Comparisons of Hospital Output in Canada: National and International Perspectives

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Background

- Health care expenditure growth has gained increasing attention by policy makers in Canada and other industrialized counties

- Necessity to break down health care expenditure growth into price change and quantity/quality change

- Quantity not well defined and hospital output price not directly observable

- Because of the Canadian context, direct measurement of output seems to be more appropriate.

Objectives

- To examine the theoretical and practical aspects of health care output measurement in Canada.

- To investigate the feasibility of measuring the output of the Canadian hospital sector and identify methodological and data gaps.

Basic Formula

- From the basic index number theory in price and quantity aggregations, a constant dollar quantity index is defined as:

$$Q = \frac{\sum_{i=1}^{N} p_i q_i^1}{\sum_{i=1}^{N} p_i q_i^0} \qquad (1)$$

- If p is taken from the base year, we have the Laspeyres quantity index (Q_L)

- Similarly, if p is taken from the current year, we have the Paasche quantity index (Q_P)

- The Fisher index is the geometric mean of the Laspeyres and Paasche indices.

Measuring Quantities

- Production of goods and services divided into four stages:
  – Inputs
  – Activities
  – Products
  – Outcomes
- The quantity index can be one or a combination of these stages

Measuring Costs

- Most countries, including Canada, traditionally measure the total costs of outputs as total expenditures in publicly provided services such as hospital care.

- Because price information is unavailable, changes in total expenditure are treated as pure price changes; that is the quantity index is assumed to be 1 in every period.

- If zero productivity growth is assumed, this cost-based approach can be justified because zero economic profit largely prevails in the public sector.

Measuring Activities

- Activities are the number of hospital stays, LOS, clinic visits, physical exams, diagnostic tests performed.

- From the patients' perspectives, the level of activities is not the main concern. It is, instead, whether or not an acute disease or injury can be cured as quick as possible.

- If a cancerous tumour can be removed during a shorter LOS, there is a decrease in activities, but quality has improved; so output measures should be adjusted upward

- Therefore activities cannot be an appropriate measure as a proxy for output.

Measuring Products

- Products are courses (episodes) of treatment, number of cases by homogeneous groups, procedures or diseases adjusted for severity, LOS, quality of care, etc.

- Hospital services, for example, can be classified according to a well-defined system of taxonomy such as ICD-10-CA or CMG/DPG/CACS.

Measuring Strictly Outcomes

- Some suggest that change in health status of all citizens due to medical intervention can be used as a proxy for the real output of the health care sector

- The question raises several theoretical and practical issues

- Consequently, quality-adjusted episode-based approach is conceptually closer to the real output of marketed product than an approach based only on outcomes.

Quality Change

- Quality of care can be captured through many factors, including: shorter LOS, shorter wait times, less invasive procedure, lower mortality rate, etc…

- Hedonic analysis is very difficult to implement:
  - Due to the necessity to collect exhaustive data on quality for every product variety and
  - To the absence of price information.

- For publicly funded system, general effectiveness measure such as QALY is recommended (Pauly, 1999).

An Ideal Cost Weighted Output Index for Canada

- A quality-adjusted episode-based Laspeyres index is ideally proposed:

$$Q_L = \sum_{i=1}^{N} \frac{p_i^0 e_i^1 q_i^1}{p_i^0 e_i^0 q_i^0}$$

p_i^0 = average cost for episode i in the base period (proxy by CIHI RIW values)

e_i^t = outcome measure of episode i in period t,

q_i^t = number of episodes i in period t (from the CIHI databases - DAD and NACRS).

Practical Considerations

- At the product stage, adjustment can be made for unsuccessful or iatrogenic cases such as unplanned re-admissions

- At the outcome stage, the adjustment factor can be a disease or treatment specific outcome measure such as HALE

- However, time series data for HALE are currently not widely available.
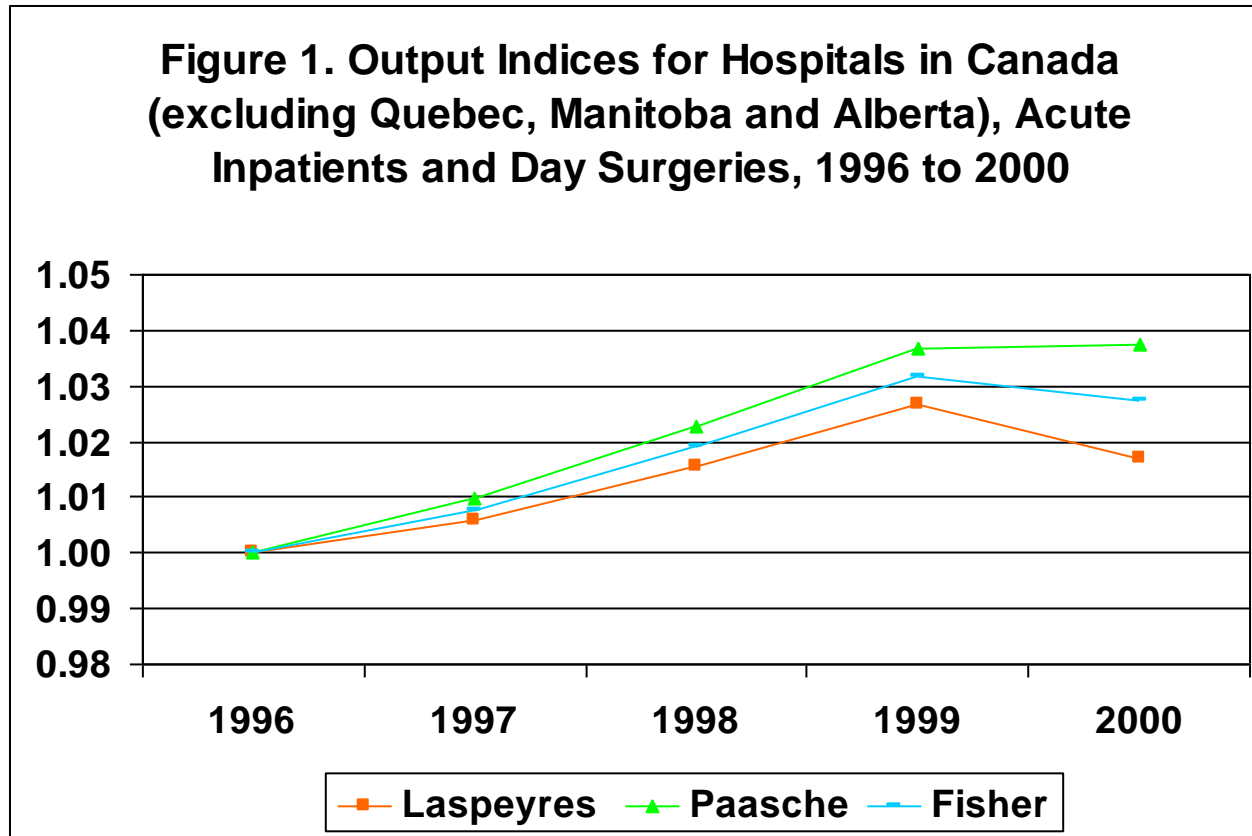
Practical Considerations, cont'd

- On top of the Canadian Vital Statistics, other data sources to compute HALE could be:
  - CCHS (The Canadian Community Health Survey)
  - NPHS (The National Population Health Survey
  - The Census
  - PALS (The Participation and Activity Limitation Survey)
- CCHS, NPHS and PALS, each has the HUI module.
- Current limitations of these data sources are:
  - Coverage of the 2005 CCHS for HUI is less than in 2001 (HUI is now optional content and comes from a subsample)
  - NPHS longitudinal data cannot be used in a cross-sectional context.
  - CCHS and PALS do not cover institutionalized respondents.

A Preliminary Cost Weighted Output Index for Canada

- Three chained episode-based indices are presented for the 1996–2000 and 2003–2005 periods: Laspeyres, Paasche and Fischer

- From the numerical results, the Fisher index between 1996-2000 and 2003-2005 is 1.027 and 1.054 respectively.

- Even when we assume that there are no changes between 2000 and 2003, the overall quantity index between 1996 and 2005 is 1.081

- This translates into an average annual growth rate of <u>1.3%</u> for the six year period for which the index is calculated.

A Preliminary Empirical Example: 1996 to 2000

Figure 1. Output Indices for Hospitals in Canada (excluding Quebec, Manitoba and Alberta), Acute Inpatients and Day Surgeries, 1996 to 2000

The Laspeyres being the lower bound and the Paasche being the upper bound of the theoretical quantity index (Diewert, 1993). The Fisher index is a close approximation of the true quantity index.

A Preliminary Empirical Example: 2003 to 2005

Figure 2. Output Indices for Hospitals in Canada (excluding Quebec, Manitoba and Alberta), Acute Inpatients and Day Surgeries, 2003 to 2005
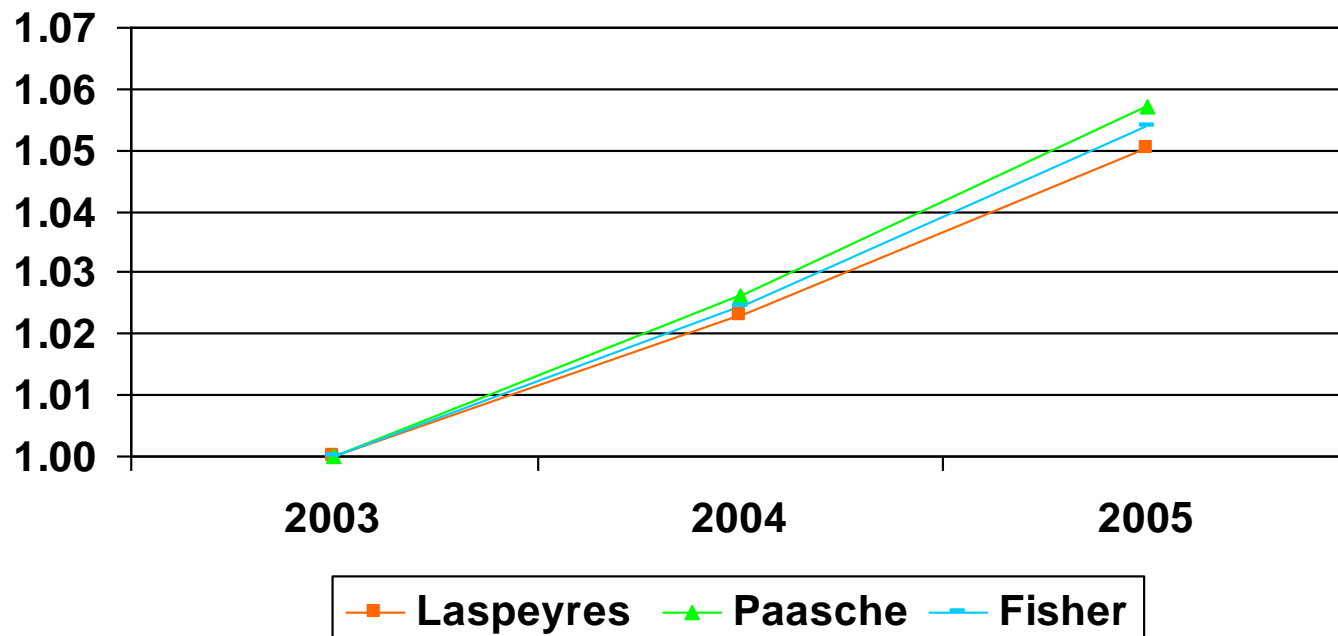
Conclusion

- Decomposition of total expenditure change into price change and quantity change is important in policy analysis and international comparison of output and productivity.

- Using available data for 1996-2000 and 2003-2005, the real output unadjusted for quality change increases at an average annual rate of 1.3%.

- This index is a lower bound estimate and needs to be adjusted for quality changes using measure such as QALY.

- It is suggested to take steps to make comprehensive quality adjustment data available on a regular basis.