Measuring the Level and Determinants of Health System Efficiency in Canada

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Why is CIHI Measuring Health System Efficiency?

- In response to widespread recognition that the health system needs to make better use of existing resources and improve value for money
- Health system managers currently face tight budget constraints
- Information about variations in efficiency could support provincial health system performance improvement
- In this work, the health system includes all activities under the jurisdiction of provincial ministries of health

Program of Work on Health System Efficiency in Canada - Phase 1

- **Phase 1** – Developed a conceptual model for measuring health system efficiency

Objective: to understand what the health system is meant to achieve – i.e. what is the objective against which we should be measuring efficiency? Summarized results of qualitative research, Results showcased in CIHI technical report *"Developing a Model for Measuring the Efficiency of the Health System in Canada"* (released July 2012)

Phase 1: Qualitative Research to Develop a Model for Measuring Health System Efficiency
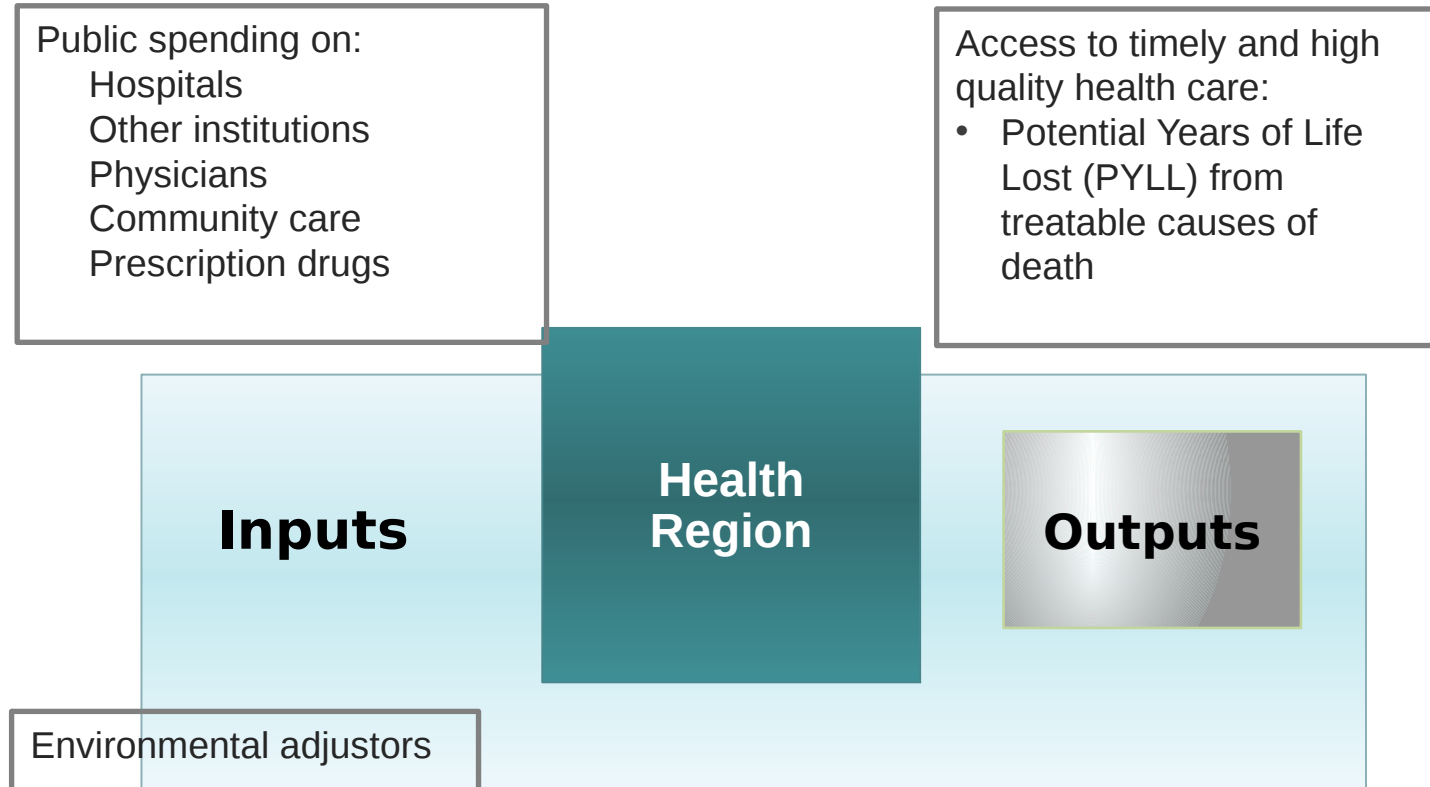
	Policy scan	Elite interviews	Stakeholder dialogue
Goal	Identify the stated objectives of the health system	Identify provincial health policy makers' views on the inputs to and outcomes of the health system	Engage stakeholders in discussion on health system objectives, boundaries and methods
Selection criteria	Publicly available documents produced by federal, provincial and territorial governments that address health systems and policies	Current or former senior health ministry officials of provincial/territorial governments	Current or former senior decision-makers, health system consultants, and senior executives from health care organizations
Sample size		17 interviewees from 9 provinces and 2 territories	16 participants from 6 provinces,1 territory, and the federal government

Note: there was no overlap among interview and dialogue participants

Program of Work on Health System Efficiency in Canada – Phase 2

- Applied the conceptual model (output: timely access to treament when sick; inputs: in $, not bodies; DMUs: regions; top-down analysis rather than disease-based or case studies) to spending and health outcome data at the regional level
- Results showcased in the analytical report, *"Measuring the Level and Determinants of Health System Efficiency in Canada"* (Released in April 2014)

Summary of the Proposed Conceptual Model to Measure Efficiency (developed in phase 1)

Public spending on:
- Hospitals
- Other institutions
- Physicians
- Community care
- Prescription drugs

Access to timely and high quality health care:
- Potential Years of Life Lost (PYLL) from treatable causes of death

Inputs

Health Region

Outputs

Environmental adjustors

Factors to explain inefficiency:
- Environmental factors (e.g. socio-economic, demographic characteristics of the regional population)
- Health system factors (e.g. clinical and operational factors)

Phase 2: Research Questions

- What is the average level of efficiency in Canada's regional health systems?
- What factors explain variations in efficiency across the health regions?
- What are the key data gaps that CIHI could address to improve future empirical analyses on health system efficiency?

Methods: Step 1 – Data Envelopment Analysis to Calculate Efficiency

- Calculate point estimates of efficiency using Data Envelopment Analysis (DEA), a descriptive approach to measuring efficiency based on linear programming.
- Apply a statistical outlier detection methodology. (Wilson 1993)
- Bootstrap point estimates to generate robust efficiency estimates. (Simar & Wilson 1998)

Methods: Step 2 – Regression Analysis to Explain Variations in Efficiency

- Factors affecting efficiency could fall into 3 broad categories:

  1. Clinical factors: Inappropriate or ineffective care provided, and prevention opportunities that are missed
  2. Operational factors: Overly expensive inputs are used
  3. Characteristics of the environment

- Step-wise regression to identify the variables significantly associated with efficiency estimates

Data: Summary of Input & Output Data in Sample of 84 Regions Across 10 Provinces

Inputs	Source (year)	Mean	Range	
Hospitals, $ per capita	Canadian Management Information Systems Database (CMDB, 2007-9)	1719	951	3826
Prescription drugs, $ per capita	IMS Brogan (2010)	546	289	884
Physicians, $ per capita	National Physicians Database (2007-9)	471	177	817
Residential care facilities (RCF), $ per capita	RCF Survey, Statistics Canada (2008)	336	74	902
Community nurses, $ per capita	Census, Statistics Canada (2006)	54	20	99
Education (% with high school certificate or more)	CCHS, Statistics Canada (2007-8)	82	63	94
Recent immigrants (%)	CCHS, Statistics Canada (2007-8)	3	0	17
Non-Aboriginal (%)	Census, Statistics Canada (2006)	93	50	99
Output				
Potential Years of Life Lost (PYLL) from treatable causes, before age 80, age standardized	Vital statistics, Statistics Canada (2007-9)	1666	1067	2453

Results: Robust Estimates of Efficiency and Sensitivity Analyses

- Efficiency point estimates from DEA averaged between 0.65-0.82, across seven separate model specifications.
- This means that treatable PYLL could be reduced between 18-35% if all regions were operating efficiently.

- Efficiency estimates were not sensitive to the age cut-off for defining premature death (75, 80, or 85), or the choice of PYLL vs. the standardized mortality rate from treatable causes.

Results: Contribution of Each Category of Factors Affecting Efficiency

Category	Variables with statistically significant associations with efficiency ($p<0.05$)	R2
Environmental and population characteristics	• Average income of the population • Inequity in the likelihood of visiting a physician	7-14%
Clinical factors	• Daily smoking (%) • Physical inactivity (%) • Multiple (three or more) chronic conditions (%) • 30-day overall readmission to hospital (rate per 100)	14-26%
Operational factors	• GPs (% of physicians) • ALC length of stay (days)	12-22%

These variables together explain nearly 50% of total variation, leaving half of variation that is unexplained.

Main Data Gaps

- More precise measures of patient flow
  - Patient-level data for physicians, prescription drugs, RCFs, nursing were unavailable

- Community care and public health spending data
  - CMDB has these but limited comparability across provinces

- Indicators of clinical and operational factors that may affect efficiency
  - Integration and coordination of care, and expanding scopes of practice (e.g., for pharmacists and nurses)

Summary of Key Findings

- Years of life lost from treatable causes of death could be reduced by up to 35% if systems were managed more effectively and if their populations had lower health risks and better health.

- Clinical factors, namely the indicators of successful prevention efforts such as the prevalence of smoking and physical activity, were significant drivers of efficiency after controlling for several key environmental characteristics.

- Operational factors, such as investments in primary care, and the appropriate use of hospitals, were also important.

- The unexplained variation in efficiency scores could be driven in part by clinical practice variations, and in part by other unmeasured patient and population characteristics.

Proposed Future Research

- Undertake case studies of a sample of high-performing regions
  - E.g., what are some of the decisions that health system leaders have made that have led to good performance in the indicators that are associated with health system efficiency?
- Collect additional data on clinical and organizational factors that could affect efficiency