

The Southwestern Ontario Joint Replacement Pilot Project: electronic point-of-care data collection

Robert B. Bourne, MD; William J. Sibbald, MD; Gordon Doig, PhD; Lydia Lee, BA, MBA; Susan Adolph, BA, MEd; Debbie Robertson, RN; Maureen Provencher, BSc, BCom; for the Southwestern Ontario Study Group

Objective: To pilot a provincial joint replacement registry using electronic point-of-care data collection. **Design:** Data collection study. **Setting:** Southwestern Ontario, which has a population base of 3.5 million people. **Participants:** Eighteen orthopedic surgeons. **Method:** Information on total hip and knee replacements was obtained by the orthopedic surgeons over a 6-month period. Information was obtained in paper form and electronically on hand-held computers. **Main outcome measures:** Patient demographics, waiting times from referral to operation, patient satisfaction and relevance and value of electronic records compared with paper records. **Main results:** Data were collected on 815 total hip and knee arthroplasties. A slightly greater number of hips required revision than knees. The majority of patients were in the 60 to 90-year age range. With respect to the waiting time from referral to operation 10% of patients waited less than 5 weeks, 50% waited less than 30 weeks, and 90% waited less than 59 weeks. There was a high level of patient satisfaction with the operation and with hospital care received. Most surgeons found that the gathering and use of data electronically was relevant and easy. The electronic data were more timely, accurate and complete than paper records. **Conclusion:** Electronic point-of-care data collection is appropriate, particularly in high-volume, high-cost surgical interventions such as total joint replacements.

Objectif : Mettre à l'essai un registre provincial des arthroplasties d'une articulation reposant sur la collecte de données électroniques aux points de service. **Conception :** Étude de la collecte des données. **Contexte :** Sud-ouest de l'Ontario, dont la population s'établit à 3,5 millions de personnes. **Participants :** Dix-huit chirurgiens orthopédiques. **Méthode :** Les chirurgiens orthopédiques ont recueilli des renseignements sur des arthroplasties totales de la hanche et du genou pendant six mois. Les renseignements ont été reçus sur support papier ainsi qu'en version électronique au moyen d'ordinateurs de poche. **Principales mesures de résultats :** Données démographiques sur les patients, délais d'attente de la référence à l'intervention, satisfaction du patient, et pertinence et valeur des dossiers électroniques comparativement aux dossiers imprimés. **Principaux résultats :** Des données sur 815 arthroplasties totales de la hanche et du genou ont été recueillies. Un nombre légèrement plus élevé de hanches que de genoux ont dû faire l'objet d'une révision. La majorité des patients étaient âgés de 60 à 90 ans. En ce qui concerne le délai d'attente entre la référence et l'intervention, 10 % des patients ont attendu moins de 5 semaines, 50 % ont attendu moins de 30 semaines, et 90 % ont attendu moins de 59 semaines. Le niveau de satisfaction des patients à l'égard de la chirurgie et des soins hospitaliers reçus était élevé. La plupart des chirurgiens ont jugé que la collecte et l'utilisation des données sur support électronique étaient pertinentes et faciles. Les données électroniques étaient plus exactes, plus complètes et d'accès plus rapide que les dossiers sur support papier. **Conclusion :** Il convient de procéder à la collecte de données électroniques aux points de service, en particulier pour les interventions chirurgicales à volumes et à coûts élevés telles les arthroplasties totales d'une articulation.

From the London Health Sciences Centre, University of Western Ontario, London, Ont.

Accepted for publication May 15, 2000.

Correspondence to: Dr. Robert B. Bourne, London Health Sciences Centre, University Campus, 339 Windermere Rd., London ON N6A 5A5; fax 519 663-3780, robert.bourne@lhsc.on.ca

© 2001 Canadian Medical Association

Canadians expect high-quality, accessible, cost-effective health care, and it is becoming increasingly obvious that we need better information to achieve these goals.¹

Total hip and knee replacement surgery illustrates our current dilemma. These joint arthroplasties are high-volume (2.5% of the population over 60 years of age), efficacious, durable procedures that are not only cost-effective but also cost-saving.²⁻⁶ In this country the demand for total hip and knee replacement exceeds available resources, resulting in rationing of services and long waiting lists. Also a perception exists among orthopedic surgeons that waiting lists are too long and that revision surgery rates are higher than necessary. There is no mechanism to identify patient, surgical and implant factors that might affect the quality of the result and implant durability.⁷ Poor information exists for even obvious questions, such as what are our Canadian joint arthroplasty revision rates, because our information databases have not separated primary from revision joint replacements or side of the procedure. In addition, countries such as Sweden and Norway who have national joint replacement registries have demonstrated a stepwise reduction in the need for revision surgery and rates that are much lower than in Canada and the United States. These improvements have been made possible by evidence-based practice guidelines, gleaned from the information in these national arthroplasty registries.⁷⁻¹⁰

In Ontario, a cooperative effort by the Ontario Ministry of Health and Long Term Care and the Ontario Orthopaedic Association was undertaken to pilot a provincial joint replacement registry.¹¹ Southwestern Ontario was selected as the site for this pilot study because of its well-defined geography, population base (3.5 million people) and perceived high utilization rates. Funding was provided by the Ontario Ministry of Health and Long Term Care for 1 year. Three months were allotted to

infrastructure set-up, 6 months to data collection and 3 months to data analysis. A computer company (Hewlett-Packard) agreed to supply hand-held computers (HP #650) to each participating surgeon, so that electronic and paper data collection might be compared for validation purposes. In this article we outline the methodology and results of the Southwestern Ontario Joint Replacement Pilot Project.

Materials and methods

The first steps were to develop a work plan and recruit orthopedic surgeon participants. A roll-out meeting was held, involving the pilot project leaders, participating surgeons, Ontario Ministry of Health and Long Term Care officials and hospital executives. Surgeons and allied health professionals were briefed on data collection, the use of the hand-held computers, electronic data transmission, the use of the secure custom-designed Web site and of add-on benefits (chat room, MEDLINE, electronic journals and "case of the week" continuing medical education). A field coordinator played a critical role in instructing and coaching surgeons on how to get immediate real-time feedback on data they submitted. The information collected is outlined in Fig. 1. Waiting time data, and referral to consult, consult to surgery and total waiting times were also collected and were available for viewing on the secure Web site.

Individual surgeons could compare their performance to the aggregate performance of the study group.

When data collection was concluded, data validation was performed comparing the paper records. Satisfaction surveys were mailed to all surgeons and to 100 randomly selected patients. The participating surgeons were surveyed concerning the relevance of the data collected and ease of using the hand-held computers. Patients were surveyed at 3 months as to their satisfaction with their joint replacement and care. Patients were also surveyed as to their preparedness to go home and their desire to be more involved with post-discharge planning. A final report was prepared, presented to the stakeholders and used to propose a province-wide registry.

Results

Eighteen out of 26 eligible surgeons participated. Reasons for non-participation included impending retirement (2 surgeons), a disabling health problem (1 surgeon) and concern about the time required for participation (3 surgeons).

The duration of data collection varied from 3 to 6 months for each surgeon. Winter weather and limited surgeon availability for training were the main impediments. Information was obtained on 815 arthroplasties (408 knees, 407 hips) (Table 1). Fig. 2 demonstrates the age distribution of the patient population.

Hospital	Patient ID
Patient initials	Health card number
Date of birth	Gender
DVT prophylaxis ordered	Antibiotics ordered
Antibiotics administered prophylactically	Referral date
Consultation date	Admission date
Surgery date	Joints replaced
Type of replacement (primary or revision)	Surgical approach
Previous operations	Implant companies
Implant catalogue and model numbers	

FIG. 1. Data collected electronically and in paper form by orthopedic surgeons, participants in the Southwestern Ontario Joint Replacement Pilot Project.

Waiting time data (Fig. 3) were more complex than originally anticipated. In patients having primary hip or knee replacement, the times from referral to consult, consult to surgery and total waiting time were clear. But patients who were already part of an orthopedic surgeon's practice (i.e., had already been seen and treated conservatively or by another joint replacement) were difficult to compare to new patients' waiting times. Therefore, only the time from final consult to surgery could be determined in this subset of patients. Ten percent of patients waited under 5 weeks, 50% waited under 30 weeks and 90% waited under 59 weeks.

Concerning the relevance of the data collected and ease of using the hand-held computers, 17 of the 18 surgeons felt that the data were relevant and that the hand-held computers were easy to use.

Patients surveyed at 3 months concerning their degree of satisfaction with joint replacement and hospital care indicated a high level of satisfaction with both (Figs. 4 and 5). Ninety-eight percent indicated

satisfaction with the results of their surgery. With respect to patients' preparedness to go home and their desire to be involved with post-discharge planning, overall, they were happy with their discharge planning and expected this planning to be done for them.

Comparison of electronic and paper data collection indicated that electronic data were substantially more timely, complete and accurate than paper records.

Discussion

The Southwestern Ontario Joint Replacement Pilot Project has demonstrated that a cooperative venture between a health care provider (the Ontario Ministry of Health and Long Term Care) and orthopedic surgeons under the umbrella of a provincial orthopedic association (the Ontario Orthopaedic Association) is possible. Patients benefit from evidence-based improvements in the quality of the results and a reduced need for revision surgery. Orthopedic surgeons benefit from com-

paring their practice patterns with their peers in terms of surgical technique, implant selection and outcomes. Health care providers benefit from improved total joint replacement quality, reduced revision surgery, help with waiting list management and guidance with regard to resource allocation. A business plan has revealed that if a provincial registry could reduce revision surgery by 10%, then funding of a province-wide joint replacement registry in Ontario would pay for itself. Indeed, if revision surgery rates were reduced by 50%, then a cost avoidance of \$4.5 million would be achieved in Ontario alone.

Health care is not only a provincial concern but a national issue. Any provincial joint replacement registry should be part of a national endeavour. Health Canada has provided funding for a Canadian Joint Replacement Registry (CJRR) through the Canadian Institute of Health Information in cooperation with orthopedic surgeons, the Canadian Orthopaedic Association and the 7 provincial/regional orthopedic associations.^{11,12} The CJRR will present a high level overview of patient, surgical and implant data, using revision as an end-point. Provincial comparisons of patient access, surgery rates and revision will be possible. In addition, Health Canada will be able to identify which total hip or knee replacement is in which patient and be

Table 1

The Number of Total Hip and Knee Replacements Captured During the Study

Type of replacement	Primary procedure	No. of revisions			
		1	2	3	4
Knee	361	37	11	3	0
Hip	331	48	16	2	1

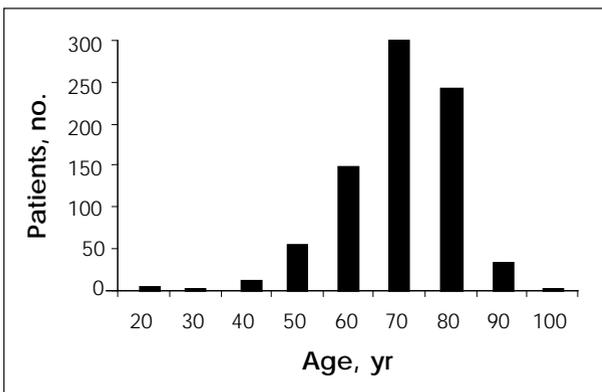


FIG. 2. The age distribution of the 815 patients assessed in the study. There is a wide range in age, but most patients are in the 60 to 90-year age group.

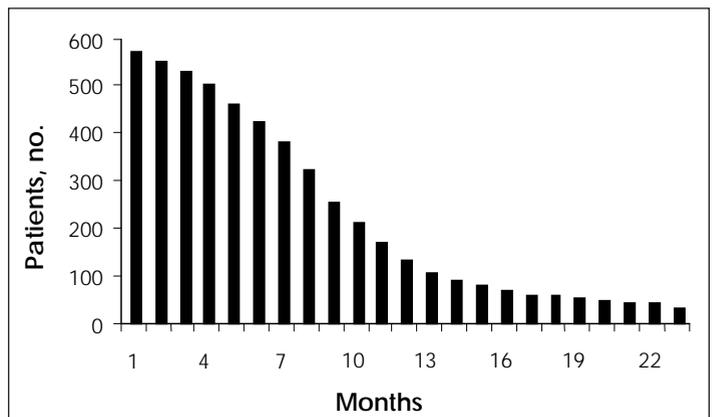


FIG. 3. Total waiting times from referral to total hip or knee replacement surgery. There were 598 patients in this sample.

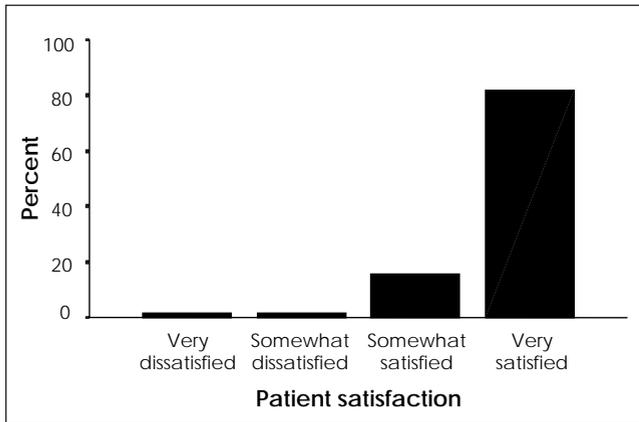


FIG. 4. Patient satisfaction with total hip or knee replacement. The survey response rate was 85%.

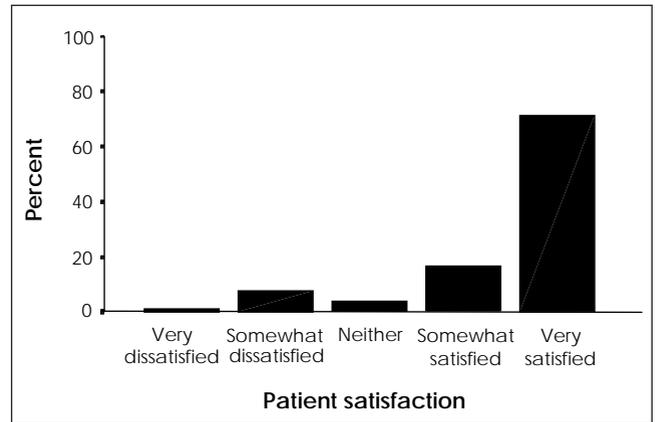


FIG. 5. Patient satisfaction with hospital care for total hip or knee replacement. The survey response rate was 85%.

able to assure the safety of new technologies in the area of total joint replacement. The provincial registries will allow more timely, detailed analyses of the needs of an ever-growing arthritic population, especially in terms of patient prioritization, waiting list management, satisfaction, quality of life and resource allocation. Point-of-care electronic data collection and transmission should be encouraged. High level data should be transferred to the national CJRR, and more detailed information retained for timely evidence-based provincial decision-making. Provider and patient satisfaction surveys should be an integral part of any provincial initiative.

Important interactions with other databases (i.e., mortality registers and billing databases) and federally or provincially funded research groups (i.e., the Canadian Institute of Health Information and the Institute for Clinical Evaluative Studies) will greatly enhance such initiatives.

The time has come for electronic point-of-care data collection, particularly in high-volume, high-cost medical interventions such as total joint replacement. Such efforts should represent a partnership between the health care provider and practitioners, and will benefit the patients, practitioners and health care providers. The application of na-

tional registries to other medical and surgical conditions should be encouraged.

Acknowledgements: We wish to thank the Ontario Orthopaedic Association, Hewlett-Packard Company and the Southwestern Ontario Study Group. Members of this group include: Drs. James Allen and John Turnbull, Chatham; Drs. Robert Bourne, David Chess, Steve MacDonald, Richard McCalden, and Cec Rorabeck, London; Drs. Robert Kutcy, Robert Miller and Paul Moroz, Owen Sound; Drs. Pran Mehta, Peter Southcott and Ralph Pototschnik, Stratford; Drs. Garth Annisette, Stephen Bartol, Dana Fleming and George Koppert, Windsor; and Drs. Gordon Krueger and Robert Reid, Woodstock.

References

1. Canada Health Infoway. *Advisory Council on Health Infrastructure*. Ottawa: Health Canada; 1999.
2. Chang RW, Pellisier JM, Hazen GB. Cost-effectiveness analysis of total hip arthroplasty for osteoarthritis of the hip. *JAMA* 1996;275:858-65.
3. Laupacis A, Bourne R, Rorabeck C, Feeny D, Wong C, Tugwell P, et al. The effect of elective total hip replacement on health-related quality of life. *J Bone Joint Surg [Am]* 1993;75:1619-26.
4. Laupacis A, Bourne R, Rorabeck C, Feeny D, Wong C, Tugwell P, et al. Costs of elective total hip arthroplasty during the first year. Cemented versus noncemented. *J Arthroplasty* 1994;9:481-7.
5. Lavernia CJ, Guzman JF, Gauchpin-

Garcia A. Cost effectiveness and quality of life in knee arthroplasty. *Clin Orthop* 1997;345:134-9.

6. Rorabeck CH, Bourne RB, Lapaucis A, Feeny D, Wong C, Tugwell P, et al. A double-blind study of 250 cases comparing cemented with cementless total hip arthroplasty. Cost-effectiveness and its impact on health-related quality of life. *Clin Orthop* 1994;298:156-64.
7. Hawelin LI, Espehaug B, Vollset SE, Engesaeter LB. Early aseptic loosening of uncemented femoral components in primary total hip replacement: a review based on the Norwegian arthroplasty register. *J Bone Joint Surg [Br]* 1995;77:11-7.
8. Herberts P, Malchau H. How outcome studies have changed total hip arthroplasty practices in Sweden. *Clin Orthop* 1997;344:44-60.
9. Malchau H, Herberts P, Ahnfelt L. Prognosis of total hip replacement in Sweden: follow-up of 92,675 operations performed 1978-1990. *Acta Orthop Scand* 1993;64:497-506.
10. Robertsson O, Dunbar M, Knutson K, Lewold S, Lidgren L. Validation of the Swedish knee arthroplasty register. A postal survey regarding 30,376 knees operated on between 1975 and 1995. *Acta Orthop Scand* 1999;70:467-72.
11. Bourne RB. The planning and implementation of the Canadian Joint Replacement Registry. *Bull Hosp Joint Dis* 1999;58:128-32.
12. Canadian Institute for Health Information. *Roadmap initiative. Launching the process*. Ottawa: The Institute; 1999. p. 7.