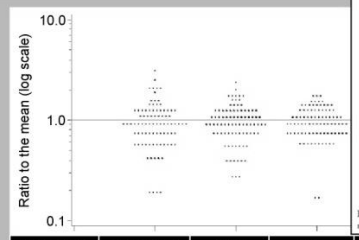
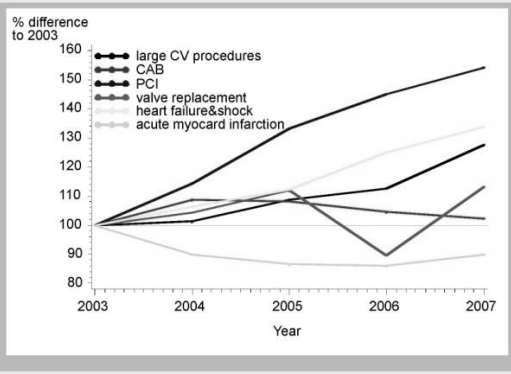


Figure 4.3. The rates of surgery for atherosclerosis of selected arteries among hospital referral regions (2003 through 2005). (Source: Dartmouth Atlas Project database.)



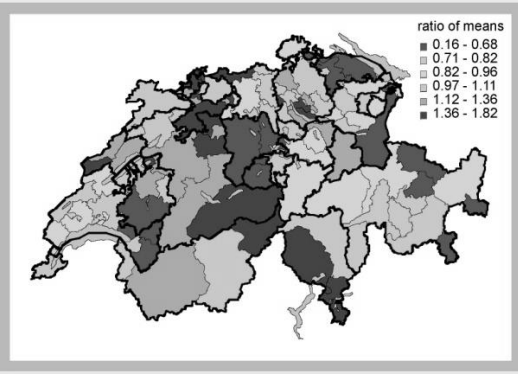
Procedure	Large CV procedures	CAB	PCI	Valve replace-ment	Heart failure & shock	Acute myocardial infarction	
HILO ratio	20.49	10.59	11.04	10.87	7.73	5.37	

Temporal variation of DRG cost weights
(per 1000 population)



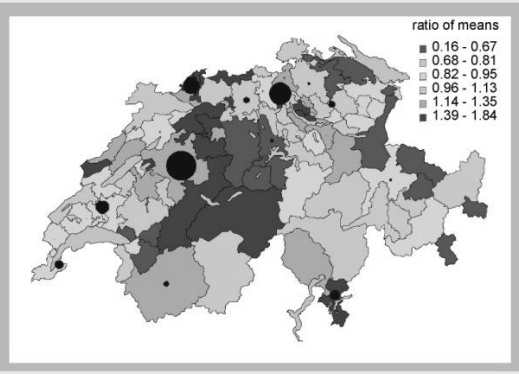
PCI: 54% increase

Percutaneous Coronary Interventions
Hospitalizations 1000 population

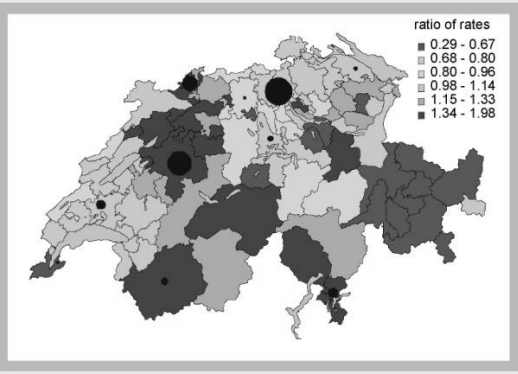


12-fold variation

Percutaneous Coronary Interventions
Hospitalizations 1000 population



Coronary Artery Bypass surgery (CAB)
Hospitalizations 1000 population



Causes of variation

- **Variation justified by medical needs**
  - Demographic structure
  - Risk factors

  } Prevalence / Incidence

- **Medically unwarranted**
  - Regional differences in capacity, quality and accessibility of care
  - Inconsistent adherence to clinical guidelines
  - Surgical signature
  - Financial incentives
  - Different coding practices
  - etc.

Causes of variation

Variation in medical practice is considered as a well established mechanism of failure in health care delivery systems.

- Inconsistent adherence to clinical guidelines
- Surgical signature
- Financial incentives
- Different coding practices
- etc.

Research on practice variation

Health Services Research:

- Are more doctors providing better outcomes?
- Progress in medicine does not always lead to better care.
- Overutilization can result in poorer quality of care.
- …

The identification of causes of unwarranted variation

Health services research in Switzerland

- No greater awareness among physicians, academic institutions and decision makers that health services research is needed.
- Focus is on what should be provided and underestimates the potential that lies in how care is provided.
- There is no sustainable research infrastructure.
- It is impossible to obtain funding for projects in health services research and peer reviewed publication of results is very difficult.

Health services research in Switzerland

*"...with trivial and mostly unimportant exceptions, health services research had **no impact** on medical or social policy".*

NEJM, 297:1073 (1977)

- There is no sustainable research infrastructure.
- It is impossible to obtain funding for projects in health services research and peer reviewed publication of results is very difficult.

The geography of cardio-vascular health care in Switzerland

Research Plan

1. To document practice variation of cardiovascular procedures.
2. To describe the geographic variation of the cardiologic work
3. To id… …rs related to va…
4. To di… …ion to physi… …ology.

Project review of the Swiss National Science Foundation:

- "Rein deskriptive Erhebung und nicht Hypothesen gestützt"
- "geringe wissenschaftliche Originalität"

Understanding variation in surgical outcomes: Rethinking the calculus of quality

Justin B. Dimick, MD, MPH
University of Michigan

Wennberg International Collaborative
London School of Economics, 2010

Need to improve surgical quality

- Surgical morbidity and mortality is a public health issue
  - 100,000 operative deaths a year in US
- Wide variation in outcomes across hospitals and surgeons
- Everyone is paying attention
  - Patients, payers, providers

Measuring surgical performance

Outcomes – "Gold standard"

- Everyone agrees they are important
- Strong track record in cardiac surgery
  - NY, PA, CA report cards
- Other specialties pushing forward
  - National Surgical Quality Improvement Program (NSQIP)

"Calculus of Quality"

Observed **of Care**

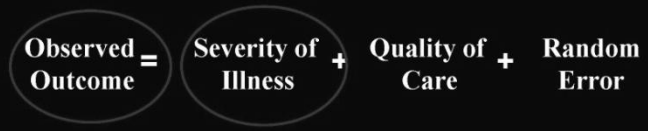
Not that simple!

"Calculus of Quality"

Overview of lecture

- Understanding the root causes of variation in surgical outcomes
  - Exploring the "Calculus of quality"
- Strategies for improving outcomes measurement in surgery
- Real-word application: Redesigning the ACS-NSQIP measurement platform

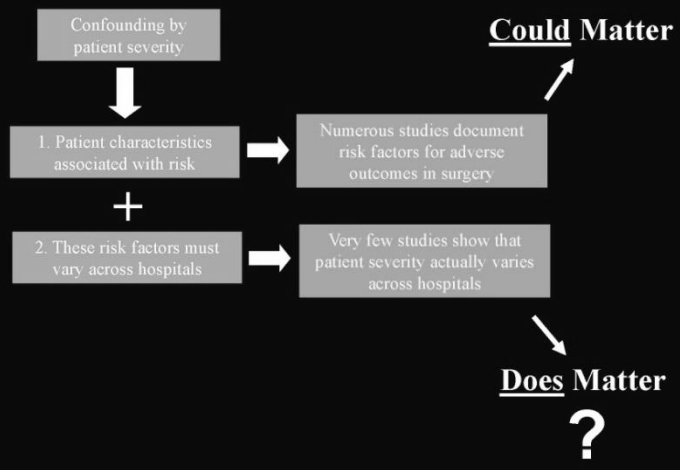
Rethinking the "Calculus of quality"



Severity of illness

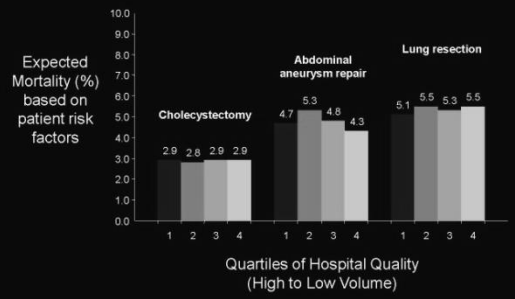
- Risk-adjustment: Importance of adjusting for severity is self-evident
  - Surgical outcomes may vary because some hospitals treat sicker, higher risk patients
- Decades of debate on how best to adjust for patient risk in quality comparisons
- Answer: "Kitchen-sink" model, adjustment using as many variables as possible

Are we asking the right question?

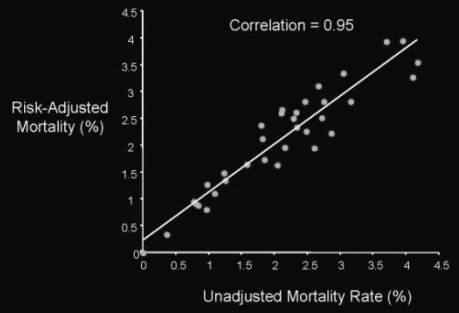


Hospital variation in patient risk

NSQIP Veterans Affairs: Do the expected mortality rates vary across hospital with different quality?



Hospital mortality with cardiac surgery New York State data, 2001-2



Dimick & Birkmeyer., J Am Coll Surg, 2008

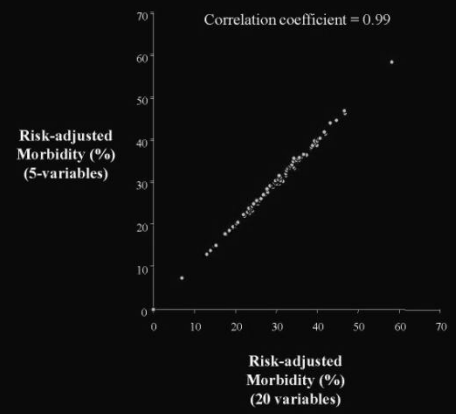
Severity of illness is overemphasized

- Too much intellectual horsepower and resources are focused on risk-adjustment
  - NSQIP collects >80 variables
  - Too expensive and not entirely necessary
- Still important for face validity and "buy in"
- But it can be simplified, saving money and resources

More efficient risk-adjustment

- Easier data collection: Continue to look for automated data collection
  - Electronic medical records
  - Hybrid administrative/clinical datasets
- Collect less data: Streamline risk-adjustment by including only the most important variables without compromising risk-adjustment

Hospital-level correlation morbidity rates (5-variable vs. 20 variable model)



Dimick et al. J Am Coll Surg 2010

Rethinking the "Calculus of quality"

Observed Outcome = **Severity of Illness** + **Quality of Care** + **Random Error**

Random error

- Surgical outcomes vary by chance
  - Compounded by any factor that reduces numerator or denominator
- Type I errors
  - High or low mortality attributed to quality, when really just chance (i.e., luck)
  - "The Zero Mortality Paradox"
- Type II errors
  - Chance obscures true differences in quality
  - "Big Problems with Small Samples"

The Zero Mortality Paradox in Surgery

Justin B Dimick, MD, MPH, H Gilbert Welch, MD, MPH

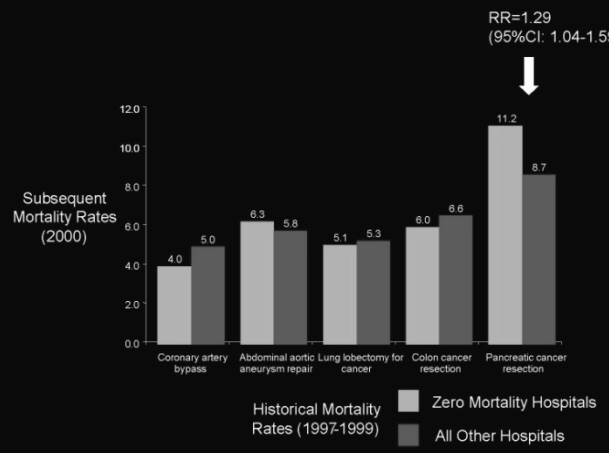
BACKGROUND: Patients considering where to have surgery may reasonably believe that their chances of survival are highest at hospitals whose reported operative mortality is zero. We sought to determine if hospitals with zero mortality over 3 years also have lower than average mortality in the subsequent year.

STUDY DESIGN: We obtained national Medicare data on five operations with high operative mortality (> 4.0%): coronary artery bypass grafting, abdominal aortic aneurysm repair, and resections for colon, lung, and pancreatic cancer. For each procedure, we defined zero mortality hospitals as those with no inpatient or 30-day deaths during the 3-year period 1997 to 1999. To determine whether these hospitals actually have lower mortality than other hospitals, we compared their mortality during the next year (2000) with the mortality at all other hospitals.

RESULTS: For four procedures, operative mortality in zero mortality hospitals in the subsequent year was no different than that in other hospitals: abdominal aortic aneurysm repair (6.3% zero mortality hospitals versus 5.8% other hospitals; (adjusted relative risk [RR] = 1.09; 95% CI 0.92 to 1.29); lobectomy for lung cancer (5.1% versus 5.3%; RR = 0.96; 95% CI 0.80 to 1.15); colon cancer resection (6.0% versus 6.6%; RR = 0.91; 95% CI 0.80 to 1.03); and coronary artery bypass surgery (4.0% versus 5.0%; RR = 0.81; 95% CI 0.61 to 1.04). In the case of pancreatic cancer resection, zero mortality hospitals had substantially higher mortality than other hospitals (11.2% versus 8.7%; RR = 1.29; 95% CI 1.04 to 1.59).

CONCLUSIONS: Paradoxically, hospitals with a history of zero mortality subsequently experience mortality rates that are the same or higher than those of other hospitals. Patients considering surgery should not consider a reported mortality of zero as being a reliable indicator of future performance. (J Am Coll Surg 2008;206:13–16. © 2008 by the American College of Surgeons)

Type I errors: The Zero Mortality Paradox



ORIGINAL CONTRIBUTION

Surgical Mortality as an Indicator of Hospital Quality

The Problem With Small Sample Size

Justin B. Dimick, MD
H. Gilbert Welch, MD, MPH
John D. Birkmeyer, MD

Context Surgical mortality rates are increasingly used to measure hospital quality. It is not clear, however, how many hospitals have sufficient caseloads to reliably identify quality problems.

Objective To determine whether the 7 operations for which mortality has been advocated as a quality indicator by the Agency for Healthcare Research and Quality (coronary artery bypass graft [CABG] surgery, repair of abdominal aortic aneurysm, pancreatic resection, esophageal resection, pediatric heart surgery, craniotomy, hip replacement) are performed frequently enough to reliably identify hospitals with increased mortality rates.

Design and Setting The US national average mortality rates and hospital caseloads of the 7 operations were determined using the 2000 Nationwide Inpatient Sample (NIS), and sample size calculations were performed to determine the minimum caseload necessary to reliably detect increased mortality rates in poorly performing hospitals. A 3-year hospital caseload was used for the baseline analysis, and poor performance was defined as a mortality rate double the national average.

Main Outcome Measure Proportion of hospitals in the United States that performed more than the minimum caseload for each operation.

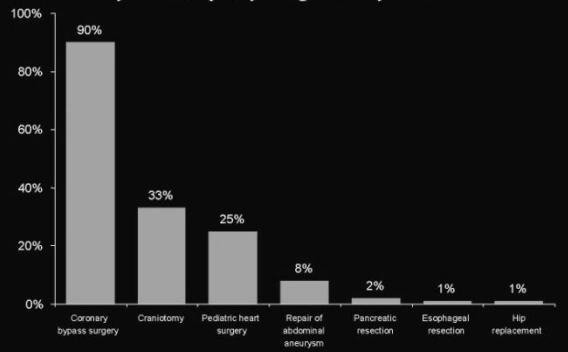
Results The national average mortality rates for the 7 procedures examined ranged from 0.3% for hip replacement to 10.7% for craniotomy. Minimum hospital caseloads necessary to detect a doubling of the mortality rate were 64 cases for craniotomy, 77 for esophageal resection, 86 for pancreatic resection, 138 for pediatric heart surgery, 195 for repair of abdominal aortic aneurysm, 219 for CABG surgery, and 2668 for hip replacement. For only 1 operation did the majority of hospitals exceed the minimum caseload, with 90% of hospitals performing CABG surgery having a caseload of 219 or higher. For the remaining operations, only a small proportion of hospitals met the minimum caseload: craniotomy (33%), pediatric heart surgery (25%), repair of abdominal aortic aneurysm (8%), pancreatic resection (2%), esophageal resection (1%), and hip replacement (<1%).

Conclusion Except for CABG surgery, the operations for which surgical mortality has been advocated as a quality indicator are not performed frequently enough to judge hospital quality.

JAMA. 2004;292:847-851 www.jama.com

Type II errors: Big problems with small samples

What proportion of hospitals perform enough cases to reliably measure quality using mortality rates?



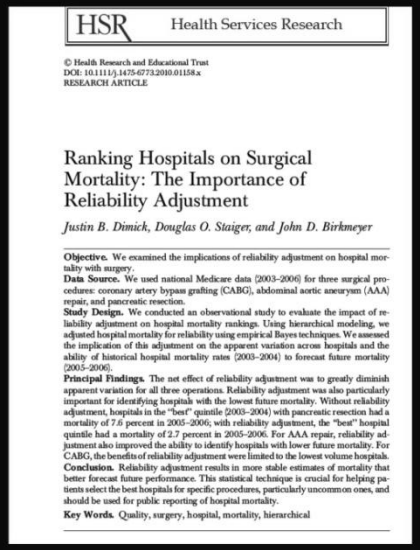
Dimick et al. JAMA 2004

Random error is underemphasized

- Randomess due to small numbers severely plagues quality measurement in surgery
- Type I and Type II errors are the norm rather than the exception
- Techniques for addressing sample size problems are needed

Techniques for dealing with random error ("statistical noise")

- Reliability adjustment
  - Use empirical Bayes techniques to "shrink" observed mortality toward the average (according to relative precision of hospital's data)
  - Application of hierarchical modeling
  - Much more reliable in predicting true mortality



HSR Health Services Research

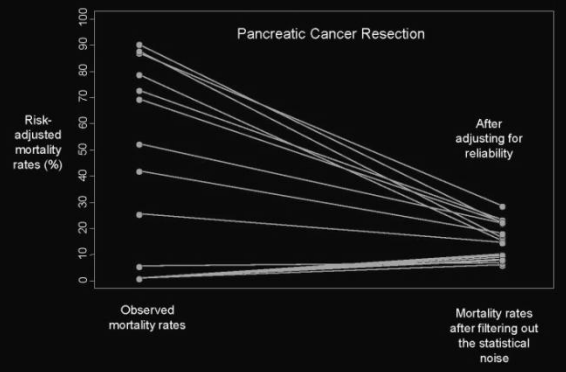
DOI: 10.1111/j.1475-6773.2010.01158.x
RESEARCH ARTICLE

Ranking Hospitals on Surgical Mortality: The Importance of Reliability Adjustment

Justin B. Dimick, Douglas O. Staiger, and John D. Birkmeyer

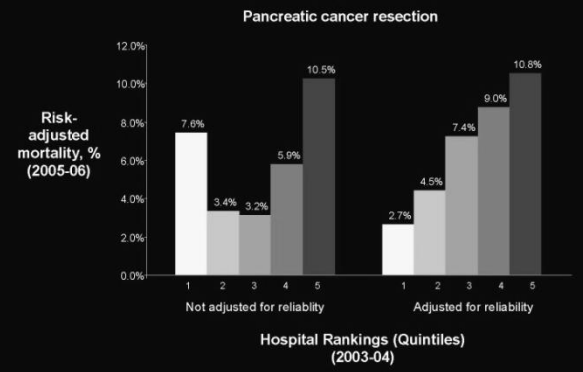
Objective. We examined the implications of reliability adjustment on hospital mortality with surgery.
Data Source. We used national Medicare data (2003–2006) for three surgical procedures: coronary artery bypass grafting (CABG), abdominal aortic aneurysm (AAA) repair, and pancreatic resection.
Study Design. We conducted an observational study to evaluate the impact of reliability adjustment on hospital mortality rankings. Using hierarchical modeling, we adjusted hospital mortality for reliability using empirical Bayes techniques. We assessed the implication of this adjustment on the apparent variation across hospitals and the ability of historical hospital mortality rates (2003–2004) to forecast future mortality (2005–2006).
Principal Findings. The net effect of reliability adjustment was to greatly diminish apparent variation for all three operations. Reliability adjustment was also particularly important for identifying hospitals with the lowest future mortality. Without reliability adjustment, hospitals in the "best" quintile (2003–2004) with pancreatic resection had a mortality of 7.6 percent in 2005–2006; with reliability adjustment, the "best" hospital quintile had a mortality of 2.7 percent in 2005–2006. For AAA repair, reliability adjustment also improved the ability to identify hospitals with lower future mortality. For CABG, the benefits of reliability adjustment were limited to the lowest volume hospitals.
Conclusion. Reliability adjustment results in more stable estimates of mortality that better forecast future performance. This statistical technique is crucial for helping patients select the best hospitals for specific procedures, particularly uncommon ones, and should be used for public reporting of hospital mortality.
Key Words. Quality, surgery, hospital, mortality, hierarchical

Impact of reliability adjustment on hospital mortality rates



Dimick et al. Health Services Research 2010

Are reliability adjusted mortality rates better at predicting future performance?



Dimick et al. Health Services Research 2010

Rethinking the "Calculus of quality"

Observed Outcome = **Severity of Illness** + **Quality of Care** + **Random Error**

Quality of care

- Variation in surgical mortality not due to illness severity or random error may be reasonably attributed to quality of care
- But what is "quality?"

"Calculus of quality"

Observed Outcome = **Severity of Illness** + **Process of Care** + **Random Error**

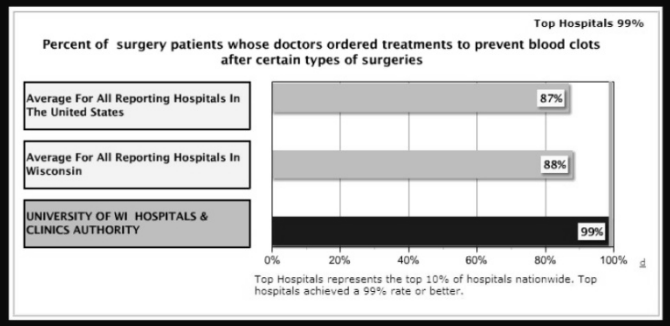
Process of Care = [**Measurable** + **Unmeasurable**]

- **Measurable**
  - Discrete aspects of perioperative care
- **Unmeasurable**
  - Patient selection
  - Technical proficiency

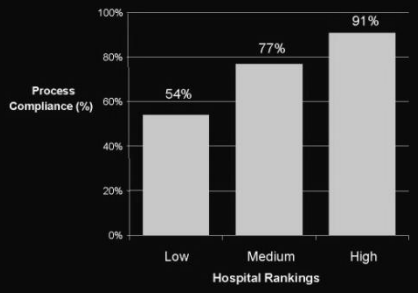
Process measures in surgery

- Most focus on measurable aspects of perioperative care
- Medicare's Surgical Care Improvement Project (SCIP)
  - Prophylaxis of complications (e.g., wound infection and venous thrombosis)
- Subset of measures publicly reported on CMS' Hospital Compare website (www.hospitalcompare.hhs.gov)

Hospital Compare website

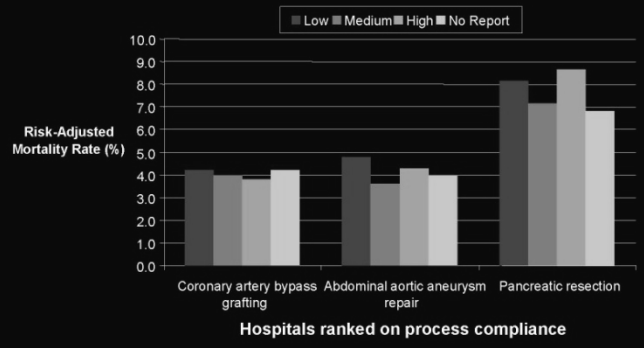


Process of care compliance in Medicare's Hospital Compare



Lauren Nicholas, PhD et al. Archives of Surgery (In press)

Process compliance and risk-adjusted mortality, National Medicare population, 2005-06



Lauren Nicholas, PhD et al. Archives of Surgery (In press)

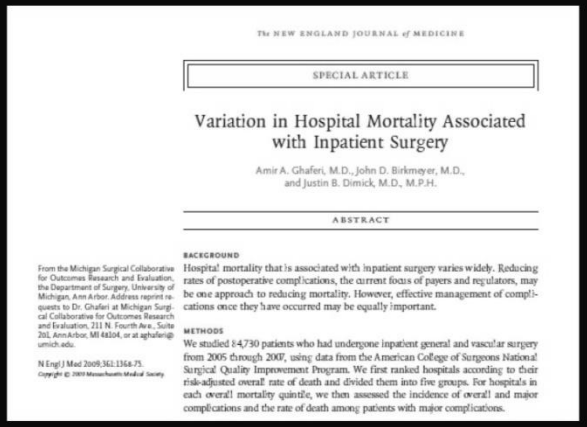
Process of care is oversimplified

- Existing processes do not explain the wide variations in surgical outcomes
- Most relate to secondary outcomes or extremely rare complications
- High leverage processes need to be uncovered before "process improvement" can fulfill the promise of its name

Identifying high leverage processes of care

- Continue to investigate new process measures
  - Randomized trials and linkage of process to outcome within clinical registries
- Develop better tools to measure important but currently unmeasurable processes
  - What happens in the operating room?
- Use tools of clinical epidemiology to identify the clinical mechanisms that lead to bad outcomes

Isolating high leverage processes…



The NEW ENGLAND JOURNAL of MEDICINE

SPECIAL ARTICLE

Variation in Hospital Mortality Associated with Inpatient Surgery

Amir A. Ghaferi, M.D., John D. Birkmeyer, M.D., and Justin B. Dimick, M.D., M.P.H.

ABSTRACT

BACKGROUND

Hospital mortality that is associated with inpatient surgery varies widely. Reducing rates of postoperative complications, the current focus of payers and regulators, may be one approach to reducing mortality. However, effective management of complications once they have occurred may be equally important.

METHODS

We studied 84,730 patients who had undergone inpatient general and vascular surgery from 2005 through 2007, using data from the American College of Surgeons National Surgical Quality Improvement Program. We first ranked hospitals according to their risk-adjusted overall rate of death and divided them into five groups. For hospitals in each overall mortality quintile, we then assessed the incidence of overall and major complications and the rate of death among patients with major complications.

From the Michigan Surgical Collaborative for Outcomes Research and Evaluation, the Department of Surgery, University of Michigan, Ann Arbor. Address reprint requests to Dr. Ghaferi at Michigan Surgical Collaborative for Outcomes Research and Evaluation, 211 N. Fourth Ave., Suite 202, Ann Arbor, MI 48104, or at aghaferi@umich.edu.

N Engl J Med 2009;361:1368-75.

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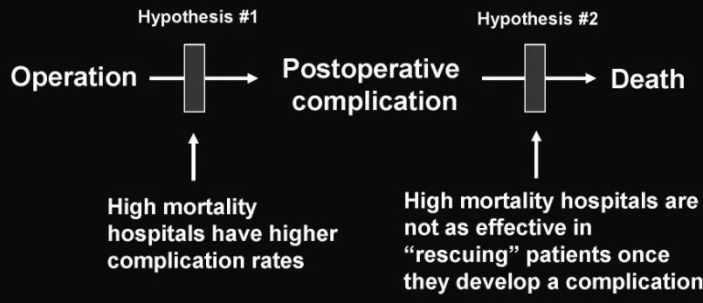
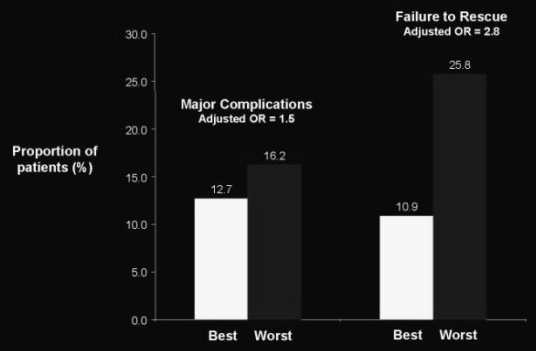
Explaining variations in surgical mortality rates



Mechanisms underlying variation, colectomy in ACS-NSQIP hospitals, 2005-2006



Amir Ghaferi, MD, Research Fellow, University of Michigan, New England Journal of Medicine, 2009

Rethinking the "Calculus of quality"

Observed Outcome = **Severity of Illness** + **Process of Care** + **Random Error**

Overemphasized:
Adjusting for patient severity is not the whole battle. Needs to be streamlined.

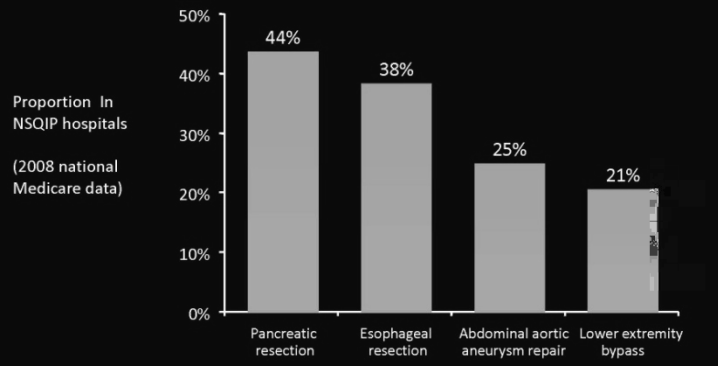
Oversimplified:
We need to identify high leverage processes of care using tools of clinical epidemiology.

Underemphasized:
We need to explicitly deal with random error. Develop better measures that take it into account and adjust for reliability.

Outcomes measurement

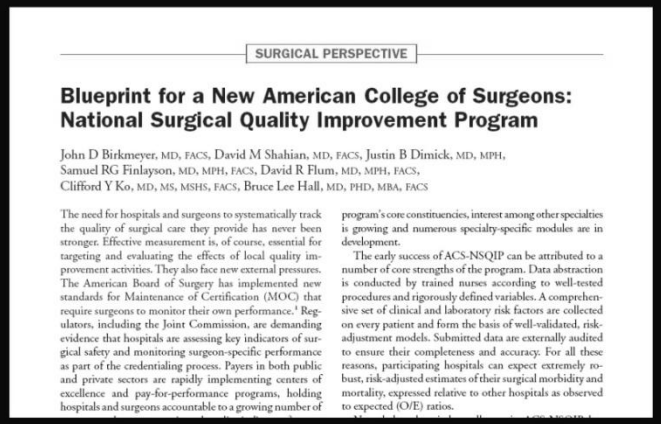
- National Surgical Quality Improvement Program (NSQIP)
- Feedback of risk-adjusted outcomes
- Began in Veterans Affairs hospitals
- American College of Surgeons disseminating in private hospitals
  - 250+ hospitals enrolled

How much surgery is performed in ACS-NSQIP hospitals?



Source: Nicholas H. Osborne, MD, MS, RWJ Scholar, University of Michigan

Context: Transformation of ACS-NSQIP



SURGICAL PERSPECTIVE

Blueprint for a New American College of Surgeons: National Surgical Quality Improvement Program

John D Birkmeyer, MD, FACS, David M Shahian, MD, FACS, Justin B Dimick, MD, MPH, Samuel RG Finlayson, MD, MPH, FACS, David R Flum, MD, MPH, FACS, Clifford Y Ko, MD, MS, MSHS, FACS, Bruce Lee Hall, MD, PHD, MBA, FACS

The need for hospitals and surgeons to systematically track the quality of surgical care they provide has never been stronger. Effective measurement is, of course, essential for targeting and evaluating the effects of local quality improvement activities. They also face new external pressures. The American Board of Surgery has implemented new standards for Maintenance of Certification (MOC) that require surgeons to monitor their own performance.[1] Regulators, including the Joint Commission, are demanding evidence that hospitals are assessing key indicators of surgical safety and monitoring surgeon-specific performance as part of the credentialing process. Payers in both public and private sectors are rapidly implementing centers of excellence and pay-for-performance programs, holding hospitals and surgeons accountable to a growing number of

program's core constituencies, interest among other specialties is growing and numerous specialty-specific modules are in development.

The early success of ACS-NSQIP can be attributed to a number of core strengths of the program. Data abstraction is conducted by trained nurses according to well-tested procedures and rigorously defined variables. A comprehensive set of clinical and laboratory risk factors are collected on every patient and form the basis of well-validated, risk-adjustment models. Submitted data are externally audited to ensure their completeness and accuracy. For all these reasons, participating hospitals can expect extremely robust, risk-adjusted estimates of their surgical morbidity and mortality, expressed relative to other hospitals as observed to expected (O/E) ratios.

Blueprint for a new ACS-NSQIP

- Change from random sampling to 100% data collection for "core" procedures (5 general surgery)
- Severity of illness: Streamline risk-adjustment by including only the most important variables
- Random error: "Reliability adjustment" to reduce statistical noise
- Quality of care:
  - Collect processes of care and procedure-specific outcomes (specialty societies and clinical experts)
  - Identify high leverage processes of care

THE DARTMOUTH INSTITUTE
FOR HEALTH POLICY & CLINICAL PRACTICE
Where Knowledge Informs Change

Medical Care Variation Research: Historic and Methodological Overview

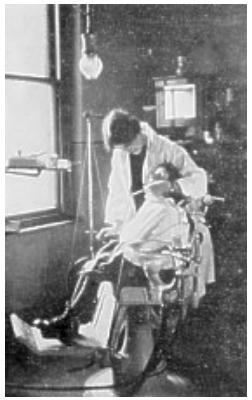
David C. Goodman, MD MS

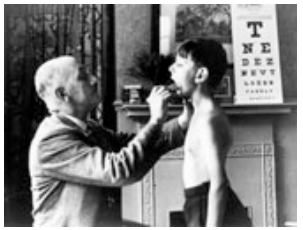
Professor of Pediatrics and of Health Policy
Center for Health Policy Research

The Dartmouth Institute for Health Policy and Clinical Practice
Hanover, NH

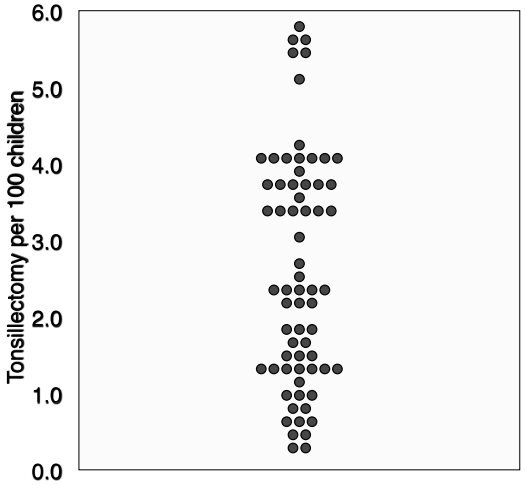
Wennberg International Collaborative
September 2010

The School Medical Service - England





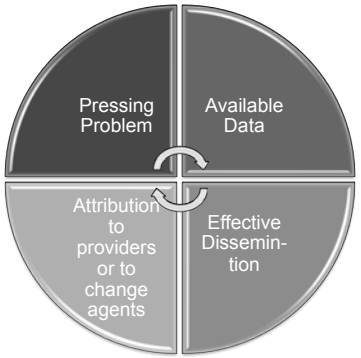
Glover Tonsillectomy Annual Incidence (1936) 5 - 14 years



Blyth MB 5.7
Oxford CB 3.1
London 2.2
Cambridge MB 1.0

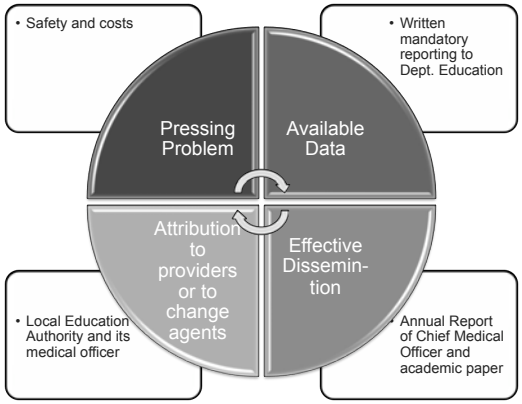
Source: Glover JA. The incidence of tonsillectomy in school children. *Proceedings of the Royal Society of Medicine* 1938;31:95-112.

Studying Medical Care Variation: Necessary Ingredients



Risk Adjustment	Theory/Conceptual framework
Timeliness	Professional and Policy Engagement with Remedies

Glover 1938: Tonsillectomies



Risk Adjustment	Theory/Conceptual framework
Timeliness	Professional and Policy Engagement with Remedies

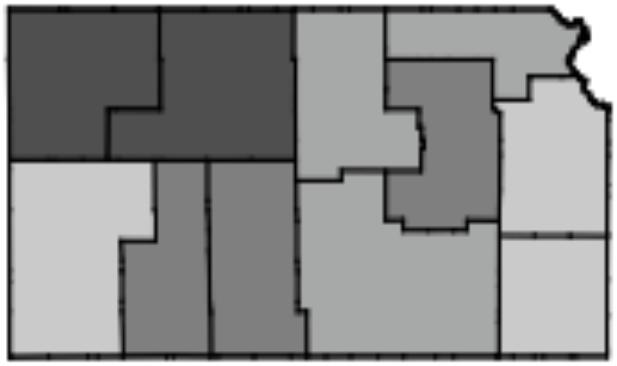
Lembcke and "Hospital Service Areas" - 1952

"The significance of hospital service areas... is that in most instances a hospital medical staff can be held pretty directly responsible for a very high percent of the medical care given to residents of that area...

Once responsibility is fixed, changes ... can be brought about with relative ease because the hospital medical staff is a well defined group of physicians, subject through their own actions and that of the hospital to educational and regulatory influences."

Lembcke PA. Am J Publ Health 1952; 42:276-286.

Physician Supply in Kansas (1965)



Surgeons & General Practitioners per 100,000

78.0 to 80.0 (2)
69.6 to < 78.0 (3)
63.2 to < 69.6 (3)
48.4 to < 63.2 (3)

Source: Lewis. N Engl J Med, 1969.

Multiple linear regression

Hernia repair = β_1(Physicians) + β_2(BC Surgeons) + intercept

R^2= 0.49

Source: Lewis. N Engl J Med, 1969.

1973 - Hospital Service Areas in VT

Small Area Variations in Health Care Delivery

A population-based health information system can guide planning and regulatory decision-making.

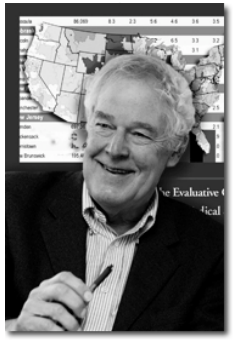
John Wennberg and Alan Gittelsohn

Recent legislation has extended planning and regulatory authority in the health field in a number of important areas. The 1972 amendments to the Social Security Act provide authority for regulating the construction of facilities and establish Professional Standard Review Organizations (PSRO's), which are accountable for setting standards and evaluating professional performance. Phase 3 of the Wage and Stabilization Act of 1970 and state insurance commissions provide authority for regulating dollar flow by controlling impact of regulatory decisions on the equality of distribution of resources and dollars and the effectiveness of medical care services.

For technical and organizational reasons, documentation of the health care experience of populations has been restricted to large political jurisdictions such as counties, states, or nations. Studies at this level of aggregation have used indicators that support direct comparisons among areas. Relationships between the supply of manpower, facilities, and expenditures and

twice as high in California as in Arkansas. The number of physicians per thousand persons has been up to three times higher in some states than in others. International comparisons and studies of regions within states show that there are large differences in the rate of delivery of specific surgical procedures (2).

In 1969, there was implemented in the state of Vermont a data system that monitors aspects of health care delivery in each of the 251 towns of the state. When the population of the state is grouped into 13 geographically distinct hospital catchment, or service, areas, variations in health care are often more apparent than they are when the population is divided into fewer, larger areas. Population rates can be used to make direct statistical comparisons between each of the 13 hospital service areas. Since the medical care in each area is delivered predominantly by local physicians, variations tend to reflect differences in the way particular individuals and groups practice medicine. The specificity of the information in Vermont's data system makes it possible to appraise the impact that decisions controlling facility construction, price of insurance, and



line). Darker line shows boundaries of hospital service areas. Circles represent hospitals. Areas without circles are served principally by hospitals in New Hampshire.

Wennberg J, Gittelsohn A. Small area variations in health care delivery. Science 1973;182:1102-8.

1973 - Hospital Service Areas in VT
Wennberg and Gittelsohn

Table 2. Variation in utilization, facilities, manpower, and expenditure rates among 13 hospital service areas, Vermont, 1969.

Resource input and utilization indicators	Lowest two areas		Entire state		Highest two areas
Utilization rates per 1000 persons					
Hospital days	1015	1027	1250	1380	1495
Hospital discharges	122	124	144	195	197
All surgical procedures	36	49	55	61	69
Respiratory disease	10	13	16	29	36
Genitourinary disease	8	9	12	15	18
Circulatory disease	12	13	17	22	25
Digestive disease	15	16	19	24	26
Nursing home admissions, age 65 and over	14	22	52	81	81
Beds per 10,000 persons					
Hospitals	34	36	42	51	59
Nursing homes	9	26	42	62	65
Personnel per 10,000 persons					
Hospital	68	76	100	119	128
Nursing home	8	23	32	51	52
FTE physicians per 10,000 persons	7.9	8.4	10.3	11.9	12.4
General practice	1.5	1.7	2.5	3.8	4.4
Internal medicine	.9	.9	1.6	1.7	2.6
Pediatrics	.1	.2	.7	1.1	1.2
Obstetrics	.1	.2	.7	1.0	1.1
General surgery	.7	.9	1.1	1.5	1.7
Expenditures per capita ($)					
Hospitals	58	63	89	92	120
Nursing homes	5	13	17	25	26
Medicare Part B, age 65 and over (1972)	54	84	127	147	162

Wennberg J, Gittelsohn A. Small area variations in health care delivery. Science 1973;182:1102-8.

Criticisms of Interpretation - 1977

Small Area Variations in Health Care Delivery

A Critique

FRANCIS D. MOORE, M.D.*

Two recent articles by Wennberg and Gittelsohn[1,2] demonstrate seemingly remarkable variations between small local areas, in the extent to which surgical operations and certain other health services are utilized. The two articles deal respec-

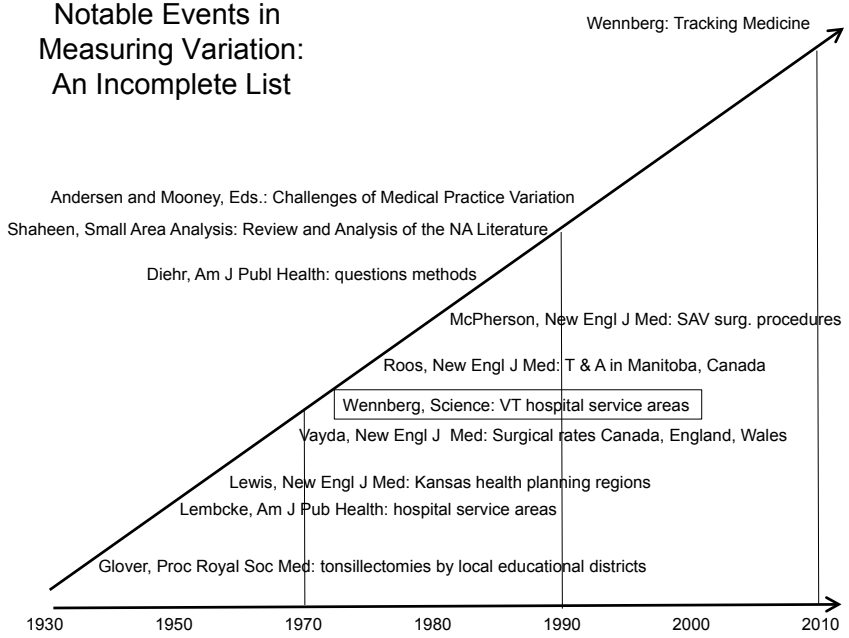
cians or surgeons. Or, is it possible that the authors did examine these two categories, and, discovering that the data failed to support their thesis, then omit them from the published report?

2) Considering the fact that some of the procedures examined are rare statistical events, affecting

They have been used to prove that it is the capricious whim and fiscal motivation of surgeons that dictates the level of surgical care in the community, rather than the needs of the population. It is unfortunate that these two studies, uncontrolled as they are, and with such glaring deficiencies were published at all, and especially unfortunate that they now provide some additional basis for medical legislation of a national character.

Moore FD. Small Area Variations In Health-Care Delivery - Critique. Journal of the Maine Medical Association 1977;68:49-52.

Notable Events in Measuring Variation: An Incomplete List



Canada enters the field - 1977
Roos, Roos, Henteleff

SPECIAL ARTICLE

ELECTIVE SURGICAL RATES — DO HIGH RATES MEAN LOWER STANDARDS?

Tonsillectomy and Adenoidectomy in Manitoba

NORALOU P. ROOS, PH.D., LESLIE L. ROOS, JR., PH.D., AND PAUL D. HENTELEFF, M.D.

Abstract We used claims data from the Canadian province of Manitoba to test alternative explanations for regional differences in tonsillectomy and adenoidectomy rates. Respiratory morbidity, standards of selection for operation, and surgical resources were compared with elective surgical rates across geographic areas. Statistically significant correlations were not found. Individual practice patterns were then examined. In some regions, a few physicians accounted for the great majority of tonsil/adenoid operations. In other regions, the work was much more widely distributed. Despite great variation among individual physicians in the frequency of performing tonsil/adenoid operations and the standards of selection for operation, use of these procedures and standards applied were only weakly related to such variables as physician age, place of training and specialty. (N Engl J Med 297:360-365, 1977)

Roos NP, Roos LL, Henteleff PD. Elective Surgical Rates--Do High Rates Mean Lower Standards? New England Journal of Medicine 1977;297:360-5.

UK enters the field – 1981/1982
McPherson, Surgical SAV – An International Comparison

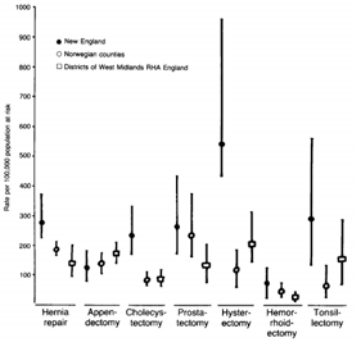


Figure 1. Mean and Range of Age- and Sex-Standardized Rates for Common Surgical Procedures in New England, Norway, and the West Midlands.

In each geographic region, let there be k hospital service areas. The age-specific and sex-specific rates for all the areas combined are known, and the numbers of people at risk in each age and sex group for each area are known. It is routine to note the observed number of operations in each area (O_i) for a particular period and to calculate the expected number of operations (E_i), given the regional age-specific and sex-specific rates. Let λ_i be the multiplicative factor associated with the ith area. Since surgery is a relatively rare event, we conclude that the distribution of O_i is approximately Poisson, with mean λE_i. If we now consider λ_i as a random variable with an expected value of 1 and a variance of σ^2, we have

$$\text{Variance } (O_i) = E_i^2\sigma^2 + E_i,$$

and if we define Y_i as the logarithm of the ratio of O_i to E_i, we have

$$Y = \log\left(\frac{O_i}{E_i}\right) \approx \frac{O_i - E_i}{E_i}.$$

It follows that the expected value of Y_i is approximately zero and $E(Y_i^2)$, the expected value of Y_i^2 is approximated by

$$E(Y_i^2) = \frac{1}{E_i^2}\text{Variance } (O_i - E_i)$$
$$= \frac{1}{E_i^2}(E_i^2\sigma^2 + E_i)$$
$$= \sigma^2 + \frac{1}{E_i},$$

so that

$$\left(\sum_{i=1}^{k} Y_i^2/k\right) = \sigma^2 + \frac{1}{k}\sum_{i=1}^{k}\left(\frac{1}{E_i}\right)$$

and therefore σ^2 can be estimated by

$$\hat{\sigma}^2 = \sum_{i=1}^{k}\frac{Y_i^2}{k} - \frac{\sum_{i=1}^{k}\left(\frac{1}{E_i}\right)}{k}.$$

Thus, the area-dependent component of variance in rates standardized for age and sex can be estimated by subtracting the random component from the observed variance of the logarithm of the observed over the expected ratios. In this way we are comparing rela-

McPherson K, Wennberg JE, Hovind OB, Clifford P. Small-Area Variations in the Use of Common Surgical Procedures: An International Comparison of New England, England, and Norway. The New England journal of medicine 1982;307:1310-4.

Parsing Variance – Stochastic and Systematic

Table 2. Indexes of Variation in Age- and Sex-Standardized Surgical Rates among Selected Hospital Services in New England, Norway, and the West Midlands.

COEFFICIENT OF VARIATION (%)	HERNIA REPAIR	APPEN-DECTOMY	CHOLECYS-TECTOMY	PROSTA-TECTOMY	HYSTER-ECTOMY	HEMORRHOID-ECTOMY	TONSIL-LECTOMY	ALL SEVEN PROCEDURES
New England	0.11	26	18	30	22	30	36	14
Norway	0.20	16	18	33	31	47	48	11
West Midlands	0.20	16	16	24	20	35	31	12
RANGE (HIGH/LOW)								
New England	1.7	2.3	1.9	2.2	2.2	4.8	4.2	1.69
Norway	1.3	1.6	1.5	2.2	3.0	2.9	4.7	1.34
West Midlands	2.0	2.0	1.5	2.1	2.1	4.6	3.3	1.55
SYSTEMATIC COMPONENT * ($\times 100\ \sigma^2$)								
New England	0.6	1.7	1.7	5.0	4.8	12.7	12.2	2.08
Norway	0.2	2.4	1.9	9.3	10.4	14.7	27.5	1.28
West Midlands	4.4	2.9	2.1	6.2	3.7	12.2	18.5	1.33

*See Appendix.

McPherson K, Wennberg JE, Hovind OB, Clifford P. Small-Area Variations in the Use of Common Surgical Procedures: An International Comparison of New England, England, and Norway. The New England journal of medicine 1982;307:1310-4.

Methodological Criticisms – P Diehr, PhD
How much variation is explained by chance?

EDITORIALS

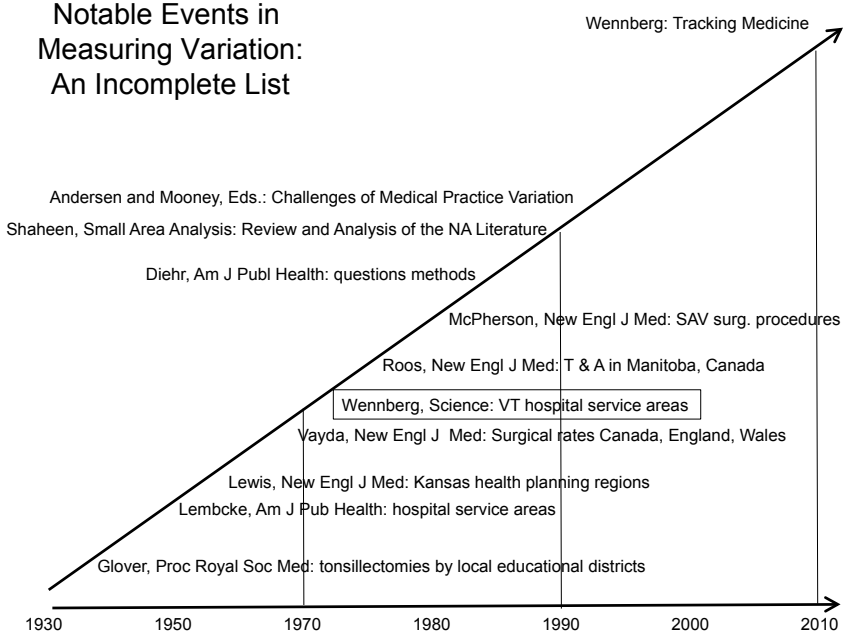
Small Area Statistics: Large Statistical Problems

Variation in the quantities of health services used by inhabitants of small geographical areas has been examined by recent research studies,[1-7] including a paper by Roos in this issue of the Journal.* The usual analytic method is to calculate the utilization rates for a service in several areas, compare the largest rate to the smallest rate, note that the difference is large, and attempt (using multiple regression or t-tests) to explain this variability as a function of service availability, physician practice styles, etc. Along with the women with a recent gynecological diagnosis (indicating the presence of a uterus) in the rate calculations. This might introduce some difficulties in the interpretation or the results, since the sample may be biased to include sicker women, but it should be applauded from a statistical point of view.

A major finding of most of the literature is that there is too much variability among the small areas, based on the difference between the highest and lowest rates. This may be

Diehr P. Small Area Analysis - Large Statistical Problems. American journal of public health 1984;74:313-4.

Notable Events in Measuring Variation: An Incomplete List



A 1987 paper well worth reading...

Small Area Analysis: A Review and Analysis of the North American Literature

Pamela Paul-Shaheen, *Michigan Department of Public Health,*
Jane Deane Clark, *Michigan Hospital Association, and*
Daniel Williams, *Michigan Department of Public Health*

Abstract. Variations in health service use rates by geographic area have long interested researchers and policymakers. Typically, investigators comparing population-based health care utilization rates among geographic areas have demonstrated substantial variations in use among seemingly similar communities. One method of investigation is ''small area analysis.'' Numerous areas in North America have been

Paul-Shaheen P, Clark J, Williams D. Small Area Analysis: A Review and Analysis of the North American Literature. J Health Politics, Policy, Law 1987;12:741-809.

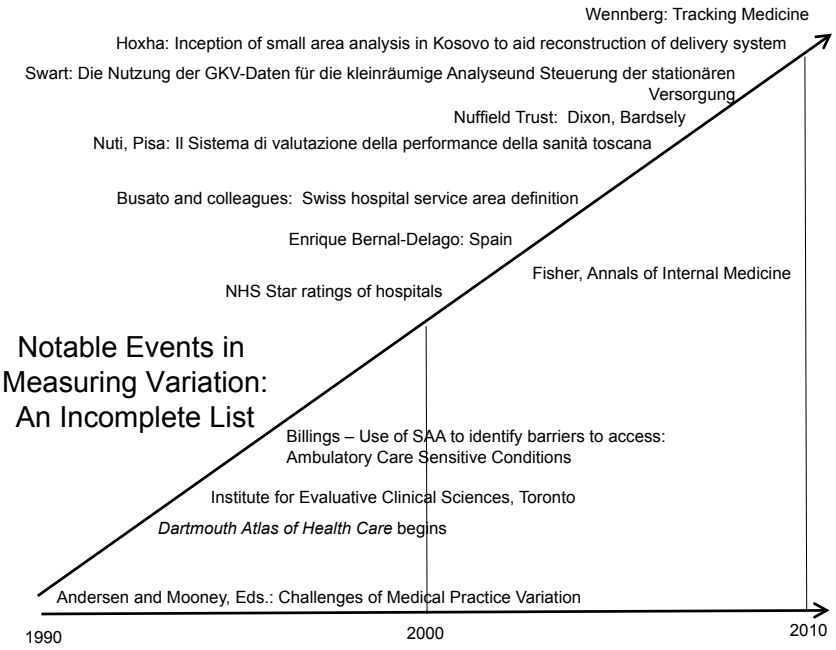
The Challenges of Medical Practice Variations, 1990

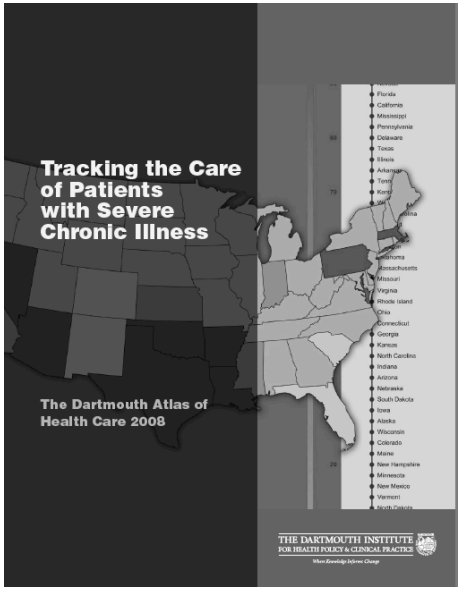
Authors	Chapter
Andresen and Mooney	Medical practice variation: Where are we?
McPherson	Why do variations occur?
Roos, et al	Variations in outcomes research
Mulley	Medical decision making and practice variation
Bevan	Equity and variability in modern health care
McGuire	Measuring performance in the health care sector: The whys and hows
Evans	The dog in the night-time: Medical practice variations and health policy
Vestergaard	Variations from a lay perspective
Wennberg	On the the need for outcomes research and the prospects for the evaluative clinical sciences
Lomas	Promoting clinical policy change: Using the art to promote the science in medicine
Mooney and Andersen	Challenges facing modern health care

Andersen TF, Mooney G. Eds. The Challenges of Medical Practice Variation. London: MacMillan Press; 1990.

Why do small area analysis?

- Reveals variation in medical resources, utilization, and outcomes.
- Often offers specific information about the performance of a health care system:
  Hospital, clinic, integrated delivery system, primary care trust
- Offers generalizable information:
  - Causes, consequences, and remedies of variation





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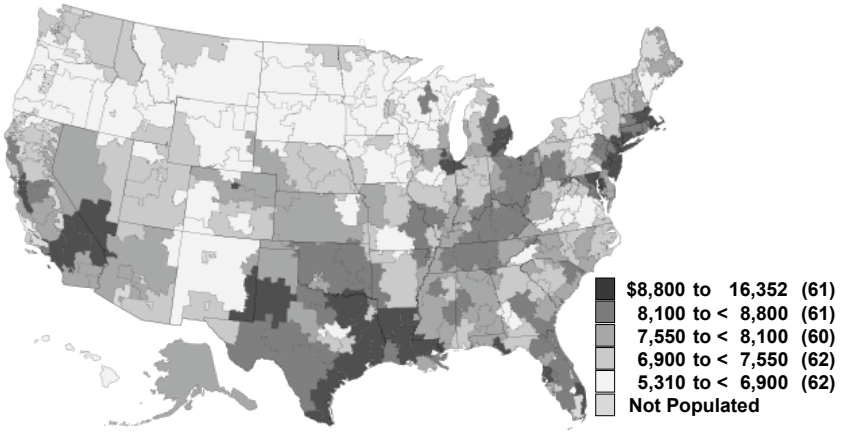
John Wennberg, MD MPH
Elliott Fisher, MD MPH
David Goodman, MD MS
Jonathan Skinner, PhD

Variation in Per-Capita Medicare Spending Across Hospital Referral Regions (N=306) (2006)



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Theories and concepts:

Unwarranted variation is variation that cannot be explained by:

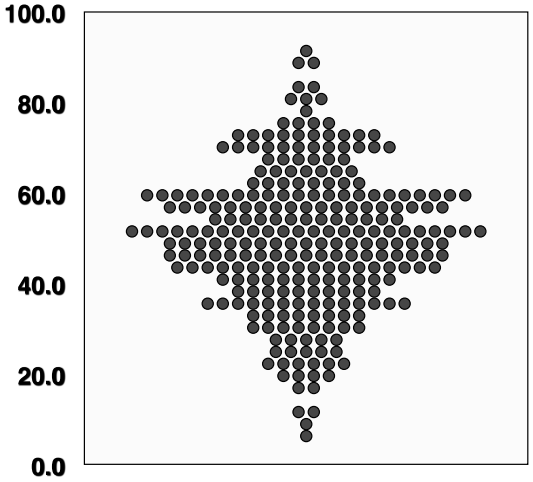
- Patient illness
- Dictates of evidence-based medicine
- Patient preference

Wennberg JE. Practice variations and health care reform: connecting the dots. Health affairs (Project Hope) 2004;Suppl Web Exclusives:VAR140-4.

Theories and concepts:

- Types of “unwarranted variation”
  - Effective care
  - Preference-based care
  - Supply sensitive care

Systematic Underuse of Effective Care across 306 Hospital Referral Regions



Percent of “Ideal” Patients Receiving Beta Blockers at Discharge Following AMI (1994-95)

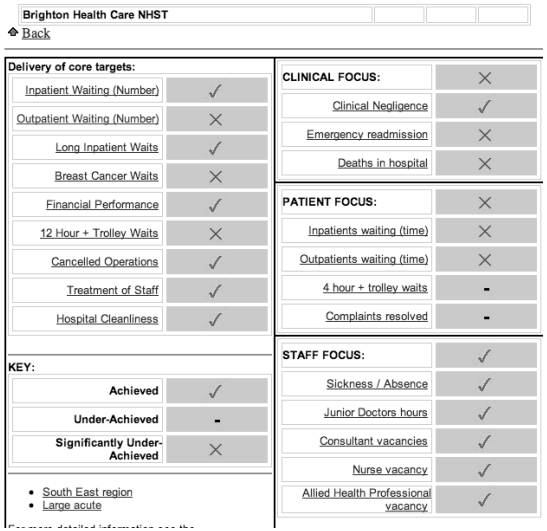
Shift Toward Provider Specific Analyses of Effective Care NYC Acute Myocardial Infarction Care

	ACE Inhibitors	PCI < 90 minutes	Smoking cessation
Beth Israel Medical Center	98%	69%	97%
Montefiore Medical Center	82%	83%	100%
Mount Sinai Hospital	97%	88%	99%
New York-Presbyterian	87%	64%	95%
NYU Medical Center	83%	75%	85%
U.S. Average	**90%**	**73%**	**94%**

Source: U.S. Government CMS, Hospital Compare web site, 10/06 - 9/07

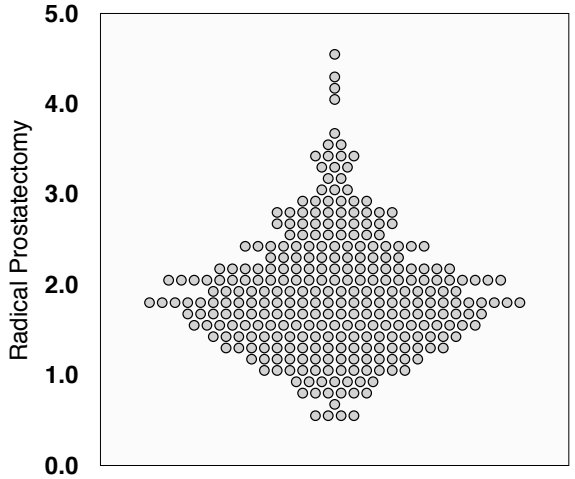
English NHS – Star Ratings 2001

No Stars for Brighton

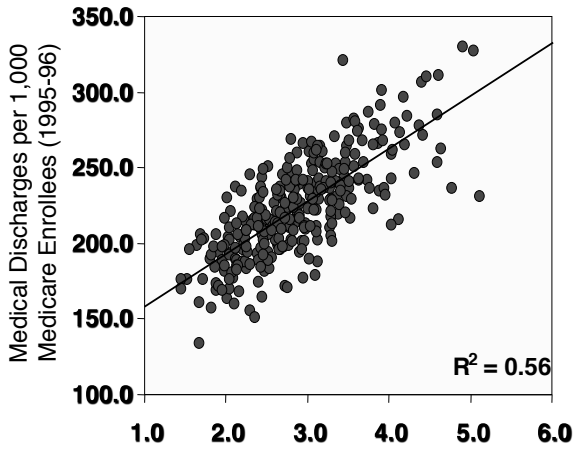


English NHS Performance Ratings: http://www.performance.doh.gov.uk/performanceratings/index.htm

Radical Prostatectomy per 1,000 Male Medicare Enrollees (1995-96) – Preference Sensitive Care



Hospital Beds (1996) vs. Adjusted Discharge Rates for Medical Conditions (1995-96) – Supply Sensitive Care



Fisher – Is More Better? 2003

Annals of Internal Medicine | ARTICLE

The Implications of Regional Variations in Medicare Spending. Part 1: The Content, Quality, and Accessibility of Care

Elliott S. Fisher, MD, MPH; David E. Wennberg, MD, MPH; Thérèse A. Stukel, PhD; Daniel J. Gottlieb, MS; F.L. Lucas, PhD; and Etoile L. Pinder, MS

Background: The health implications of regional differences in Medicare spending are unknown.

Objective: To determine whether regions with higher Medicare spending provide better care.

Design: Cohort study.

Results: Average baseline health status of cohort members was similar across regions of differing spending levels, but patients in higher-spending regions received approximately 60% more care. The increased utilization was explained by more frequent physician visits, especially in the inpatient setting (rate ratios in the highest vs. the lowest quintile of hospital referral regions were 2.13 [95% CI, 2.12 to 2.14] for inpatient visits and 2.36 [CI, 2.33

ARTICLE

The Implications of Regional Variations in Medicare Spending. Part 2: Health Outcomes and Satisfaction with Care

Elliott S. Fisher, MD, MPH; David E. Wennberg, MD, MPH; Thérèse A. Stukel, PhD; Daniel J. Gottlieb, MS; F.L. Lucas, PhD; and Etoile L. Pinder, MS

Background: The health implications of regional differences in Medicare spending are unknown.

Objective: To determine whether regions with higher Medicare spending achieve better survival, functional status, or satisfaction with care.

Design: Cohort study.

horts), change in functional status (MCBS cohort), and satisfaction (MCBS cohort).

Results: Cohort members were similar in baseline health status, but those in regions with higher end-of-life spending received 60% more care. Each 10% increase in regional end-of-life spending was associated with the following relative risks for death: hip fracture cohort, 1.003 (95% CI, 0.999 to 1.006); colorectal cancer

Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. The implications of regional variations in Medicare spending. Part 1: the content, quality, and accessibility of care. Annals of internal medicine 2003;138:273-87.

Theories and concepts:

"Ambulatory care sensitive hospital admissions"

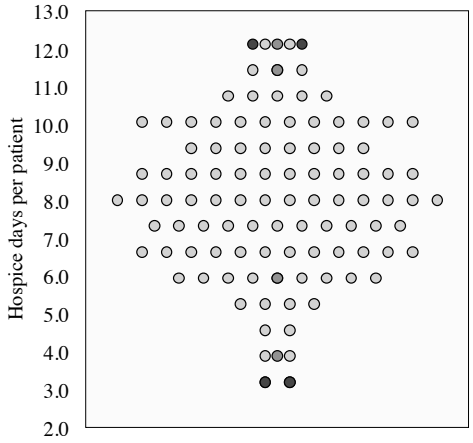
"Preventable hospitalizations"

An important source of variation in hospital use can be attributable to poor access to timely and appropriate care.

Billings, J., Anderson, G. & Newman, L. 1996. ***Recent Findings on Preventable Hospitalizations. Health Affairs (Fall): 239-249.***

Hospice days in last month of life for patients with poor prognosis cancer

NCI Cancer Centers and Academic Medical Centers (non-NCI)



University Med Ctr-Lubbock	12.5
Univ of Iowa Hosp & Clinics	12.4
MUSC Medical Center	12.0
University of Alabama Hospital	11.5
City of Hope National Med Ctr	6.0
New York-Presbyterian Hospital	3.7
Montefiore Medical Center	3.0
Westchester Medical Center	2.9

Green dots = highest & lowest NCI cancer centers
Red dots = highest & lowest academic medical centers

Goodman, et al. Unpublished data from the Dartmouth Atlas of Health Care project.

Criticism Directed Toward Dartmouth Researchers 2010

June 2, 2010

Critics Question Study Cited in Health Debate

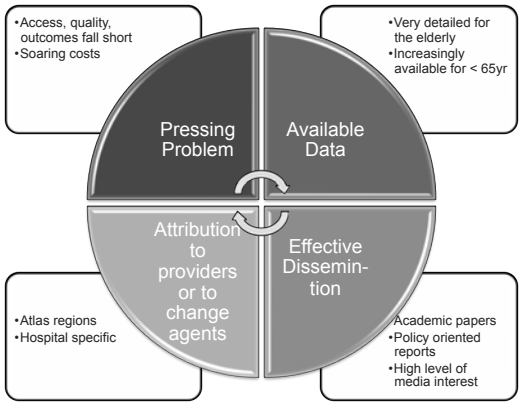
By REED ABELSON and GARDINER HARRIS

In selling the health care overhaul to Congress, the Obama administration cited a once obscure research group at Dartmouth College to claim that it could not only cut billions in wasteful health care spending but make people healthier by doing so.

Wasteful spending — perhaps $700 billion a year — "does nothing to improve patient health but subjects you and me to tests and procedures that aren't necessary and are potentially harmful," the president's budget director, Peter Orszag, wrote in a blog post characteristic of the administration's argument.

New York Times June 2, 2010.

United States 2010



Risk Adjustment	Theory/Conceptual framework
Timeliness	Professional and Policy Engagement with Remedies

Multi-Dimensional Performance of Pisa District within Tuscany Region

Paul-Shaheen P, Clark J, Williams D. Small Area Analysis: A Review and Analysis of the North American Literature. J Health Politics, Policy, Law 1987;12:741-809.

Swart – Using Claims Data for Small Area Analysis and Controlling of Hospital Care

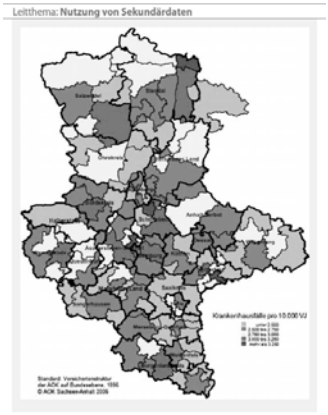


Abb. 1 a Altersstandardisierte Krankenhaushäufigkeit nach 4-stelligen Postleitzahlbereichen bei Versicherten der AOK Sachsen-Anhalt, 2006. (Streuung der Werte zwischen den 96 PLZ-Bereichen von 2080 bis 3832; 10 %-Perzentil: 2275; Median: 2626; 90 %-Perzentil: 3033)

Using claims data for small area analysis and controlling of hospital care

Abstract

In Germany, only few data sources enable a small-area analysis of medical care. However, this is necessary for empirically based planning of future medical care. Here claims data of the statutory health insurance provide new insights into medical care by utilization analysis at district and postal zip code levels. Examples of small-area analysis of hospital care show manifold possibilities of using these data for purposes of health services research and planning. The most important result of these analyses is the considerable variation of hospital care utilization which is constant over time and regions. Claims data are updated regularly, complete, unbiased, and of high quality. They also have a clear reference to population and region. Limitations of using claims data arise from the absence of clinical information. For purposes of hospital planning the restriction to the hospital sector is more important. In the future this limitation will be overcome by using claims data from primary and hospital care together.

Keywords

Claims data · hospital care · hospital planning · small area analysis

Swart E, Deh U, Robra BP. [Using claims data for small area analysis and controlling of hospital care]. Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz 2008;51:1183-92.

Busato's Studies of Swiss Health Care

BMC Health Services Research

BioMed Central

Research article

Open Access

Primary care physician supply and other key determinants of health care utilisation: the case of Switzerland

André Busato*[1] and Beat Künzi[2]

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Email: André Busato* - andre.busato@memcenter.unibe.ch; Beat Künzi - beat.kuenzi@swisspep.ch

* Corresponding author

Published: 11 January 2008

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Received: 16 January 2007

Accepted: 11 January 2008

This article is available from: http://www.biomedcentral.com/1472-6963/8/8

Abstract

Background: The Swiss government decided to freeze new accreditations for physicians in private practice in Switzerland based on the assumption that demand-induced health care spending may be cut by limiting care offers. This legislation initiated an ongoing controversial public debate in Switzerland. The aim of this study is therefore the determination of socio-demographic and health system-related factors of per capita consultation rates with primary care physicians in the multicultural population of Switzerland.

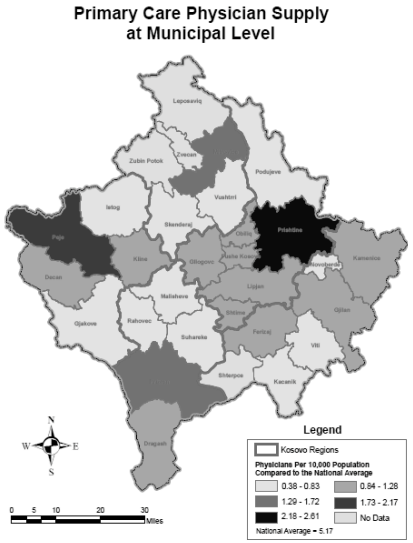
Methods: The data were derived from the complete claims data of Swiss health insurers for 2004

Busato A, Kunzi B. Primary care physician supply and other key determinants of health care utilisation: the case of Switzerland. BMC health services research 2008;8:8.

Kosovo:

Primary care per capita – regional to national ratios

Dr. Ilir Hoxha, Fulbright Scholar in residence at Dartmouth



Unpublished data

THE DARTMOUTH INSTITUTE FOR HEALTH POLICY & CLINICAL PRACTICE

Where Knowledge Informs Change

Challenges in Studies of Unwarranted Variation

- Occasionally, a lack of clarity of purpose
- Limited availability of data
- Difficulty in adjustment for population differences
- Imprecise attribution of measures to providers
- Resistance to findings – results threatens providers, angers policy makers
- Difficult in funding

management esanità
Laboratorio di ricerca e formazione per il Management dei Servizi alla Salute

Managing variation in diagnostic medical imaging to improve appropriateness and financial re-allocation

Research Team:

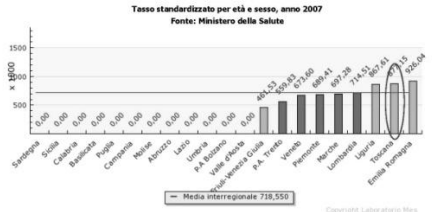
For MeS Lab.:
Scientific responsible: Prof. Sabina Nuti
Researchers: Manuela Gussoni (Ph.D), Milena Vainieri (Ph.D).

For Tuscany region's LHAs:
Dr. Claudio Vignali, Dr. Di Feo, A. Pucci A. Catassi, A. Guelfi, S. Borelli, M.Petrillo, M. Profeti, M. Arzilli, S. Vitelli, F. Bilanci, A. Militello, S. Tamburini, E. Lo Presti, C. Benvenuto, A. Salomoni, F. Taiti, R. Baronti, R. Prucher

London, 14 September 2010

Research background:

Tuscany is one of the Italian Regions with the highest Diagnostic Imaging Use-rates

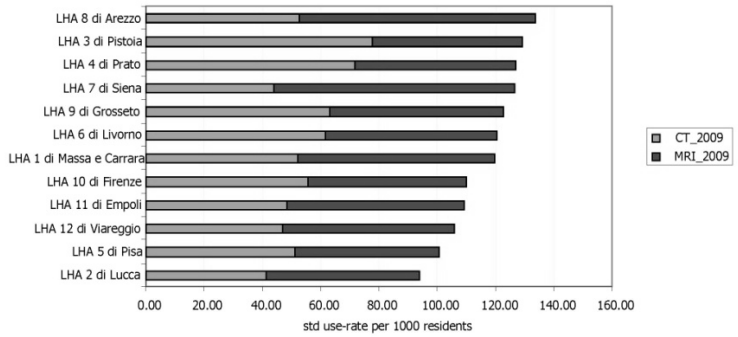


Is it a problem of inappropriateness?

Moreover, Tuscany is not able to grant waiting times within 60 days.

What is the relationship between waiting times and volumes?

Tuscany region's standardized use-rates of CT+MRI by LHA. year 2009

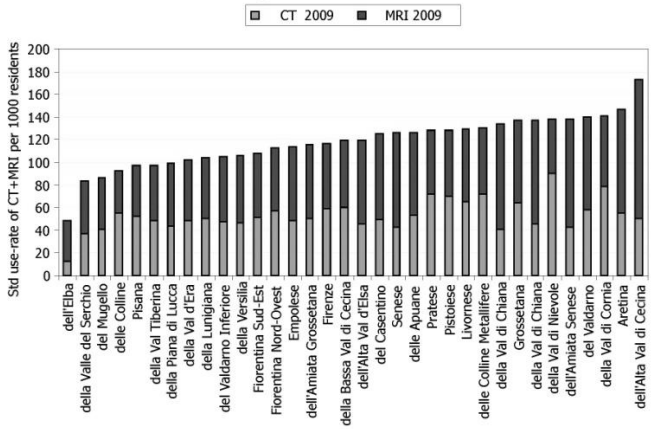


High variability both in the volumes and compositions.

In order to better understand the problem…

The analysis has been developed at the district level since, in Tuscany, districts are in charged of managing the demand of services.

Tuscany region's standardized use-rates of CT+MRI by district. year 2009



Variations are higher at the districts' than at the LHAs' level.

Research questions:

What causes variability? Does it depend on the presence of private providers?

Is there a substitution effect between CT and MRI?

Is it a problem of case mix?

What is the economic value of this potential inappropriateness?

Who is responsible for this potential inappropriateness?

How inappropriateness can be reduced awarding best practice?

How to increase efficiency and reduce waiting times?

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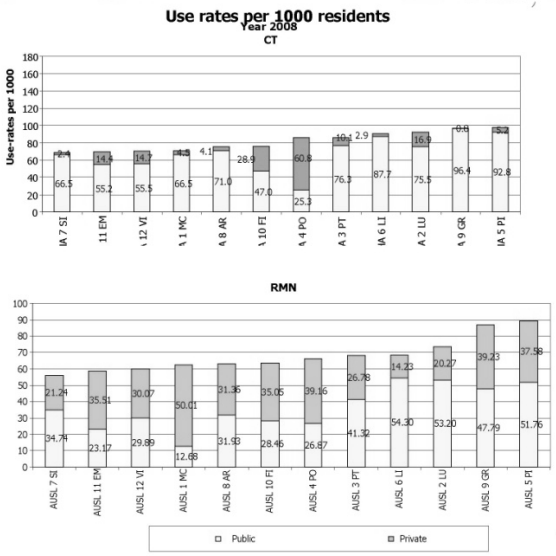
The impact of private providers on variability (2008)

The presence of private providers does not seem to increase volumes so it is not a determinant of variability



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Does variability depend on a substitution effect between MRI and CT.

Taking into account four couples of diagnostic procedures that may be subject to a substitution effect, we report the following correlation matrix.

Couples	Repleaceable procedures	CT facial massive	MRI facial massive	MRI vertebral column	CT rachis	CT head	MRI brain	CT sup abdomen	MRI sup abdomen
1	CT facial massive	1							
1	MRI facial massive	**-0.1784**	1						
2	MRI vertebral column	-0.1063	0.6921*	1					
2	CT rachis	0.1339	-0.1064	**-0.2496**	1				
3	CT head	0.4401*	-0.132	-0.1795	0.3667*	1			
3	MRI brain	-0.0514	0.2291	0.2141	0.1529	**0.1444**	1		
4	CT sup abdomen	0.4352*	0.1149	0.3027	0.1577	0.2044	0.0392	1	
4	MRI sup abdomen	-0.1751	0.5653*	0.7171*	0.0857	-0.2106	-0.0658	**0.3059**	1

Notes: * significance at the 5% level

For each couple, results show that MRI and CT are not significantly repleaceable confirming the hypothesis suggested by the specialists composing the research team.

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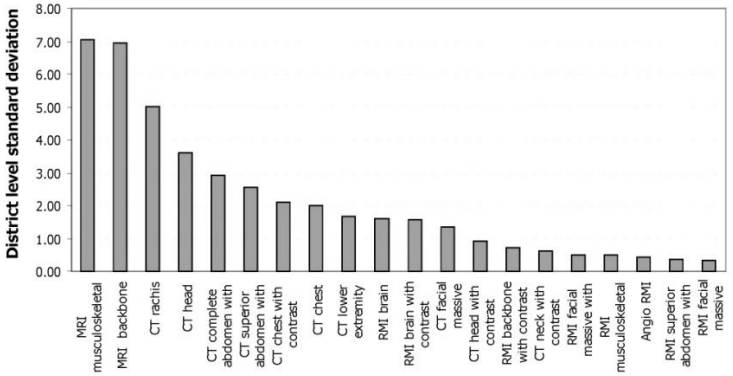
We identify the 20 most frequent MRI and CT typologies of analysis in Tuscany for the year 2009 and compute their variability in use rates.

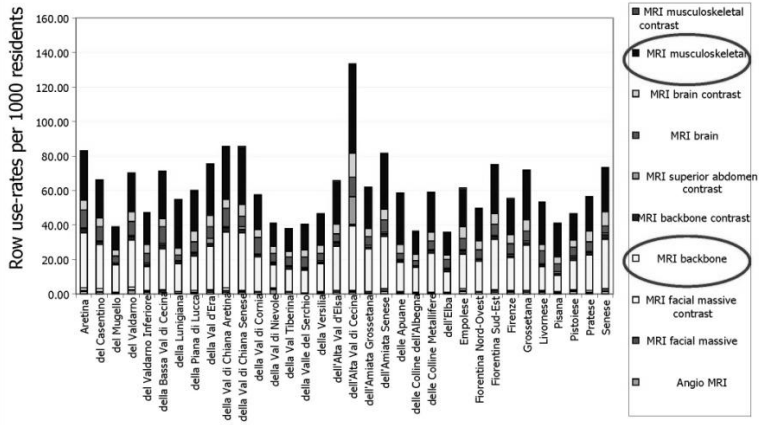
Examination type	Across-LHAs High_low ratios 2009	Across districts High_low ratios 2009	Across-LHAs standard deviations 2009	Across districts standard deviations 2009
MRI musculoskeletal	1.89	4.41	3.22	7.07
MRI backbone	1.75	5.60	3.56	6.95
CT rachis	4.27	8.38	4.58	5.02
CT head	3.42	34.51	2.96	3.60
CT complete abdomen with contrast	2.49	6.67	2.19	2.92
CT superior abdomen with contrast	9.67	17.23	1.72	2.55
CT chest with contrast	1.76	6.23	1.48	2.10
CT chest	2.32	22.63	1.18	2.01
CT lower extremity	4.93	9.02	1.06	1.67
RMI brain	2.14	3.40	1.19	1.60
RMI brain with contrast	2.24	4.51	1.01	1.56
CT facial massive	2.91	18.43	0.81	1.35
CT head with contrast	4.02	9.22	0.81	0.91
RMI backbone with contrast	2.79	6.03	0.47	0.72
CT neck with contrast	3.34	13.20	0.57	0.63
RMI facial massive with contrast	4.18	11.31	0.29	0.49
RMI musculoskeletal with contrast	3.27	24.15	0.21	0.48
Angio RMI	5.65	10.34	0.35	0.43
RMI superior abdomen with contrast	3.18	7.18	0.23	0.36
RMI facial massive	2.90	24.94	0.23	0.34

Notes: These 20 typologies of analysis constitute 87% of the total CT and 94% of the total MRI supplied to residents in 2009

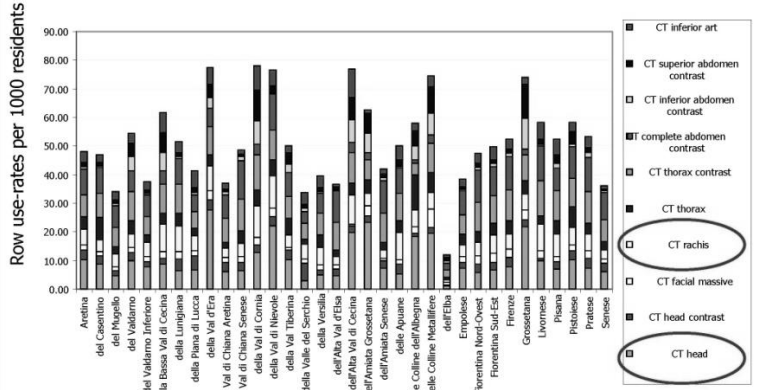
District level standard deviation by typology of analysis (2009)



Composition of the 10 most frequent MRI analyses by district (2009)



Composition of the 10 most frequent CT analyses by district (2009)



What should we focus on to explain potential inappropriateness?

- **The geographical factor**
- **The case mix**

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The cost of inappropriateness (1)

What is the value of the services delivered by each district over the regional median use-rate?

The financial value of this gap has been estimated using the regional examination fares (regional low 1178/2005)

The cost of inappropriateness (2)

District	Districts' leeway
Firenze	€ 1,152,279.62
Pratese	€ 956,636.10
Livornese	€ 857,205.68
Aretina	€ 762,053.79
della Val di Nievole	€ 760,623.10
Pistoiese	€ 627,388.57
Grossetana	€ 531,634.39
della Val di Chiana Senese	€ 498,314.36
Senese	€ 457,601.33
delle Apuane	€ 445,140.72
Fiorentina Sud-Est	€ 432,933.37
Fiorentina Nord-Ovest	€ 426,311.15
del Valdarno	€ 400,703.83
della Piana di Lucca	€ 394,373.17
dell'Alta Val di Cecina	€ 393,386.06
della Val di Cornia	€ 369,558.39
della Bassa Val di Cecina	€ 363,548.47
della Val di Chiana Aretina	€ 303,189.70
Empolese	€ 303,178.43
della Val d'Era	€ 284,460.78
Pisana	€ 214,512.08
delle Colline Metallifere	€ 180,203.59
dell'Alta Val d'Elsa	€ 176,939.27
del Casentino	€ 148,557.21
dell'Amiata Senese	€ 107,718.77
della Versilia	€ 105,501.51
della Lunigiana	€ 89,603.44
delle Colline dell'Albegna	€ 89,208.43
del Valdarno Inferiore	€ 80,128.44
dell'Amiata Grossetana	€ 60,636.10
della Val Tiberina	€ 38,499.17
della Valle del Serchio	€ 34,430.62
del Mugello	€ 786.95
TOTAL	€ 12,047,246.59

Examination type	Leeway by examination type
MRI backbone	€ 1,667,171.81
CT rachis	€ 1,626,567.96
RMI musculoskeletal	€ 1,478,680.68
CT complete abdomen with contrast	€ 1,156,931.12
CT head	€ 859,425.02
CT superior abdomen with contrast	€ 801,062.16
CT chest with contrast	€ 712,608.52
RMI brain with contrast	€ 616,104.05
RMI brain	€ 534,384.00
CT lower extremity	€ 317,876.39
RMI backbone with contrast	€ 306,785.63
CT chest	€ 295,498.37
CT neck with contrast	€ 294,356.49
CT facial massive	€ 268,732.87
RMI facial massive with contrast	€ 233,975.56
CT head with contrast	€ 232,926.14
RMI superior abdomen with contrast	€ 189,079.64
RMI musculoskeletal with contrast	€ 188,078.43
Angio RMI	€ 159,615.45
RMI facial massive	€ 107,386.30
TOTAL	€ 12,047,246.59

The value of such a leeway, for the year 2009, is **12,047,246.59 Euro**

This method allows each district to identify the mix of the most problematic examinations and the resource value that could be saved through policies aimed to reduce inappropriateness.

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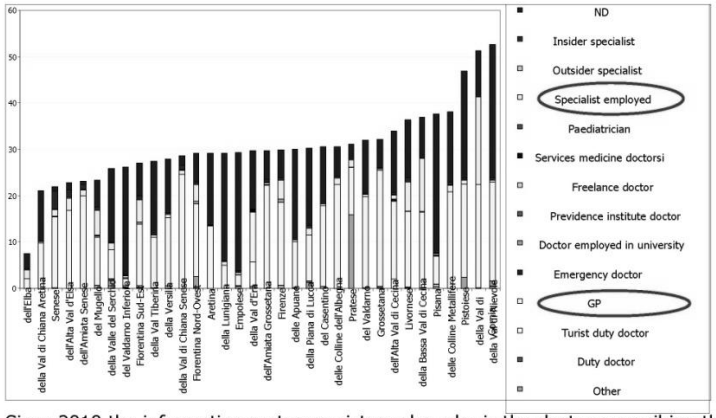
Typologies of doctors who prescript CT scans by district.

First 6 months 2010 on 2009 population



Since 2010 the information system registers also who is the doctor prescribing the exams. The data flow is not yet complete, however it is already able to point out some evidence.

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The use of data to manage performance.

Some concluding remarks…

In Tuscany the results of this paper will be shared in a number of **focus groups** composed by physicians, general practitioners, specialists, radiologists and LHAs' top managers leading to:

1) Sharing the evidence regarding where potential overuse occurs and which performance-driven strategies could be adopted;

2) Identifying and awarding best practice useful to build achievable targets.

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Future steps: increasing efficiency in diagnostic imaging sevice supply

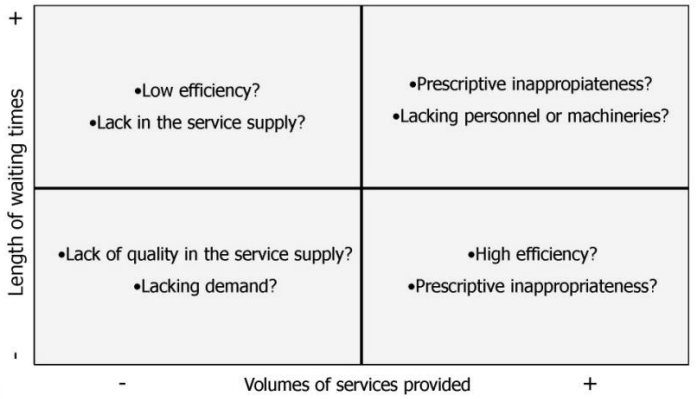
Currently we are collecting data on the number of diagnostic imaging machines and radiologists by LHA. This will allow to compute two measures of productivity:

1) productivity of machines (CT and MRI)

2) productivity of personnel

Benchmarking will allow to identify problematic areas and to operate in order to reduce **waiting times**.

A model to analyse the relationship between volumes and waiting times: Four possible scenarios ...



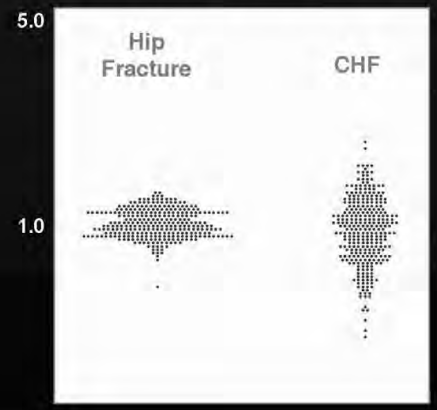
Thank you!

Causal Inference in Health Policy Research Studies

Thérèse A. Stukel
Senior Scientist and VP, Research
Institute for Clinical Evaluative Sciences

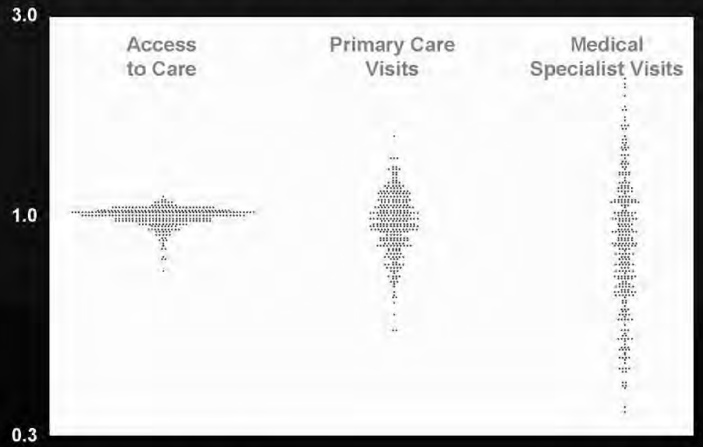
Wennberg International Collaborative
London School of Economics
September 2010

Variation in Hospitalization for Common Conditions



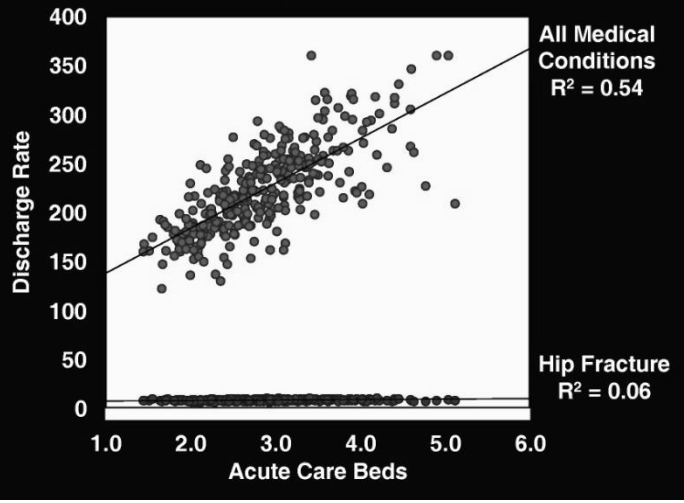
Enhancing the effectiveness of health care for Ontarians through research
ICES Institute for Clinical Evaluative Sciences

Variation in Use of Physician Services

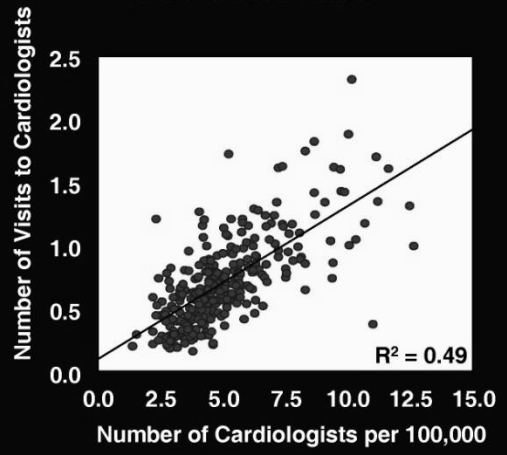


Enhancing the effectiveness of health care for Ontarians through research
ICES Institute for Clinical Evaluative Sciences

Relationship Between Capacity and Hospitalization Rates



Relationship Between Physician Supply and Visit Rates



Population Outcomes Differ But Does X Really Cause Y?

- Are healthcare expenditures lower in HMOs (managed health care plans) than FFS (fee-for-service) for enrollees?
- Do U.S. regions that spend more on healthcare have better outcomes?
- Does cardiac catheterization followed by revascularization reduce AMI mortality? More than by use of evidence-based medications?

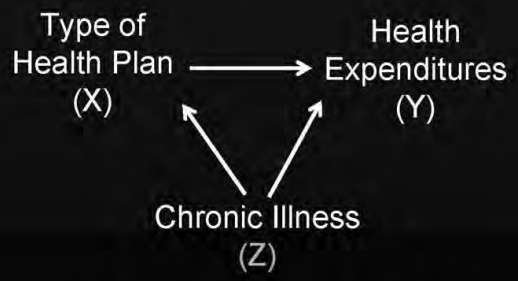
Observational Studies

- Patients receiving treatment (e.g., surgery) may differ from untreated patients in prognostic variables that affect outcome.
- Differences in outcomes are due to both effects of treatment and effects of patient prognosis
- Prognostic variables may be measured or unmeasured.
- Patients may not survive long enough to receive treatment

Randomized Controlled Trials (RCTs) vs. Observational Studies

- RCTs: "gold standard"
- Observational studies – causal inference issues:
  - Selection bias (surgeons choose healthier patients)
  - Unmeasured confounding (severity and type of AMI unknown)
  - Survival bias (patients die before surgery)
- Alternatives to randomization: instrumental variable (IV) analysis

Confounding: Omitted Variable Bias



Z is related to both X and Y

Confounding: Omitted Variable Bias

- HMOs attract healthier patients.
- Healthier patients use the health system less.

➔ Healthcare expenditures are lower in HMO health plans.

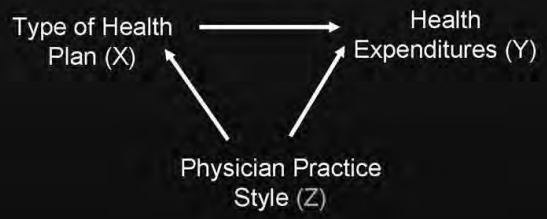
➔ Ignoring Z gives spurious correlation between type of health plan and expenditures (due to lower prevalence of chronic disease in HMOs).

Confounding: Omitted Variable Bias

Chronic Disease (Z)	HMO	FFS	Δ
Yes	$10,000 (10%)	$10,500 (25%)	$500 (unbiased)
No	$2,500 (90%)	$3,000 (75%)	$500 (unbiased)
	$3,250	$4,875	$1,625 (biased)

- If Z **observed**, we can "control" for the effects of chronic disease.
- If Z **unobserved** ➔ biased estimate of health plan expenditures.

Confounding: More Adjustment Is Not Always Warranted



Z is not a confounder since this is how HMOs reduce expenditures

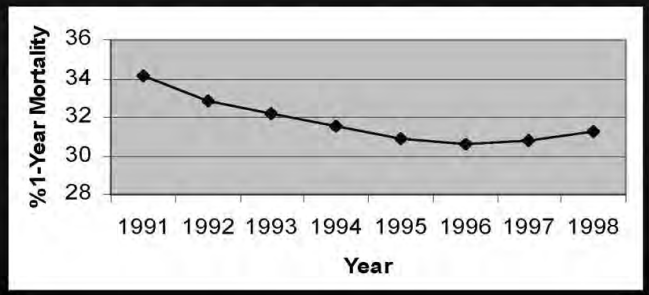
➔ One should not control for Z

Analytic Approaches to Remove Confounding

- Collect additional data.
- Traditional modeling to "control" for confounders.
- Refine definition of exposure ("treatment").
- Instrumental variable (IV) approach.
- Technical quality measures: no adjustment needed?

Modeling to Remove Confounding

One-Year Mortality for AMI Medicare Admissions*



Is one-year AMI mortality increasing?

* Ash et al. *HSR* (2003)

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Modeling Approaches: Case-Mix Adjustment

Models to predict 1-year mortality following AMI hospitalization:

- using Medicare administrative data.
- adjusting for case-mix.
- basing on rich comorbidity profiles.
- using existing profiling systems that summarize diagnoses 1 year prior to and during index AMI admission.

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Modeling Approaches: Case-Mix Adjustment

- Charlson Comorbidity Classifications

  17 categories of disorders and diseases, entered into the model directly.

- DCG Clinical Classification*

  → ICD-9 diagnosis codes → Dx Groups → DCG/HCC Clinical Classifications (N = 118 disease groups).

* Ash et al. *HCFR* (2000)

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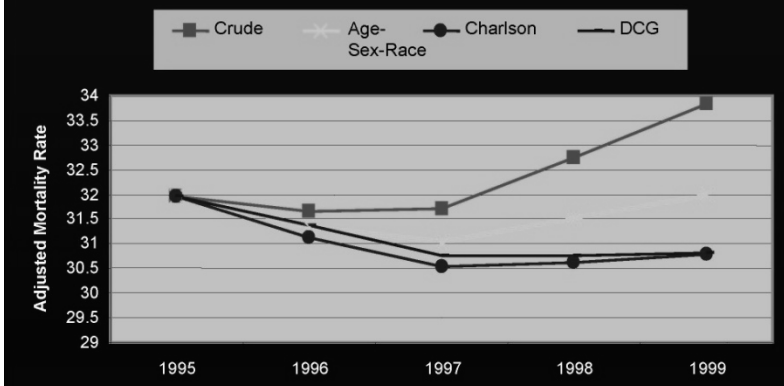
Modeling: Crude and Adjusted AMI Mortality Trends



Technical Quality of Care Measures

Examples

- Annual eye exams (diabetes)
- Metformin (diabetes)
- Statins, beta-blockers, ACE-I (AMI)
- Psychiatry consult within 30 days of hospital discharge (schizophrenia)

No risk adjustment needed since all eligible patients, regardless of age, sex, risk factors, should have these therapies

Refining the Exposure Definition

Does Increased Healthcare Spending Improve Outcomes?

Do U.S. regions that spend more on healthcare have better outcomes?

Regional spending ←→ Health outcomes

- Reverse Causality. If regions that spend more on healthcare have sicker patients, then perhaps illness rates are driving the spending, not the reverse.

*Fisher et al. (2002) *Ann Intern Med.*

Does Healthcare Spending Improve Outcomes?

Cohorts of incident AMI, colon cancer, hip fracture, similarly ill at baseline, followed up to 7 years.

L6M Regional Spending Intensity (exposure):

- L6M patients are similarly ill across regions, at least in one respect.
- "Pure" measure of intensity (exogenous).
- Controls for differences due to price or policy payments.

Refining the Exposure Definition
Does Increased Healthcare Spending Improve Outcomes?

- Exposure is regional medical intensity in order to study system-level effects.
- Intensity is defined as amount of care given to patients who are similarly ill.
- Measured as total hospital and physician spending in L6M measured at regional level using Medicare administrative data.
- Exposure is ecological, but this is not an ecological study.

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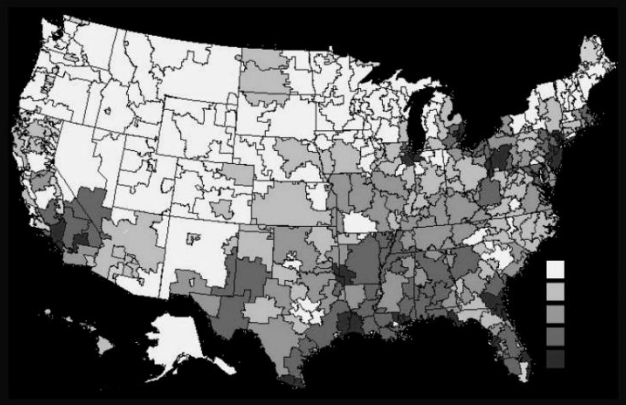
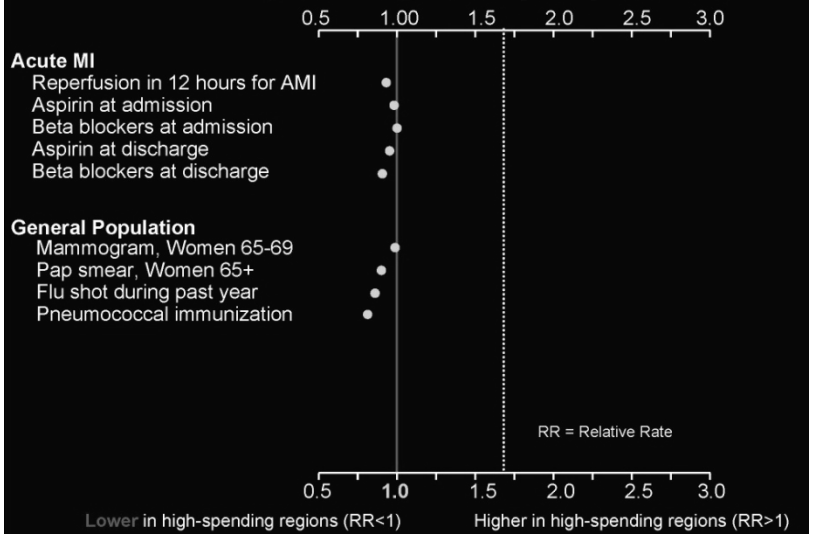
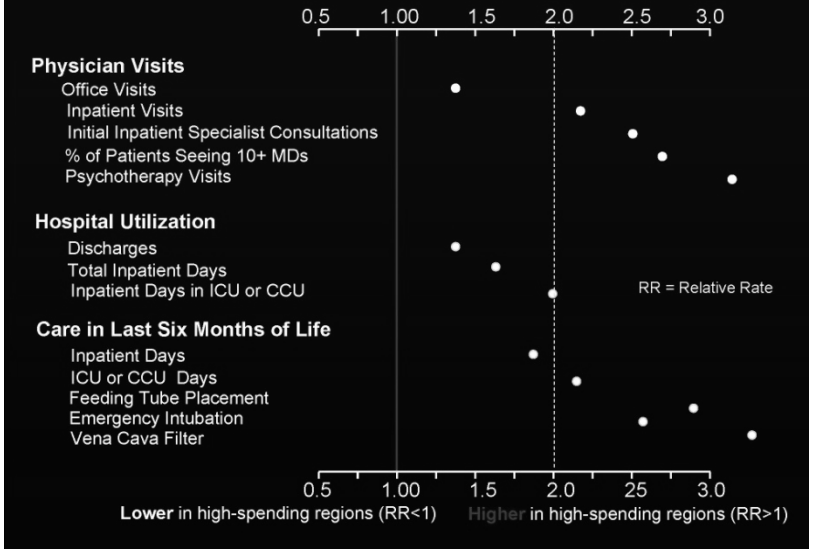
Regional Variations in L6M Spending Intensity



Rates of evidence-based care were lower or similar in high-spending regions (RR<1)



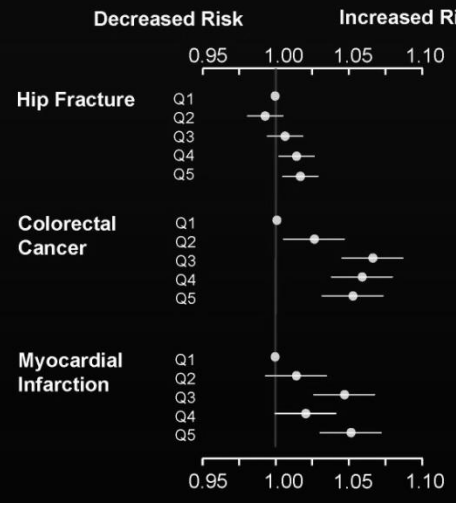
Rates of utilization were higher in high spending regions (RR>1)



Baseline Characteristics of AMI Cohort, by Receipt of CATH

	Overall Cohort		
	CATH within 30 Days		Standardized
	No	Yes	Difference (%)
Cohort Members, N	48,886	73,238	
Predicted 1-Year Mortality (%)	32.3	20.9	73.7
Demographic Characteristics (%)			
• Age 65-74	40.2	64.4	49.9
• Male	49.7	58.4	17.6
• Black	7.5	4.8	11.3
Clinical Presentation (%)			
• Non-ST segment elevation AMI	41.8	38.9	5.9
• Hypotension	3.5	2.3	7.4
Comorbidities (%)			
• Chronic obstructive pulmonary disease	24.9	17.6	18.3
• Congestive heart failure	27.2	10.4	45.7
• Previous myocardial infarction	32.9	26.4	14.3
• History of angina	44.1	49.9	11.8
Hospital Characteristics (%)			
• Annual AMI volume > 200	20.1	30.4	23.6
Mortality (%)			
• Died within 4 years of admission (Kaplan Meier)	62.0	27.8	

Mortality rates were higher in high-spending regions



Does Intensive Management of AMI Patients Improve Mortality?

Does cardiac catheterization (CATH) reduce AMI mortality?

- Patients receiving CATH are healthier in unmeasured ways (selection bias), i.e., important risk factors are not measured.
- Sicker patients do not live long enough to receive CATH (survival bias).
- Patients receiving CATH receive more related therapies (cardiac revascularization).

* Stukel, *JAMA* (2007)

Baseline Characteristics of Matched AMI Cohort, by Receipt of CATH

	Matched Cohort		
	CATH within 30 Days		Standardized
	No	Yes	Difference (%)
Cohort Members, N	31,193	31,193	
Predicted 1-Year Mortality (%)	26.8	27.8	**6.3**
Demographic Characteristics (%)			
• Age 65-74	45.2	45.3	0.1
• Male	53.2	49.6	7.2
• Black	5.7	6.6	3.7
Clinical Presentation (%)			
• Non-ST segment elevation AMI	39.8	40.1	0.8
• Hypotension	3.1	3.6	2.6
Comorbidities (%)			
• Chronic obstructive pulmonary disease	20.9	23.3	5.9
• Conjestive heart failure	16.6	18.3	4.4
• Previous myocardial infarction	28.7	31.9	6.8
• History of angina	46.0	45.6	0.9
Hospital Characteristics (%)			
• Annual AMI volume > 200	22.9	20.5	5.6
Mortality (%)			
• Died within 4 years of admission (Kaplan Meier)	55.4	36.3	

Adjusted Relative Mortality Rate Associated with CATH (Traditional Survival Models)

Risk Adjustment Method	Adjusted Relative Mortality Rate	95% CI
Unadjusted Survival Model	0.364	0.358, 0.370
Risk-Adjusted Survival Model	0.510	0.502, 0.519
Survival Models Using Simple Propensity Score Model		
• Propensity deciles alone	0.538	0.529, 0.547
• Propensity deciles + all covariates	0.520	0.511, 0.529
Survival Models Using Complex Propensity Score Model		
• Propensity deciles alone	0.540	0.531, 0.549
• Propensity deciles + all covariates	0.522	0.513, 0.531
Survival Models Using Propensity-Matched Cohort		
• Match within ±0.05 of propensity score	0.538	0.518, 0.558
• Match within ±0.10 of propensity score	0.528	0.514, 0.542
• Match within ±0.15 of propensity score	0.511	0.499, 0.523

Instrumental Variable (IV) Analysis to Remove Unmeasured Confounding

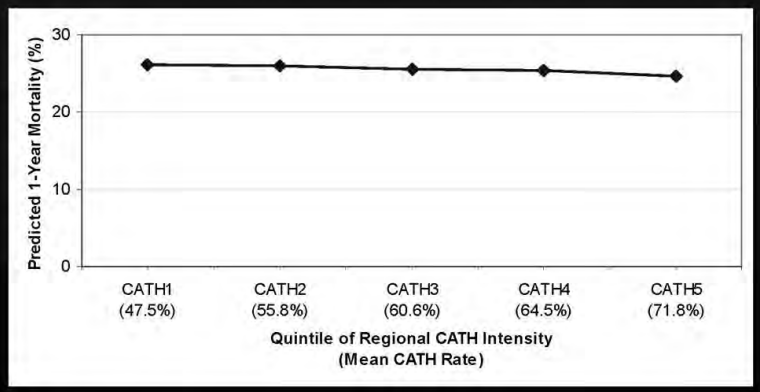
- IV is related to treatment.
- IV is not independently associated with outcome (unrelated to illness).
- IV ➔ geography (region, regional intensity) or time period.
- IV behaves like a "natural randomization" of patients to varying treatment intensities, rather than 0% and 100% as in randomization.
- IV estimates are uncontaminated by hidden bias.
- Interpretation: effect on the marginal patient.

Simple IV Example

	CATH Rate (%)	One-Year Mortality (%)	Mortality Difference (%)
Ordinary Least Squares (OLS)			
Patient Received CATH			
• No	0.0	47.5	
• Yes	100.0	15.3	-32.2
Instrumental Variables (IV)*			
Area-Level CATH Rate			
• < Median	49.7	29.5	
• > Median	62.4	27.8	-13.4

IV estimator ➔ β *(IV)* = ΔP(Mortality) / ΔP(CATH) x 100%

Is Observed Mean AMI Severity Similar across IVs? Yes
Is Unobserved Illness Severity Related to IV? Never Sure



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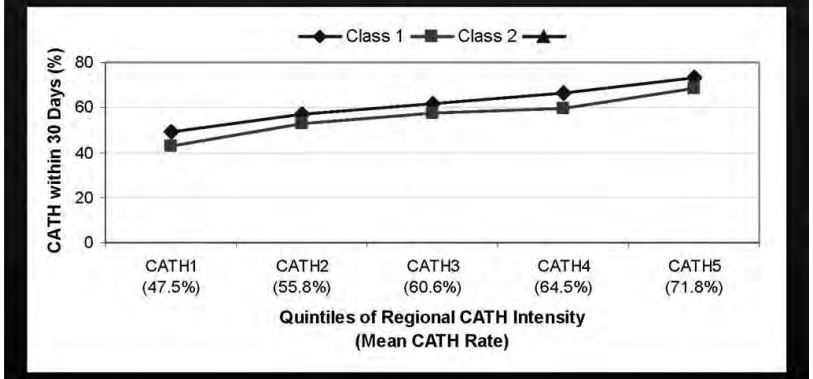
Is IV Related to Exposure? Yes
Exposure = % in region receiving CATH within 30 Days



Absolute and Relative Adjusted Mortality Rates Associated with CATH Using IV Analysis

Risk Adjustment Method	Absolute Mortality Difference ±SE (%)	Adjusted Relative Mortality Rate (95% CI)
1-Year Mortality		
• Unadjusted	-0.244 ± 0.002	0.37 (0.35, 0.38)
• Linear regression, adjusted	-0.162 ± 0.002	0.58 (0.57, 0.59)
• IV, adjusted	-0.054 ± 0.015	0.86 (0.78, 0.94)
4-Year Mortality		
• Unadjusted	-0.339 ± 0.003	0.45 (0.44, 0.46)
• Linear regression, adjusted	-0.207 ± 0.003	0.67 (0.66, 0.68)
• IV, adjusted	-0.097 ± 0.016	0.84 (0.79, 0.90)

Women's Health Initiative (WHI)
RCTs vs Observational Studies: Resolving the Discrepancy

- Postmenopausal HRTs decrease coronary heart disease (CHD) (observational studies) or increase CHD (RCT)
- Protective effect partially resolved by removing age/lifestyle confounding (RR, 0.71 → 0.87)
- CHD decreases with time since initiation of HRT: after 5+ years, RR = 0.66 (RCT) vs 0.83 (Obs.)

Prentice et al., *Am J Epidemiol* (2005)

Conclusions

- Some studies cannot be undertaken without a randomized clinical trial (RCT).
  - Women's Health Initiative on HRTs and CHD.
  - Effects of cardiac catheterization (CATH) on AMI survival.
- Observational studies
  - Can confounders be identified, measured and controlled for?
  - Think carefully about the nature of the confounding and find clever ways to remove it.

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Conclusions

Risk-adjustment via traditional modeling using health administrative data

- Use the richest, broadest set of clinical risk adjustors, collected over the longest time period appropriate to the study outcome.
- Model the covariates as finely as possible to preserve information.

Which Method? Which Question?

- Standard methods with patient-level exposures answer **clinical** questions,

  "What are the benefits of providing invasive therapy to my patient?"

- IV methods better suited to inform **policy** decisions,

  "What are the benefits of increasing regional cardiac cath lab supply?"

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Conclusions

- Reverse causation is the most difficult type of confounding to remove.
  - Call an econometrician (2SLS, 3SLS).
  - Refine the exposure definition.
- Instrumental Variables (IV)
  - Can you find a valid instrument?
  - Inference is to the "marginal" patient.
  - Inference includes bundled effects of correlates of IV.

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