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Access to emergency operative care: a comparative study between the Canadian and American health care systems

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The term “evidence-based medicine” was first coined by Sackett and colleagues as “the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients.”¹ The key to practising evidence-based medicine is applying the best current knowledge to decisions in individual patients. Medical knowledge is continually and rapidly expanding. For clinicians to practise evidence-based medicine, they must have the skills to read and interpret the medical literature so that they can determine the validity, reliability, credibility and utility of individual articles. These skills are known as critical appraisal skills, and they require some knowledge of biostatistics, clinical epidemiology, decision analysis and economics, and clinical knowledge.

Evidence Based Reviews in Surgery (EBRS) is a program jointly sponsored by the Canadian Association of General Surgeons (CAGS) and the American College of Surgeons (ACS) and is supported by an educational grant from ETHICON and ETHICON ENDO-SURGERY, both units of Johnson & Johnson Medical Products, a division of Johnson & Johnson and ETHICON Inc. and ETHICON ENDO-SURGERY Inc., divisions of Johnson & Johnson Inc. The primary objective of EBRS is to help practising surgeons improve their critical appraisal skills. During the academic year, 8 clinical articles are chosen for review and discussion. They are selected for their clinical relevance to general surgeons and because they cover a spectrum of issues important to surgeons, including causation or risk factors for disease, natural history or prognosis of disease, how to quantify disease, diagnostic tests, early diagnosis and the effectiveness of treatment. A methodological article guides the reader in critical appraisal of the clinical article. Methodological and clinical reviews of the article are performed by experts in the relevant areas and posted on the EBRS website, where they are archived indefinitely. In addition, a listserv allows participants to discuss the monthly article. Surgeons who participate in the monthly packages can obtain Royal College of Physicians and Surgeons of Canada Maintenance of Certification credits and/or continuing medical education credits for the current article only by reading the monthly articles, participating in the listserv discussion, reading the methodological and clinical reviews and completing the monthly online evaluation and multiple choice questions.

We hope readers will find EBRS useful in improving their critical appraisal skills and in keeping abreast of new developments in general surgery. Four reviews are published in condensed versions in the *Canadian Journal of Surgery* and 4 are published in the *Journal of the American College of Surgeons*. For further information about EBRS, please refer to the CAGS or ACS websites. Questions and comments can be directed to the program administrator, Marg McKenzie, at mmckenzie@mtsinai.on.ca.

Reference

1. Evidence-Based Medicine Working Group. Evidence-based medicine. *JAMA* 1992;268:2420-5.

SELECTED ARTICLE

Krajewski SA, Hameed MA, Smink DS, et al. Access to emergency operative care: a comparative study between the Canadian and American health care systems. *Surgery* 2009;146:300-7.

ABSTRACT

Question: Do variations of income impact rates of perforation in patients with acute appendicitis? Are variations in appendiceal perforation related to income consistent across these 2 countries? **Design:** Cohort study using administrative data. **Data sources:** Canadian Institute for Health Information (CIHI) database (102 692 patients) and the US Nationwide Inpatient Sample (NIS; 276 890 patients). **Patient sample:** Patients with acute appendicitis diagnosed from 2001 to 2005 were identified using ICD-9 codes. Patients were characterized further by age, sex, insurance status, race and socioeconomic status. **Results:** In Canada, there was no difference in the odds of perforation among income levels. In the United States, there was a significant, inverse relation between income level and the odds of perforation. The odds of perforation in the lowest income bracket were significantly higher than those in the highest income bracket (odds ratio 1.20, 95% confidence interval 1.16–1.24). **Conclusion:** The results suggest that access to emergency operative care is related to socioeconomic status in the United States, but not in Canada. This difference could result from the concern over the ability to pay medical bills or the lack of a stable relationship with a primary care provider that can occur outside of a universal health care system.

COMMENTARY

Krajewski and colleagues¹ used information drawn from US and Canadian hospital discharge abstracts for patients hospitalized for acute appendicitis to explore the relation between rates of perforated appendicitis and income in both countries. They also assessed whether variations in appendiceal perforation related to income were consistent across these 2 nations. They hypothesized that in the setting of universal health care, there may be fewer socioeconomic barriers to receiving timely emergency surgical care and that this would be reflected in lower rates of perforated appendicitis in patients from poorer locations.

There is good evidence to suggest that appendiceal perforation is closely related to timely access to care. In a study of 5755 consecutive appendectomies, Pittman-Waller and colleagues² found that the median time from onset of symptoms to evaluation was 16.5 hours in patients with nonperforated appendices compared with 39.8 hours in those with perforated appendices. As such, appendicitis has been used frequently as a model for studying disparities

in access to timely care. Higher rates of appendiceal rupture have been reported in many populations, including members of minority races, patients without health insurance, rural patients, infants and elderly patients.³⁻⁸

In the study by Krajewski and colleagues, data were obtained in Canada from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database, and in the United States from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS). The CIHI database includes data on all hospital admissions and day surgery procedures from all hospitals in the country except those in the province of Quebec. Data are extracted by trained health care data collectors who review the charts of all patients discharged from hospital. Similarly, the NIS is a federal-state joint venture that is the largest all-payer inpatient care database in the United States. This database represents about 20% of hospital admissions in the United States and incorporates data from 1056 hospitals in 42 states. Both databases include basic demographic data and diagnosis and procedure information based on the International Classification of Diseases (ICD; versions 9 and 10) for diagnosis and procedure coding.

All patients with an ICD-9 principal discharge diagnosis of acute appendicitis were included the study. The only outcome considered was perforation, defined as either generalized peritonitis or peritoneal abscess, as reflected in the database coding. Operative and pathology reports were not assessed. The rates of perforation in both countries were compared by age, sex and socioeconomic group, and the rates in the United States were also compared by race and insurance status. The 2 study populations were stratified based on the mean (Canadian) or median (United States) income levels in the postal code areas where the patients resided.

The authors observed an inverse relation between perforation rates and median income levels by postal code in the United States. The overall rate of perforation was 32%. In the multivariate analysis, patients with the lowest income were shown to have the highest rate of perforation. Patients who were privately insured had the lowest rate of perforation, which may suggest that excellent coverage led to faster care. However, it is interesting that the uninsured patients had the second-lowest rate of perforation, which was lower than for patients with Medicaid and Medicare. The groups with the highest rate of perforation (55.9%), were those with the best public coverage, Medicare. However, most patients covered by Medicare were older than 65 years, and it is known that older patients have a higher rate of perforation than younger patients. In Canada, the overall rate of perforation was 34.1%. In contrast to the findings in the United States, there was no correlation between perforation rates and mean income levels by postal code, but age significantly impacted perforation rates.

The authors concluded that their findings suggest that the absence of universal health care in the United States

creates economic barriers to emergency surgical care that do not exist in Canada. However, there are potential limitations to the study that should be considered. The main ones are the limitations of administrative data. Generally, demographic data (age, sex, postal code) are valid in large administrative databases, but the validity of the diagnostic codes is more dubious. The authors' main outcome variable was appendicitis with or without perforation; however, they did not provide any data assessing the accuracy of the coding of the diagnosis of appendiceal perforation in the administrative databases compared with data from clinical charts assessed by physicians. A surrogate measure of the accuracy of the codes was presented: patients with codes for perforated appendicitis had a longer length of stay in hospital and a higher cost of care compared with patients with codes for nonperforated appendicitis.

To our knowledge, there are no published studies that have validated the accuracy of the diagnosis of appendicitis or perforated appendicitis. Thirumurthi and colleagues⁹ evaluated ICD-9 codes in a sample of 3827 patients with the diagnosis of Crohn disease and ulcerative colitis. They found that the positive predictive value (PPV) of the coding for Crohn disease was 88%–100%, whereas the PPV for ulcerative colitis was 50%–93%. Similarly, Abraham and colleagues¹⁰ found that diagnostic codes for upper gastrointestinal bleeding had a PPV of only 27%. The authors combined simple diagnostic codes with procedural codes and improved the PPV to 51%. Nonetheless, both studies demonstrated that the variability in a diagnostic code can range from 12% to 43%. Recent studies of the precision of diagnostic codes, even when combined with procedural codes, have shown wide variability in validity. Thus, in lieu of a validation study of ICD codes for appendiceal perforation, it is highly likely that the uncertainty in the coding is greater than the small differences in perforation between income quintiles, and any conclusions drawn based on these codes may be questionable.

Income levels were assessed using census data and by linking these data to postal codes (Canada) and zip codes (United States). Again, these were not measured directly, although it is generally accepted that the income of individuals within the same geographic area, as defined by post office designation, does not differ significantly.

A second limitation is that the authors only considered the effect of socioeconomic status on rates of perforated appendicitis. Another possible explanation might be urban/rural living status, particularly in Canada where 20% of citizens live in rural areas.¹¹ The authors also did not report the proportion of individuals who underwent imaging to ascertain the diagnosis, and it would have been interesting to know whether this proportion differed according to insurance status or between countries and whether it impacted the timeliness of diagnosis. Finally, the wait time between patients' arrival in the emergency department and the time of surgery was not considered, probably because

the data were not available. However, this is often a concern raised by providers in Canada. Another concern is that this study did not examine access, but the authors used perforation as a marker for poor access, which may or may not be accurate. Every practising surgeon has treated patients who seemed to have perforated appendices early in the clinical course when there was no issue of delayed access to care. Also, abdominal or pelvic abscesses have developed in patients who did not appear to have a perforation at the time of surgery. The development of an abscess cannot necessarily be attributed to preoperative perforation on the basis of a delay to surgery.

It is interesting that people living in Canada's richest areas had higher perforation rates than people living in the poorest areas of the United States (34.9% v. 34.7%). This raises the uneasy question of whether there may be disparities in the delivery of emergency care in Canada and the United States that are clinically as important as disparities between rich and poor patients. This observation unwittingly provides critics of federally mandated universal coverage the argument that the Canadian system very equitably distributes lower-quality care.

The US data also show that income is a significant predictor of appendiceal perforation, even when controlling for insurance status, suggesting that universal health insurance would not necessarily result in diminished disparities in outcomes between rich and poor patients in the United States. How significantly the deleterious health effects associated with poverty could be ameliorated through the institution of universal health coverage in the United States therefore requires further study. Given the overwhelming amount of evidence in the global health literature related to poverty and disease, it is easy to believe that low income is associated with worse health outcomes in the United States for reasons that extend far beyond the payment system. Whereas a growing number of Americans believe that providing health care to all is a moral imperative, it is likely that even greater gains in health could be achieved by solving the problem of poverty. It is also possible that the differences observed between Canada and the United States have more to do with differences in the characteristics of poverty in the 2 countries (e.g., urban v. rural poverty, racial issues) than with the different health care financing systems.

Despite the limitations of this study, as both countries struggle with issues of health care delivery, it is highly desirable for there to be meaningful comparisons of outcomes between different delivery models. Rather than debates based on opinion or hyperbole, it is in everyone's best interest to have actual data as a basis for discussion. Whereas a number of studies have compared the 2 health care systems, few have considered access to care between them. The conclusion that seems to be justified from the current study is that poor patients in the United States with acute appendicitis are more likely to experience perforation than

wealthy patients, but in Canada there is no difference in perforation rates by income level. However, it is not clear whether this disparity is related to issues of access to care. The difference does not seem to be related to the type of insurance coverage in each country. It is possible that there is another explanation, such as a reluctance among poor patients to seek medical attention or a difference in the quality of the medical care available to them.

Competing interests: None declared.

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