The relationship between health policies, medical technology trend, and outcomes:

A perspective from the TECH Global Research Network

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Outline of Presentation

I. Background: Unresolved Issues in International Comparisons of Health and Health Care Systems

II. Importance of “Micro” International Comparisons

III. Technological Change in Health Care (TECH) Global Research Network: Preliminary Results

IV. TECH Research Network: Ongoing Research

Conclusions from Previous “Macro” Studies of Population Health and Health Care

Population health has improved: life expectancy increases are occurring at advanced ages; in many countries, increased life expectancy is not associated with increased time in impaired functional status

Medical expenditures have increased substantially

Contribution of medical treatment is not clear: behavior changes, improved socioeconomic status, public health interventions, and other factors may all account for health improvements

“Micro” Approach to Answer Unresolved “Macro” Questions

- Focus on a common, well-defined illness: acute myocardial infarction (AMI, or heart attack)
  - Common, serious condition that affects individuals in all developed countries
  - Similarly defined throughout the world
  - Substantial epidemiological literature; many previous comparative studies
  - Reliable data: most key treatments delivered in an inpatient setting
  - Significant technological innovations in treatment

Conclusions from Previous "Micro" Studies of Health Care Systems

- Availability of intensive procedures varies substantially (for example, Japan vs. US vs. UK)
- Prices vary substantially (for example, Japan vs. Canada vs. US), but hard to determine if this reflects unmeasured differences in quality or intensity of care
- Results generally consistent with aggregate differences in health expenditures across countries
- Little apparent difference in important disease outcomes

…But virtually no studies of technological change, and the effects of technological change on health system productivity

Innovative Aspects of TECH Global Research Network

- the design of data collection protocols and standardised collaborative analyses of changes in medical care and health outcomes at the "micro" level, across many countries;
- recent studies have put considerably more direct evidence on the importance of technological change, though most of it is confined to the United States. Little comparable evidence exists for other countries: TECH network aim to fill this gap;
- our understanding of the role of economic and regulatory influences on technological change is more speculative;
- longitudinal cross-country comparisons at the micro level appear to be an essential foundation for understanding how health policy may affect the contribution of technological change to health improvements and medical expenditure growth, and thus to guiding future policies to improve the welfare of populations worldwide;
- our research builds upon the work undertaken by both the McKinsey study and the MONICA WHO study in several important ways.

Importance of Technological Change in Health Care

- Previous "micro" studies in the US suggest technological change is a crucial factor in understanding expenditure growth:
  - Most important explanation of expenditure growth for specific illnesses is technological change
  - Other possible contributing factors are relatively unimportant: demographic change (population aging), price increases, policy changes, etc.
  - Changes in medical treatment also explain much of improvement in mortality after AMI in the United States between 1975-1995 (about 70% of total); also has improved quality of life among survivors
  - This suggests that technological change in the US, though expensive, has increased productivity of the US health care system: improvements in outcomes are worth the increases in costs

- Little evidence on technological change and its effects outside US, even though comparisons of <u>changes</u> in medical treatments and health outcomes may avoid many of the confounding factors that have complicated previous international comparisons

Data Elements for International Comparisons of AMI Treatment

Initial Hospitalization

- Principal Diagnosis of initial AMI (acute myocardial infarction)
- Utilization
  - Cardiac Procedures angiography; revascularization (PTCA, CABG)
  - Drug Treatment (some countries)
  - ICU/ CCU use
  - Length of Stay
- In-hospital Mortality

Linked Data

- Utilization after Initial Hospital Stay
- Hospital Readmissions
  - Cardiac Procedures
  - Diagnoses
  - Expenditures
- Mortality

Other Medical Conditions Raise Different Data Concerns

- Careful attention to data consistency across countries is critical to successful international comparisons
- AMI: Relatively reliable inpatient data
  - Patients generally hospitalized
  - Important treatments delivered soon after patient is hospitalized
  - Important outcomes occur soon after patient is hospitalized
  - Inpatient hospital data, especially if longitudinal, is adequate to address many important issues of treatment, costs, and outcomes
- Stroke: Fewer major innovations in treatment to compare, and more difficult to compare functional outcomes
  - Use of postacute/ rehabilitation services varies in the US and internationally, but postacute data are usually collected separately
  - Subset of TECH project is investigating international differences in trends in carotid endarterectomy use

Other Medical Conditions Raise Different Data Concerns

- Breast Cancer: More difficult
  - Many outpatient treatments, long-term outcomes important
  - Need registry data to identify date of diagnosis accurately, but can approximate from date of first treatment (some patients do not receive much treatment, and can be difficult to distinguish from “rule out” cases)
  - At a minimum, need to link inpatient and outpatient data from particular hospitals longitudinally to describe course of treatment

Technological Change in Health Care (TECH)
Global Research Network

Objectives

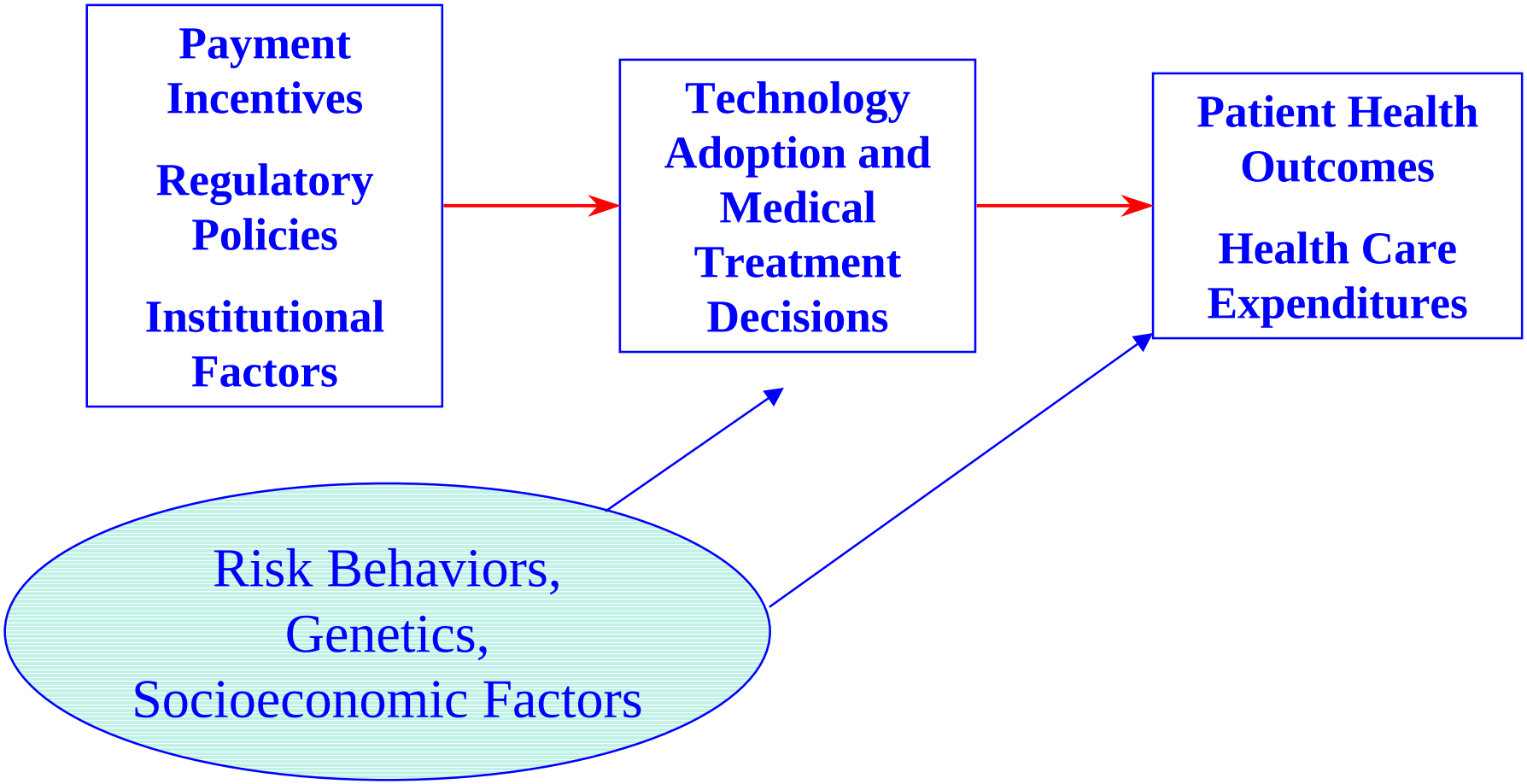
- Answers to three important questions:
  - How do national health policies affect technological change?
  - What is the role of technological change in explaining medical spending growth worldwide?
  - What is the contribution of technological change to improvements in disease outcomes?
- Capability for ongoing collaboration by an international network of research teams
  - Similar analysis of other important illnesses
  - Comparing and improving quality of care

Technological Change in Health Care (TECH) Global Research Network

Research strategy:

- Collaborative research teams from 17 participating countries (Australia [Perth and Victoria], Belgium, Canada [Alberta, Ontario, Quebec], Denmark, Finland, France, Israel, Italy, Japan, Korea, Norway, Singapore, Sweden, Switzerland, Taiwan, United Kingdom [England and Scotland], United States) consisting of experts in economics, medical care, epidemiology, and related fields
- Development of comparable data and standardized analytic methods for the study of heart attacks
- Focus on differences in technology diffusion, because virtually all medical treatments are available globally
- Comparison of results across countries to study the consequences of different health care systems for technological change

TECH Research Strategy



Summary of TECH Research Methods

I. Structured Review of Key Economic and Regulatory Incentives for Technological Change

II. Description of Technological Change in Heart Attack Care: diffusion of “high-tech” treatments, diffusion “low-tech” treatments, changes in “appropriateness” of treatment use

III. Analysis of Incentive Effects on Technological Change

IV. Empirical Description of Changes in Health Outcomes and Resource Use for Heart Attack Patients

V. Analysis of Consequences of Differences in Technological Change for Health System Productivity

Data

- Longitudinal microdata in most countries
  - patient level spanning 1982-1997
  - at least 1990-1995 in most countries
  - future work will include more recent data updates
  - population registries (especially WHO MONICA sites)
  - administrative claims data
- Data from hospital discharges in other countries
- Standard definitions of variables
- Common analysis plan

Table 1: National Differences in Economic and Regulatory Incentives for Technological Change in 1995

Type of Incentive	**Strong Limit**	**Intermediate Limit**	**Weak Limit**
Costs Borne by Patient	*Substantial out-of-pocket payments*: Japan Korea Singapore	*Some out-of-pocket payments and/or significant optional private insurance sector with premiums borne directly by patients:* Australia France Switzerland United States	*Zero/very low patient payments for services:* Belgium Canada Denmark Finland Israel Italy (for AMI patients) Sweden Taiwan United Kingdom
Generosity of Payments to Hospitals (both *level* of payments and *responsiveness* of payments to intensity of treatment may differ; this table focuses on responsiveness)	*Fixed global budgets, more or less stringent:* Canada* Denmark Finland** Sweden** United Kingdom	*Some additional payments for the provision of more costly treatments:* Australia*** Belgium France*** Israel Italy United States	*Fee-for-service payments:* Japan Korea Switzerland Taiwan

* Canadian provinces have varied in the extent to which their governments have expanded capacity for intensive treatments.
** Some districts have implemented DRG-like payments that provide additional revenues for supplying additional treatment.
***Australia and France have well-developed private hospital systems, with relatively generous incentives for technological change, operating alongside public hospital systems, with relatively strict incentives.

Table 1, Continued: National Differences in Economic and Regulatory Incentives for Technological Change in 1995

Type of Incentive	**Strong Limit**	**Intermediate Limit**	**Weak Limit**
Generosity of Payments To Physicians (both *level* of payments and *responsiveness* of payments to intensity of treatment may differ; focus on responsiveness)	*Physicians are mainly salaried:* Denmark (cardiovascular doctors) Finland France (public hospitals) Israel Italy Sweden United Kingdom	*Some additional payments for the provision of more Costly treatments:* Australia United States Israel Canada	*Fee-for-service:* Japan Korea Taiwan Belgium Australia (private hospitals) France (private hospitals) Switzerland
"Micro" Technology Regulation (mainly involves costly "high-tech" procedures, and potentially expensive patients)	*Extensive reviews of individual treatment decisions:* United States	*Limited case-level review and/or "gatekeeping":* Ontario, Canada (placement in bypass surgery queues) Denmark Israel	*Little or no case-level review:* Most countries
Choice and Competition among Insurance Plans	*No choice (universal insurance):* Canada Denmark Finland Sweden Taiwan United Kingdom	*Limited choice (e.g. in supplemental coverage):* Australia France Japan Switzerland	*Substantial choice:* Korea United States

Table 2: Technological Change in Heart Attack Care - Trends in Intensive Cardiac Procedures, 1991-1995

Type of Procedure	No Change/Slow Growth[1]	Intermediate Growth[2]	Rapid Growth[3]
catheterization/ angiography	*Finland*; Quebec, Canada	*Denmark*; England; *France*; Manitoba, Canada[4]; Ontario, Canada; *Sweden*	Australia; *Israel*; Italy; Japan*; USA
PTCA	*Denmark*; England; *Finland*; Ontario, Canada; *Sweden*	*Belgium*; *France*; Manitoba, Canada[4]; Quebec, Canada	Australia; *Israel*; Italy; Japan*; Korea*; USA
CABG	*France*; Japan*; Korea*; England; Ontario, Canada; Quebec, Canada;	Australia; *Belgium*; Manitoba, Canada; USA	*Denmark*; Finland; *Israel*; Italy; Sweden

Countries were divided into categories based on procedure growth rates for heart attack (AMI) patients if available (regular font). If procedure growth rates for AMI patients were not available, countries were divided into categories based on the total growth in procedures per million residents (italic font). An individual country may report differently across the three types of procedures (e.g., procedure growth rates for AMI patients for one procedure, total growth in procedures per million residents for another procedure, and no information for the third procedure).

* Classification should be interpreted with caution because the sample of hospitals on which the procedure rate is based may not be representative of hospitals in the country as a whole.

[1] For catheterization and PTCA (CABG), no change/slow growth category includes countries with average annual procedure growth rates of less than 1 (0.5) percentage point per year for AMI patients; if linked data on AMI patients are not available, then category includes countries with rates less than 100 (50) procedures per million population per year.

[2] For catheterization and PTCA (CABG), intermediate growth category includes countries with average annual procedure growth rates of 1-1.75 (0.5-1) percentage points per year for AMI patients; if linked data on AMI patients are not available, then category includes countries with rates of 100-250 (50-100) procedures per million population per year.

[3] For catheterization and PTCA (CABG), rapid growth category includes countries with average annual procedure growth rates of greater than 1.75 (1) percentage points per year for AMI patients; if linked data on AMI patients are not available, then category includes countries with rates greater than 250 (100) procedures per million population per year.

[4] Manitoba rates increased around 1992, in association with the addition of cardiac procedure capacity, but essentially did not change in subsequent years.

Incentives and Growth in Use of Intensive Procedures

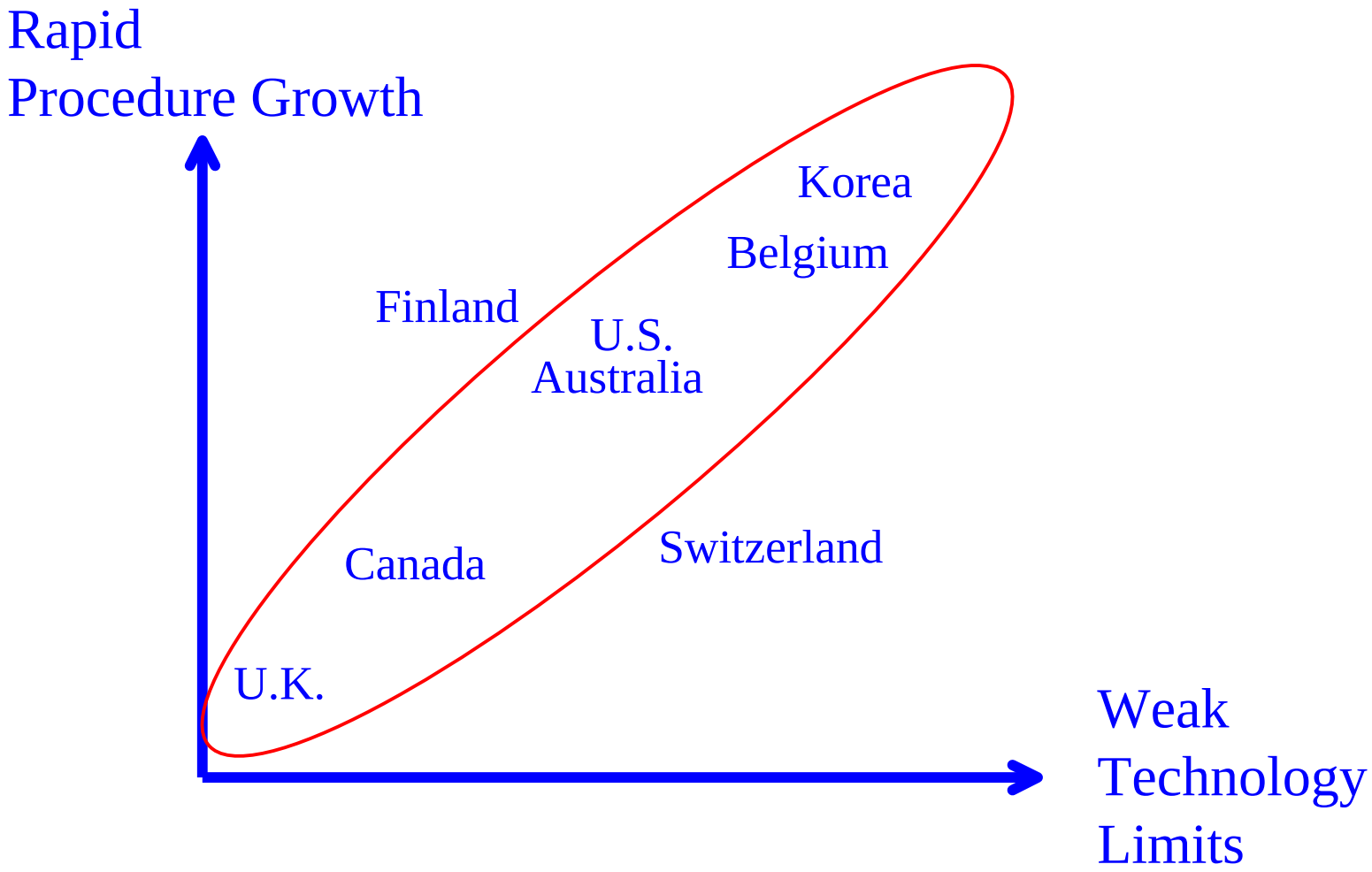


Table 3: Trends in All-Cause One Year Mortality for Heart Attack Patients, 1991-1995

Increase or Slow Decline[1]	Rapid Decline[2]
England; Manitoba, Canada	Australia; Quebec, Canada; USA

[1] Category includes countries with average annual increases in mortality and declines of less (in absolute value terms) than 0.5 percentage point per year.

[2] Category includes countries with average annual declines in mortality of greater (in absolute value terms) than 0.5 percent point per year.

Conclusions from Preliminary TECH Analysis

- Utilization of costly treatments is increasing in virtually all developed countries -- both “high tech” (intensive cardiac procedures) and “low tech” (drugs)
- Only slight differences in when new treatments become available in each country, but enormous differences in rates of diffusion into medical practice
- Supply-side incentives are important for “high tech” treatments, but less influential in “low technology” treatments like drug use
- Compared to the United States, many countries have lower health care spending levels but similar rates of spending growth, because prices are lower but rates of technological change are the same or faster.
- Mortality rates for heart attack patients are improving in virtually all countries, but at somewhat different rates

Next Steps for TECH Research Network

- All TECH investigators met at Stanford from September 7-9, 2000
- Full standardization of data collection allows for direct comparisons across countries
- Final analysis of survey of TECH investigators on the regulatory and reimbursement incentives their countries provide for technological change in heart attack care
  - Use factor analysis to reduce dimensionality of 168-question survey and develop indices of incentives for technological change in health care

Next Steps for TECH Research Network: New Projects

- Estimating the effect of incentives for technological change on treatment decisions and health outcomes
- Analysis of costs and cost-effectiveness of care
- Impact of socioeconomic status (such as area income) on care: do effects of socioeconomic status differ in countries and for populations with and without universal insurance?
- Male/female differences in care for heart attack
- Differences in care for the old and the very old