Variability in the Surgical Management of Carpal Tunnel Syndrome: Implications for the Effective Use of Healthcare Resources

Amr ElMaraghy and Moira W. Devereaux

Abstract

Medicine has been said to be as much art as science, where physicians invoke their individual skills and judgment to address the unique aspects of each presenting patient. Yet to what extent should physicians exercise their own discretion in determining the use rates of hospital resources? This article examines the results of a study on surgeon use of surgical setting and anesthetic technique for carpal tunnel release (CTR) surgery – a simple, low-risk surgical procedure that can be performed in either a formal operating room or a minor surgical setting, using local, regional or general anesthetic. The selected combination of surgical setting and anesthetic technique employed by a surgeon has not been standardized and can significantly impact both patient outcomes and administrative healthcare costs for hospital resources, equipment and pharmaceuticals. While a certain amount of variability in surgical management is necessary to allow clinicians to practise their "art," policy makers have an opportunity to standardize some surgeon practices to control costs, particularly when those practices are found to be as strongly influenced by the subjective attitudes of individual surgeons as by evidence-based science and economics.

Background

In a recent report sponsored by the Health Council of Canada (2009), per capita health spending increased 46% over the past decade. The report suggests that the rise in Canada's health spending is not a result of aging or population growth but is, rather, due to an increasing use of services. The report attributes this, in part, to wide variability in healthcare practices across the country, and it recommends the implementation of more evidence-based guidelines to reduce variations in practice and enhance value for money.

As orthopedic clinicians in Ontario, a small percentage of patients in our upper extremity orthopedic practice present with carpal tunnel syndrome. Current scientific literature highlights the variability in practice related to the diagnosis and management of this condition. Referrals for the treatment of carpal tunnel syndrome are directed across a diverse group of specialists (orthopedic and plastic surgeons and neurosurgeons) who do not all agree on a standardized set of diagnostic criteria (Graham et al. 2001, 2006b; Boden et al. 2005; Manktelow et al. 2004). Inconsistent diagnoses can result in inappropriate treatment

(including the use of expensive and possibly unwarranted diagnostic studies) and poor surgical outcomes. Given the differences in education and case mix of each treating specialist, we wondered if the lack of standardization in diagnosis and treatment extends into the choices of surgical setting and anesthetic technique when carpal tunnel release (CTR) surgery is performed. Variability in surgical management can impact a medical institution's ability to effectively schedule and efficiently use expensive surgical resources (Strum et al. 2000).

In 2006, we conducted a research study on choice of surgical setting and anesthetic technique for CTR surgery in three distinct parts:

1. A cross-sectional survey of orthopedic and plastic surgeons to identify any variations in choice of surgical setting and anesthetic technique, and to explore the primary influencers of these choices
2. An assessment of post-operative patient satisfaction for each combination of surgical setting and anesthetic technique used
3. An assessment of the pharmaco-economic impact of each combination of surgical setting and anesthetic technique

By understanding the primary influencers on choices of surgical practice and the associated costs and patient impact of those choices, we felt we could provide administrators and clinicians with information to benchmark their own surgical practices. Moreover, we felt it might instigate discussion of the implications these surgical practices have on access and use rates of resources in their own organizations.

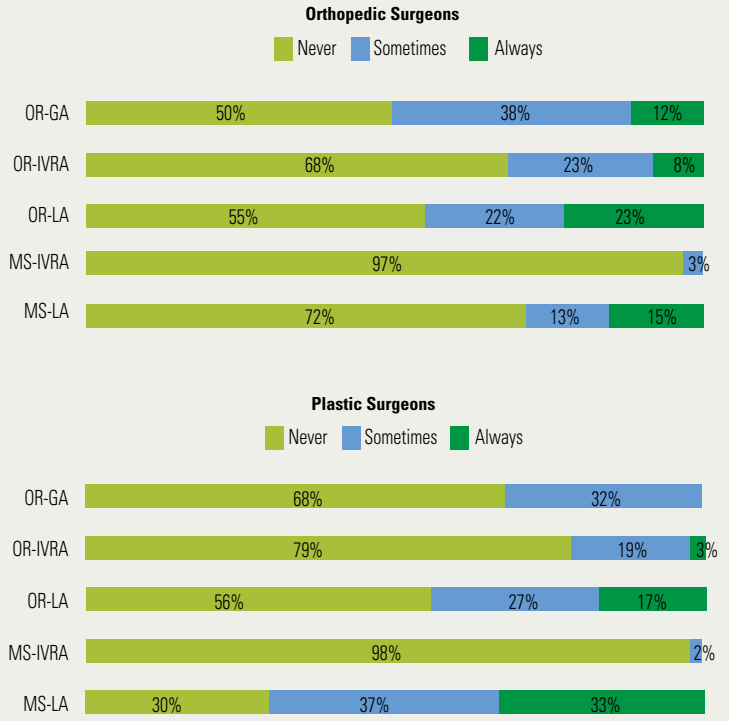
Findings in Ontario

Surgeon Practices

Our study was the first to compare surgical management practices between orthopedic and plastic surgeons for CTR surgeries and the first to attempt to identify the primary influencers when selecting surgical setting and anesthetic technique. We surveyed all orthopedic and plastic surgeons registered in Ontario (N = 606: 419 orthopedic and 187 plastic). We did not include neurosurgeons in our survey as there are only 67 registered as active practitioners in Ontario and the Ministry of Health and Long-Term Care does not list CTR surgery as part of a neurosurgeon's standard case mix group (Ministry of Health and Long-Term Care 2007). From the orthopedic and plastic surgeons, we received a 75% overall response rate (77% and 79%, respectively). This response rate provided a representative sample of surgeon practices in the province.

We assessed five alternative combinations of surgical setting and anesthetic technique available to surgeons: (1) formal operating room (OR) with general anesthetic, (2) formal OR with intravenous regional anesthetic, (3) formal OR with local anesthetic, (4) minor surgery with intravenous regional anesthetic and (5) minor surgery with local anesthetic. The results suggest that there is wide variability both within and between specialists in the use of surgical setting and anesthetic technique for CTR procedures (Figure 1). When it came to choice of surgical setting, orthopedic surgeons used the formal OR significantly more frequently than did plastic surgeons ($p <$ 0.001), with 43% reporting use of the formal OR for *all* CTR surgeries. There was a high degree of variability among orthopedic specialists in the selection of anesthetic technique, with local anesthetic used most frequently, but regional or general

Figure 1. Percentage of surgeons who perform open carpal tunnel release by type of surgical setting and anesthetic technique



MS-IVRA = minor surgery with intravenous regional anesthetic; MS-LA = minor surgery with local anesthetic; OR-GA = operating room with general anesthetic; OR-IVRA = operating room with intravenous regional anesthetic; OR-LA = operating room with local anesthetic.

anesthetic used significantly more often when compared with plastic surgeons (p = .001). Plastic surgeons use a minor surgical setting with significantly more frequency than do orthopedic specialists (p < .001) and demonstrated less intra-specialist variability in their choice of anesthetic; 50% used a local anesthetic technique for *all* their CTR procedures.

When we asked what influenced their choices of surgical setting and anesthetic technique, both orthopedic and plastic surgeons cited "surgeon preference" for both choices (Table 1). "Limited access" to either a minor surgical setting (for orthopedic surgeons) or to a formal OR (for plastic surgeons) was the second most frequently cited influence on choice of surgical setting, but to a far lesser extent. Few surgeons cited "patient preference" or "anesthetist preference" as a factor for either choice of surgical setting or anesthetic. Not a single surgeon in either specialty cited "cost" as a primary influence.

Table 1. Primary influencers on choice of surgical setting and anesthetic technique

Category	Orthopedic Surgeons	Plastic Surgeons
Respondents performing CTR surgery in 2005	*n* = 147	*n* = 118
Primary influence on type of surgical setting		
Patient preference	10.2% (*n* = 15)	6.8% (*n* = 8)
Anesthetist preference	3.4% *n* = 5)	1.7% (*n* = 2)
Hospital policy	8.2% (*n* = 12)	3.4% (n = 4)
Surgeon preference	**45.6% (*n* = 67)**	**64.4% (*n* = 76)**
Limited access to formal OR	6.1% (*n* = 9)	13.6% (n = 16)
Limited access to minor surgery	21.1% (*n* = 31)	6.8% (*n* = 8)
Other	5.4% (*n* = 8)	3.4% (*n* = 4)
Primary influence on type of anesthetic technique		
Patient preference	19.2% (*n* = 28)	9.3% (*n* = 11)
Anesthetist preference	16.4% (*n* = 24)	0.0% (*n* = 0)
Hospital policy	0.0% (*n* = 0)	0.0% (*n* = 0)
Surgeon preference	**54.8% (*n* = 80)**	**82.2% (*n* = 97)**
Limited access to formal OR	2.1% (*n* = 3)	5.1% (*n* = 6)
Limited access to minor surgery	3.4% (*n* = 5)	1.7% (*n* = 2)
Other	4.1% (*n* = 6)	1.7% (*n* = 2)

CTR = carpal tunnel release; OR = operating room.

Patient Satisfaction

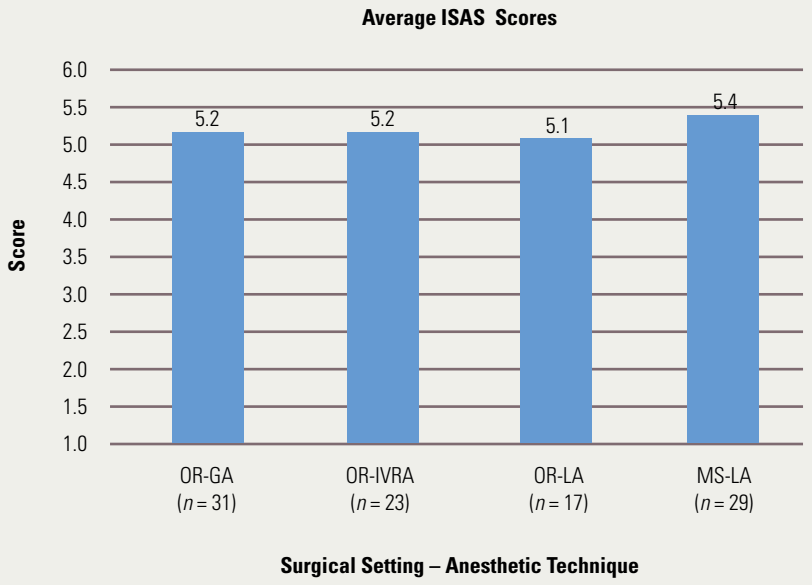
In order to understand whether patients were impacted by the different choices of surgical settings and anesthetic techniques, we conducted a retrospective review of 100 patients who underwent open CTR surgery between 2004 and 2006 by one of six surgeons on our staff (five orthopedic and one plastic). We used the Iowa Satisfaction with Anesthesia Scale, an 11-item, self-administered psychometric questionnaire developed by Dexter et al. (1997) that has been validated as a reliable measure of patient satisfaction with monitored anesthesia care. Patients were grouped based on the four combinations of surgical setting and anesthetic technique assessed: (1) OR with general anesthetic, (2) OR with intravenous regional anesthetic, (3) OR with local anesthetic and (4) minor surgery with local anesthetic.

The questionnaire was administered on average 13.9 months after the surgery took place. We had a 67% response rate, with no significant difference in response rates between patient groups. There was no significant difference in patient satisfaction between the groups (Figure 2). However, there was an extended amount of time between the surgeries and administration of the patient satisfaction questionnaire, which was originally designed to be applied in the early post-operative period. We therefore undertook a separate evaluation of the immediate post-anesthesia outcomes of 124 patients undergoing CTR surgery between 2000 and 2005 using the same combination of surgical setting and anesthetic described above. For each case, we recorded the incidence of post-operative pain, nausea and vomiting that required pharmacological treatment. The incidence of post-operative pain or nausea requiring medication was significantly higher (p < .001) in the OR–general anesthetic group compared with all other groups (Figure 3). There were no significant differences in post-operative nausea and pain between the other three combinations of surgical setting and anesthetic technique.

Pharmaco-economic Impact

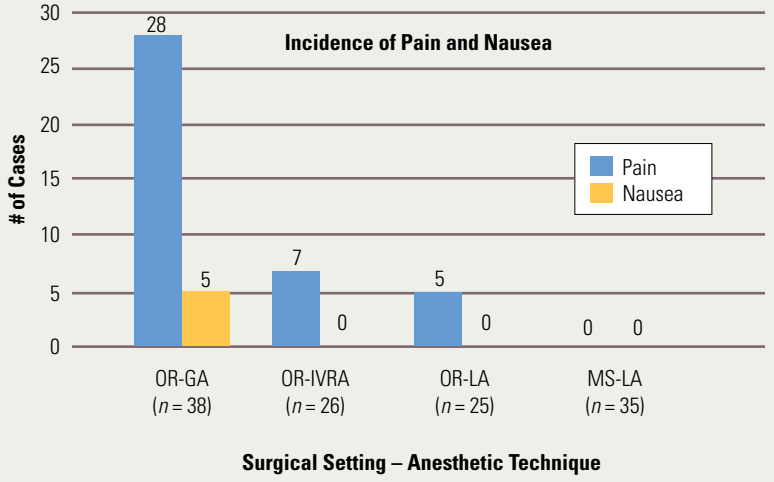
Lastly, we investigated the economic impact of each combination of surgical setting and technique. A retrospective analysis of the same 124 cases (identified above for patient satisfaction) was used to measure cost and time data for each procedure. Costs included preoperative investigations and anesthesiologist billings (if required), as well as peri- and post-operative nursing labour and medication expenses based on data supplied by our Departments of Finance and Surgery, Ontario Health Insurance Plan billing codes for procedures and time units and nurse-to-patient ratios for the OR, post-anesthetic care unit (PACU) and day surgery unit (DSU) (Table 2). Time data included perioperative times (induction time, surgical time and total time

Figure 2. Patient satisfaction by combination of surgical setting and anesthetic technique



Average Iowa Satisfaction with Anesthesia Scale (ISAS) based on a modified scoring system as described by Fung et al. (2005), where responses are scored from 1 to 6, with 6 representing the highest degree of patient satisfaction. OR-GA = operating room with general anesthetic; OR-IVRA = operating room with intravenous regional anesthetic; OR-LA = operating room with local anesthetic + sedation; MS-LA = minor surgery with local anesthetic and no sedation.

Figure 3. Comparison of immediate post-operative outcomes



The number of patients for each combination of surgical setting and anesthetic technique who required post-operative pharmalogical treatment for pain or nausea prior to discharge. OR-GA = operating room with general anesthetic; OR-IVRA = operating room with intravenous regional anesthetic; OR-LA = operating room with local anesthetic + sedation; MS-LA = minor surgery with local anesthetic and no sedation.

in the surgical setting) and post-operative recovery times (PACU and DSU) (Table 3).

The cost of performing open CTR surgery in a minor surgical setting using local anesthetic was significantly lower ($28.62 ± $6 per case) than any of the other combinations of surgical setting and anesthetic technique ($p < .001$) and is, on average, 90% less expensive than conducting the same procedure in a formal OR with general anesthetic. The total cost of using local anesthetic in a formal OR was significantly lower than that using other types of anesthetic in the OR ($p < .001$). The use of local anesthetic required significantly less patient time in the hospital, regardless of the surgical setting.

Discussion

The findings from our research suggest that it is most cost-effective to perform CTR surgery in a minor surgical setting using local anesthetic. This combination of surgical setting and anesthetic technique appears to have no negative impact on patient satisfaction and supports process efficiencies in terms of the number of procedures that can be booked and performed in an allocated block of surgical time (47 ± 9 minutes per case versus between 150 and 300 minutes for procedures performed in a formal OR using variable types of anesthetic). Our findings are consistent with a similar study of Canadian plastic surgeon practices performed by Leblanc et al. (2007) that concluded that the use of the main OR for CTR is almost four times as expensive and less than half as efficient as performing the procedure in a minor surgical setting. Leblanc et al. observed, as we did, that despite these findings, a significant number of surgeons performing CTR surgery continue to use the more expensive, less efficient venue of the formal OR with variable types of anesthetic. We find it somewhat enigmatic that high-cost, low-efficiency approaches for a simple

procedure should remain popular at a time when our healthcare system is hard pressed for adequate funding and resources.

When we asked Ontario surgeons what influenced their particular selection of surgical setting and type of anesthetic for open CTR procedures, the overwhelming response was "surgeon preference." Rather than citing economic factors, patient preferences or evidence-based outcomes, CTR surgical management appeared to be most strongly influenced by the subjective attitudes of the treating specialist. J.E. Wennberg (1984), who has written extensively on persistent variations in practice for common surgical procedures, refers to these subjective influences as the "practice style factor," noting that it can play a decisive role in determining the specific services and treatments provided to a patient. Rather than adherence to medical standards based on research evidence and professional consensus, patient treatment and the use of services have become dependent upon where the patients lives and who they see. It is unlikely that this approach results in either optimal patient care or effective use of healthcare resources.

Consideration of a surgeon's overall practice pattern may provide some context to subjective preferences for the choices of surgical setting we observed. In Ontario, it appears that referrals for CTR are directed primarily

Table 2. Average cost* per case based on combination of surgical setting and anesthetic technique

Cost Category	OR-GA	OR-IVRA	OR-LA	MS-LA
Preoperative investigations	$48.68 ± 31	$30.38 ± 35	$43.30 ± 30	$0.00 ± 0
Intraoperative costs				
Nursing	$67.16 ± 30	$73.53 ± 22	$33.68 ± 10	$27.16 ± 6
Medications	$9.87 ± 7	$4.77 ± 7	$6.09 ± 3	$1.47 ± 0
Anesthetist	$111.25 ± 40	$116.40 ± 27	$97.04 ± 23	$0.00 ± 0
Subtotal	$188.28 ± 73	$194.70 ± 42	$136.81 ± 26	$28.63 ± 6
Postoperative costs (PACU and DCU)				
Nursing	$69.14 ± 25	$55.51 ± 36	$40.14 ± 17	$0.00 ± 0
Medications	$1.36 ± 2	$0.30 ± 1	$0.15 ± 0.4	$0.00 ± 0
Subtotal	$70.50 ± 26	$55.81 ± 36	$40.29 ± 17	$0.00 ± 0
Total average cost per case	$307.47 ± 94	$280.90 ± 73	$220.40 ± 50†	$28.62 ± 6‡

OR-GA = operating room with general anesthetic; OR-IVRA = operating room with intravenous regional anesthetic; OR-LA = operating room with local anesthetic and sedation; MS-LA = minor surgery with local anesthetic, no sedation.

*All values in Canadian dollars, average cost ± standard deviation. Nursing labour costs based on $40.22 per hour in 2005; assumes nurse-to-patient ratios of 2:1 for the formal OR, 1:1 for the post-operative anesthetic care unit (PACU) and 1:4 for the day surgery unit (DSU).

†Total cost significantly lower than the other two anesthetic techniques in the OR ($p < .001$).

‡Total cost significantly lower than other three combinations of surgical setting and anesthetic technique ($p < .001$).

Table 3. Average time to discharge (minutes) based on combination of surgical setting and anesthetic technique

Time Category	OR-GA	OR-IVRA	OR-LA	MS-LA
Intraoperative times				
Induction of anesthesia	20 ± 7	23 ± 7	18 ± 6	5 ± 6
Surgical procedure	23 ± 19	24 ± 9	6 ± 3	32 ± 7
Post-operative times				
PACU recovery	87 ± 24	75 ± 35	50 ± 19	0
DSU	127 ± 86	95 ± 50	79 ± 36	10 ± 2
Total time procedure room to discharge	257 ± 86	217 ± 64	153 ± 38*	47 ± 9†

OR-GA = operating room with general anesthetic; OR-IVRA = operating room with intravenous regional anesthetic; OR-LA = operating room with local anesthetic and sedation; MS-LA = minor surgery with local anesthetic, no sedation; DSU = day surgery unit; PACU = post-operative anesthetic care unit.

*Total time in hospital significantly lower for OR-LA than other two types of anesthetic in the OR ($p < .001$).

†Total time in hospital significantly lower in MS-LA than other three groups ($p < .001$).

at plastic surgeons as their CTR volumes were 3.6 times the number performed by the orthopedic specialists we surveyed. When one considers plastic surgeons' case mix, it is apparent that a large proportion of their surgeries lend themselves to a minor surgical setting (e.g., skin tumour removals, minor tendon repairs of the hand). Alternatively, most orthopedic surgeons manage cases that require the use of a formal OR (e.g., large joint arthroplasties and soft tissue repairs). Orthopedic surgeons who opt to treat the occasional case of carpal tunnel syndrome likely find it easier to add that case to their regular surgical list for the formal OR rather than attempt to access the queue for minor surgery. The efficient use of a hospital scheduling system would likely preclude occasional access to a minor surgical setting that is being used more frequently by other specialists (e.g., plastic surgeons) with higher case volumes. The reverse is true for plastic surgeons who might seek to move out of minor surgery and into the formal OR for certain procedures. This hypothesis is borne out to some extent by the percentage of surgeons reporting "limited access" to a particular surgical setting as having some influence over their choice of surgical venue (see Table 1).

Given the diversity of medical education, clinical experience and surgical training undertaken by the various specialists, their comfort level with alternative anesthetic techniques and the presence (or absence) of an anesthetist is also likely to vary. Recent Canadian studies by Leblanc et al. (2007) and Lalonde et al. (2005) indicate a growing trend among plastic surgeons to perform CTR surgeries using a wide-awake approach with pure local anesthetic (no sedation, no tourniquet and no anesthetist). The survey by Leblanc et al. (2007) reported that 73% of plastic surgeons performed the majority of CTR surgeries (>95%) without an anesthesia provider present. Patient safety does not appear to be compromised, and the absence of an anesthetist considerably reduces the costs associated with the procedure. It also frees up that resource to be used elsewhere. However, surgeons who are in the habit of using the formal OR tend to have an anesthetist present for most of their cases; as a result, they have greater flexibility in the choice of anesthetic technique used. These surgeons are more likely focused on simply getting the procedure done rather than on considering the cost implications of using these resources for smaller, low-risk procedures.

It is of the utmost economic importance for medical institutions to effectively schedule and efficiently use expensive surgical resources. Yet variations in training, case mix and comfort level invite surgeons to use their professional discretion in determining the use of surgical setting and anesthetic for CTR surgery. The current approach to treating carpal tunnel syndrome appears to lack the scientific norms and clinical standards that might limit a specialist's practice options and thus reduce the variability in practices that can increase costs (Graham 2006a; Strum et al. 2000; Watts and McEachan 2006). CTR procedures appear to be slowly moving out of the OR and into a minor surgical setting for a subset of surgeons. The benefits of this approach – field sterility versus full sterility, fewer nursing resources, local anesthetic with the optional attendance of an anesthesiologist and higher patient turnover – make it a more accessible and less expensive combination of surgical setting and anesthetic technique. Yet these benefits do not appear to have translated into widespread adoption of a standardized practice for routine open CTR procedures.

Many surgeons are aware of the scientific evidence that supports the development of standardized diagnostic criteria and approaches to surgical management of carpal tunnel syndrome. However, more is required to encourage surgeons to make clinical choices that are efficient and cost-effective. Providing a review of their own practice styles, monitored against the practices of other surgeons in their local catchment, could help to inform their personal preferences and modify their clinical policies to reduce practice variations. Moreover, funnelling referrals to a more centralized group of specialists who can agree on a minor surgical practice can help to decrease the demand for expensive hospital resources without sacrificing the delivery of surgical services.

Volume-driven "centres of excellence" for common, low-risk surgical procedures have proven to be model programs for achieving high efficiency and improved patient flow while simultaneously containing costs. The integrated approach to cataract surgery is a prime example. Much like CTR surgery, surgeons initially performed cataract surgery in a formal OR under general anesthetic. As surgical techniques began to evolve, the procedure moved to a minor surgical setting. Today's cataract procedure takes five to 10 minutes under topical anesthetic and requires no sutures (Tayfour 2006). Centralizing these high-demand surgical volumes into single centres with a standardized approach supports economies of scale and its associated benefits: the centralized use of instrumentation unique to the procedure, the centralization of surgeons and staff, the refinement of surgical techniques and more efficient and consistent preoperative and post-operative procedures that both improve the patient experience and offer a higher degree of control over discharge times and resources.

Allowing variability in the choice of surgical setting and anesthetic technique for simple, low-risk procedures increases costs by impacting both the under- and over-utilization rates of expensive surgical resources. It also precludes the implementation of an optimal "gold standard" treatment for patients. The question becomes this: are policy makers and administrators providing the right facilities, processes and information to allow surgeons to gain professional consensus on the preferred place and form of treatment? Given that surgeon preference is a primary driver in the choice of surgical setting and anesthetic technique, more work is required to concentrate carpal tunnel

syndrome referral volumes across a focused number of specialists who are willing to modify their practices in support of standardized approaches that consider both optimizing clinical outcomes and minimizing relative costs. Policy makers and administrators who are burdened with the management of healthcare dollars should recognize that surgeons' differing opinions on the need to use particular clinical services and resources have as much influence over total costs to the healthcare system as do the prevalence rates of disease or the service demands of patients. HQ

Acknowledgements

We thank Dr. Farid Guirguis, Dr. Vivek Panchapakesan and Miss Andreia Carvalho for their support and input on this project.

References

Boden, S.D., T.A. Einhorn, T.S. Morgan, L.L. Tosi and J.N. Weinstein. 2005. "An AOA Critical Issue: The Future of the Orthopaedic Surgeon – Proceduralist or Keeper of the Musculoskeletal System?" *Journal of Bone and Joint Surgery* 87A(12): 2812–21.

Dexter, F., J. Aker and W.A. Wright. 1997. "Development of a Measure of Patient Satisfaction with Monitored Anesthesia Care: The Iowa Satisfaction with Anesthesia Scale." *Anesthesiology* 87(4): 865–73.

Fung, D., M. Cohen, S. Steward and A. Davies. 2005. "Can the Iowa Satisfaction with Anesthesia Scale Be Used to Measure Patient Satisfaction with Cataract Care Under Topical Local Anesthesia and Monitored Sedation at a Community Hospital?" *Anesthesia & Analgesia* 100(6):1637–43.

Graham, B. 2001. *Carpal Tunnel Syndrome* [Medical Discussion Paper]. Toronto, ON: Workers Safety and Insurance Appeals Tribunal.

Graham, B., G. Regehr, G. Naglie and J.G. Wright. 2006a. "Development and Validation of Diagnostic Criteria for Carpal Tunnel Syndrome." *Journal of Hand Surgery* 31A(6): 919.e1–e7.

Graham, B., L. Dvali, G. Regehr and J.G. Wright. 2006b. "Variations in Diagnostic Criteria for Carpal Tunnel Syndrome among Ontario Specialists." *American Journal of Industrial Medicine* 49: 8–13.

Health Council of Canada. 2009. Value for Money: Making Canadian Health Care Stronger. Ottawa, ON: Author. Retrieved March 9, 2009. <http://www.healthcouncilcanada.ca/docs/rpts/2009/HCC_VFMReport_WEB.pdf>.

Lalonde, D., M. Bell, G. Sparkes, K. Denkler and P. Chang. 2005. "A Multicenter Prospective Study of 3,110 Consecutive Cases of Elective Epinephrine Use in the Fingers and Hand: the Dalhousie Project Clinical Phase." *Journal of Hand Surgery* 30(A): 1061–67.

Leblanc, M.R., J. Lalonde and D.H. Lalonde. 2007. "A Detailed Cost and Efficiency Analysis of Performing Carpal Tunnel Surgery in the Main Operating Room versus the Ambulatory Setting in Canada." *Hand* 2: 173–78.

Manktelow, R.T., P. Binhammer, L.R. Tomat, V. Bril and J.P. Szalai. 2004. "Carpal Tunnel Syndrome: Cross-Sectional and Outcome Study in Ontario Workers." *Journal of Hand Surgery* 29A(2): 307–17.

Ministry of Health and Long-Term Care. 2007. Report of the Neurosurgery Expert Panel: December 2007. Toronto, ON: Author. Retrieved December 22, 2008. <http://www.health.gov.on.ca/transformation/waittimes/providers/reports/neuro_rep_

Strum, D.P., A.R. Sampson, J.H. May and L.G. Vargas. 2000. "Surgeon and Type of Anesthesia Predict Variability in Surgical Procedure Times. *Anesthesiology* 92(5): 1454–66.

Tayfour, F. 2006. "Maximizing Efficiency in Cataract Surgery: A Model Program." *Healthcare Quarterly Case Study Library.* Retrieved December 18, 2008. <http://www.longwoods.com/product.php?productid=18162&page=1>.

Watts, A.C. and J. McEachan. 2006. "Carpal Tunnel Syndrome in Men." Current Orthopaedics 20: 294–98.

Wennberg, J.E. 1984. "Dealing with Medical Practice Variations: A Proposal for Action." *Health Affairs* 3(2): 6–32.

About the Authors

Amr ElMaraghy, MD, FRCSC, is an upper extremity orthopedic surgeon at St. Joseph's Health Centre in Toronto, Ontario, and an assistant professor in the Division of Orthopaedic Surgery, Department of Surgery at the University of Toronto.

Moira W. Devereaux, MScPT, is a registered physical therapist and researcher in the field of orthopedic surgery and a lecturer in the Division of Rehabilitation Sciences, Department of Physical Therapy at the University of Toronto. She can be contacted at 416-530-0400 or by e-mail at mwdevereaux@earthlink.net.