

# Robotic thoracic surgery in Canada: Are patients willing to pay out of pocket?

Yogita S. Patel, BSc  
Megan Kay, BSc  
Isabella F. Churchill, MSc  
Kerrie A. Sullivan, MSc  
Yaron Shargall, MD  
Bobby Shayegan, MD  
Anthony Adili, MD  
Wael C. Hanna, MDCM, MBA

Accepted Jan. 18, 2022

## Correspondence to:

W. Hanna  
Department of Surgery, Division of  
Thoracic Surgery  
St. Joseph's Healthcare Hamilton  
50 Charlton Ave. East, Suite T-2105F  
Hamilton ON L8N 4A6  
hannaw@mcmaster.ca

**Cite as:** *Can J Surg* 2022 October 12;  
65(5). doi: 10.1503/cjs.021721

## SUMMARY

Robotic-assisted thoracoscopic surgery (RTS) is safe and effective, but is associated with high capital and operating costs that are not reimbursed by the Canadian government. Currently, patients have access to RTS only when it is supported by research or philanthropic funds. In a recent study, we assessed the extent of patient-reported satisfaction with RTS, whether patients would have been willing to pay out of pocket for it, and what factors were associated with patients' willingness to pay. Many patients (290 of 411 [70.56%]) stated that they would have paid the additional \$2000 to supplement the government health care coverage to have access to RTS. Factors found to be significantly associated with participants' willingness to pay were an annual income of \$60 000 or more ( $p = 0.034$ ), private insurance coverage ( $p = 0.007$ ), overall experience with RTS rated as 8 or higher out of 10 ( $p < 0.001$ ), and overall postoperative postdischarge experience rated as satisfying or very satisfying ( $p = 0.004$ ).

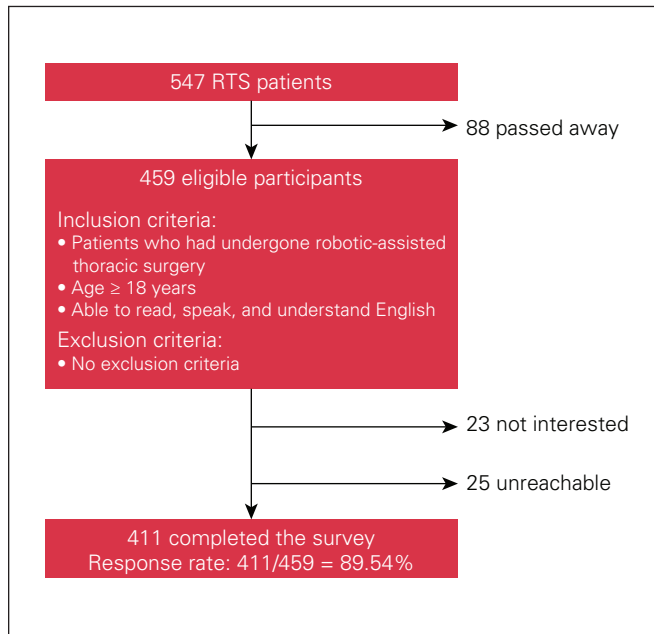
**R**obotic-assisted thoracoscopic surgery (RTS) is a minimally invasive platform for lung cancer surgery that has been demonstrated to be safer, more effective, and associated with more favourable patient outcomes than thoracotomy.<sup>1</sup> However, RTS is associated with a high capital cost of purchase (\$2 million to \$4 million), and additional ongoing operating costs (\$2.9 million/7 yr).<sup>2</sup> To date, there are 30 surgical robots operating in 14 Canadian cities, performing about 6000 operations annually.<sup>3</sup> Currently, RTS is not funded by the Canadian public health care system, and its existence depends solely on philanthropic and research funds, limiting patient access to this technology.

In a recent study, we hypothesized that Canadian patients who have undergone RTS at a centre where the procedure costs were covered by research or philanthropic funding would have been willing to contribute a \$2000 supplemental payment (incremental cost per case for RTS) out of pocket to gain access to this technology.

## SURVEY

All patients who underwent RTS for early-stage lung cancer at our tertiary care centre from January 2014 to July 2020 were invited to participate in a short telephone survey between August 2020 and February 2021. Patients were asked about their demographic characteristics, experience with RTS, and willingness to contribute to the cost of RTS (Appendix 1, available at [www.canjsurg.ca/lookup/doi/10.1503/cjs.021721/tab-related-content](http://www.canjsurg.ca/lookup/doi/10.1503/cjs.021721/tab-related-content)).

Of the 459 eligible patients who were contacted, 411 (89.54%) participated in the survey (Figure 1). The mean age of patients at surgery was  $65.44 \pm 10.27$  years, and 241 (58.64%) participants were female (Table 1).



**Fig. 1.** Response rate flow diagram. RTS = robotic-assisted thoracoscopic surgery.

On a scale of 1 (poor) to 10 (excellent), 353 (85.89%) of the respondents rated their overall experience with RTS as 8 or higher. On a 5-point Likert scale ranging from “too short” to “too long,” 223 (54.26%) rated the wait time for RTS as “adequate.” With regards to overall postoperative experience, 365 (88.81%) were either satisfied or very satisfied with their hospital admission, and 354 (86.13%) were either satisfied or very satisfied with their recovery postdischarge (Table 2).

Most respondents (333 [81.02%]) expressed a willingness to pay out of pocket for RTS. A somewhat smaller majority (290 [70.56%]) stated that, in the absence of research and philanthropic funds, they would have paid the additional \$2000 to supplement the government health care coverage in order to have access to RTS, while the remainder of those who expressed a willingness to pay out of pocket (43 [10.46%]) stated that they would have contributed between \$1 and \$1499 (Figure 2). However, 78 (18.98%) participants stated that they would not have been willing to contribute toward the cost of their RTS, and this includes patients who had a negative surgical and/or postoperative experience, low annual income

Characteristic	No. (%)*
Age at surgery, mean ± SD, yr	65.44 ± 10.27
Gender	
Male	170 (41.36)
Female	241 (58.64)
Ethnicity	
White	386 (93.92)
Non-white	25 (6.08)
Education level	
Elementary school	79 (19.22)
High school	169 (41.12)
College	74 (18.00)
University undergraduate	38 (9.25)
University graduate	24 (5.84)
Professional school	19 (4.62)
Prefer not to answer	8 (1.95)
Annual income at the time of surgery	
\$0 –\$19999	82 (19.95)
\$20000–\$39999	105 (25.55)
\$40000–\$59999	70 (17.03)
\$60000–\$79999	34 (8.27)
\$80000–\$99999	18 (4.38)
≥ \$100000	21 (5.11)
Prefer not to answer	81 (19.71)
Insurance at the time of surgery	
OHIP	245 (59.61)
Private	4 (0.97)
Both OHIP and private	160 (38.93)
No insurance	2 (0.49)

OHIP = Ontario Health Insurance Plan; SD = standard deviation.  
\*Unless indicated otherwise.

Rating	No. (%)
Overall experience with robotic surgery	
1 – poor	6 (1.46)
2	1 (0.24)
3	0 (0)
4	2 (0.49)
5 – moderate	14 (3.41)
6	6 (1.46)
7	29 (7.06)
8	65 (15.82)
9	55 (13.38)
10 – excellent	233 (56.69)
Experience with the wait time for robotic surgery	
Too short	3 (0.73)
Short	172 (41.85)
Adequate	223 (54.26)
Long	9 (2.19)
Too long	4 (0.97)
Overall postoperative experience in the hospital	
Very unsatisfied	7 (1.70)
Unsatisfied	10 (2.43)
Neutral	29 (7.06)
Satisfied	158 (38.44)
Very satisfied	207 (50.36)
Overall postoperative experience after discharge from the hospital	
Very unsatisfied	6 (1.46)
Unsatisfied	22 (5.35)
Neutral	29 (7.06)
Satisfied	153 (37.23)
Very satisfied	201 (48.91)

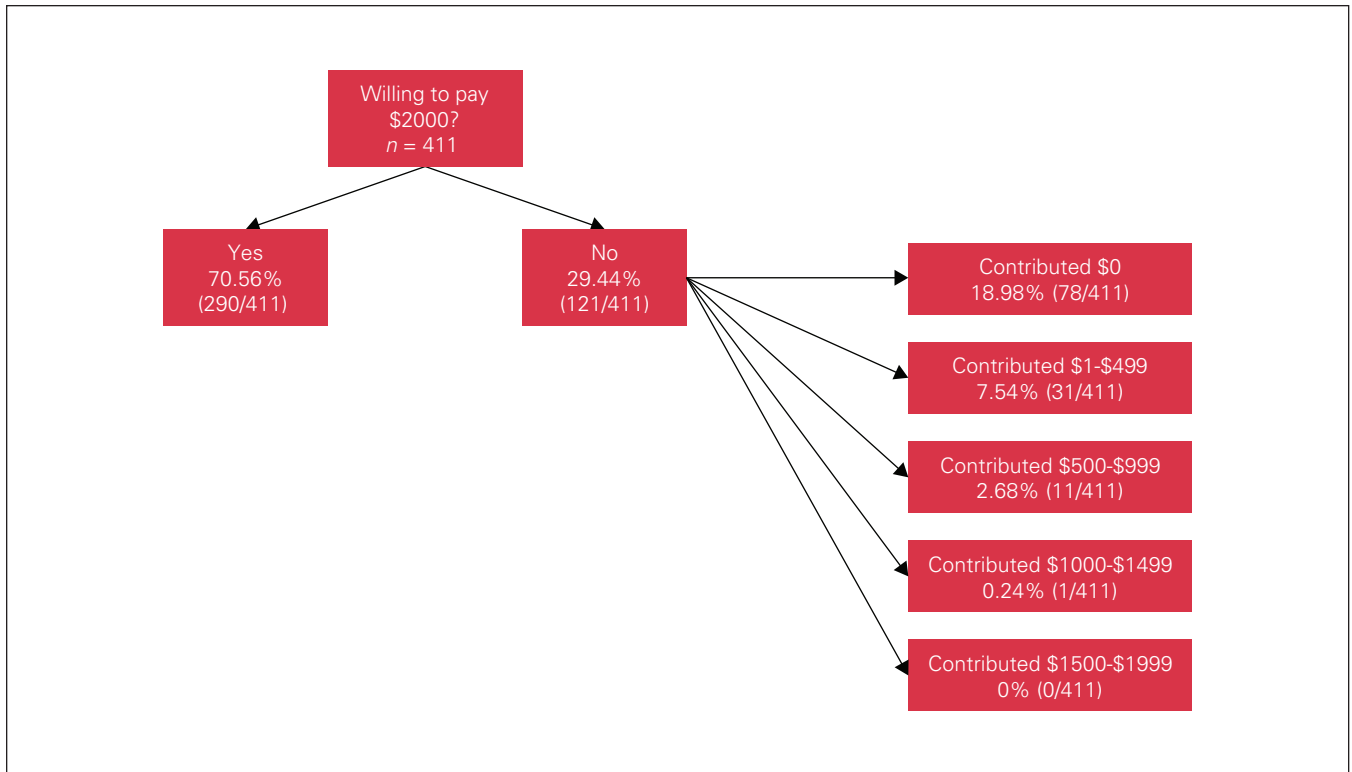


Fig. 2. Breakdown of willingness to pay, willingness to contribute, and contribution amount.

levels, and/or lack of private insurance coverage (Table 3). The majority of participants (341 [82.97%]) stated that they would not have paid to shorten their wait time for RTS. This suggests that although most patients believe it is justifiable to pay to access nonfunded technology, most of them still believe in the equal accessibility of the Canadian health care system.

## DISCUSSION

Factors we found to be significantly associated with participants' willingness to pay a fee for RTS were an annual income of \$60 000 or more at the time of surgery ( $p = 0.034$ ), private insurance coverage at the time of surgery ( $p = 0.007$ ), an overall experience with RTS rated as 8 or higher out of 10 ( $p < 0.001$ ), and an overall postoperative experience postdischarge from the hospital rated as satisfying or very satisfying ( $p = 0.004$ ) (Table 4). The socioeconomic association suggests that patients with higher income levels are more willing to pay. This could be related to an improved awareness of health care innovations or a better ability to afford health care costs. Participants who had private insurance coverage at the time of surgery also seemed to be more willing to pay, likely because they are accustomed to receiving upgraded health care options in general. The associations with positive surgical and postdischarge experiences suggest that patients place value on their

experience receiving treatment as well as on the outcomes of treatment. Age at surgery, gender, ethnicity, education level, wait times, and overall postoperative experience in hospital were not associated with patients' willingness to pay.

Although RTS is associated with significant capital and operating costs, which are borne by the host institution, several Canadian hospitals have chosen to invest in robotic surgery because it has been shown to be cost-effective at high-volume centres.<sup>4,5</sup> In a review of Canadian prostatectomy data, Parackal and colleagues found that the robotic platform is cost-effective with an incremental cost per quality-adjusted life years gained ratio of \$25 704 and recommended its uptake in prostate cancer surgery.<sup>4</sup> In a microcosting analysis of RTS resections for lung cancer, Kaur and colleagues found that RTS compares favourably to video-assisted thoracoscopy.<sup>5</sup>

Although many of the patients in our study would be willing to pay for access to RTS for lung cancer, we do not believe that patients in the Canadian health care system should be made to pay for cancer surgery. In contrast, we believe that the willingness to pay is a surrogate for the patients' desire to have access to this technology. This study demonstrates that patient preferences and experiences are important factors that funders in the Canadian health care system should consider when making decisions about whether to fund new technology and treatment techniques.

**Table 3. Characteristics of patients willing to pay \$1–\$2000 for robotic-assisted thoracoscopic surgery compared with patients unwilling to contribute**

Characteristic	Unwilling to pay, no. (%) <i>n</i> = 78	Willing to pay \$1–\$2000, no. (%) <i>n</i> = 333	<i>p</i> value
Age at surgery			0.851
≥ 65	45 (57.69)	196 (58.86)	
< 65	33 (42.31)	137 (41.14)	
Gender			0.563
Male	30 (38.46)	140 (42.04)	
Female	48 (61.54)	193 (57.96)	
Ethnicity			0.509
White	72 (92.31)	314 (94.29)	
Non-white	6 (7.69)	19 (5.71)	
Insurance at the time of surgery			0.009
Solely private, both private and OHIP	21 (26.92)	143 (42.94)	
Solely OHIP, no insurance	57 (73.08)	190 (57.06)	
Overall experience with robotic surgery			< 0.001
< 8 out of 10	28 (35.90)	30 (9.01)	
≥ 8 out of 10	50 (64.10)	303 (90.99)	
Experience with the wait time for robotic surgery			0.353
Too short, short, long, too long	32 (41.03)	156 (46.85)	
Adequate	46 (58.97)	177 (53.15)	
Overall postoperative experience in the hospital			0.012
Very unsatisfied, unsatisfied, neutral	15 (19.23)	31 (9.31)	
Satisfied, very satisfied	63 (80.77)	302 (90.69)	
Overall postoperative experience after discharge from the hospital			0.009
Very unsatisfied, unsatisfied, neutral	18 (23.08)	39 (11.71)	
Satisfied, very satisfied	60 (76.92)	294 (88.29)	
Education level*			0.238
Elementary school, high school	50 (67.57)	198 (60.18)	
Postsecondary (college, university undergraduate, university graduate, professional school)	24 (32.43)	131 (39.82)	
Annual income at the time of surgery†			0.035
\$0–\$39999	37 (69.81)	150 (54.15)	
≥ \$40000 or more	16 (30.19)	127 (45.85)	

OHIP = Ontario Health Insurance Plan.  
 \*Patients who chose “prefer not to answer” were removed from the analysis (patients unwilling to pay, *n* = 74; patients willing to pay \$1–\$2000, *n* = 329).  
 †Patients who chose “prefer not to answer” were removed from the analysis (patients unwilling to pay, *n* = 53; patients willing to pay \$1–\$2000, *n* = 277).

## CONCLUSION

Most Canadian patients who have experienced RTS at a high-volume centre would have been willing to pay a supplemental fee out of pocket in order to have access to RTS technology. At a time when patients are being recognized as important stakeholders in health care policy, our survey results provide important insights into the conversation about the role and funding of robotic surgery in the Canadian health care system.

**Affiliations:** From the Division of Thoracic Surgery, Department of Surgery, McMaster University / St. Joseph’s Healthcare Hamilton, Hamilton, Ont. (Patel, Kay, Churchill, Sullivan, Shargall, Hanna); the Department of Health Research Methods, Evidence and Impact, McMaster University, Hamilton, Ont. (Churchill, Sullivan, Hanna); the

Division of Urology, Department of Surgery, McMaster University / St. Joseph’s Healthcare Hamilton, Hamilton, Ont. (Shayegan); the Division of Orthopedic Surgery, Department of Surgery, McMaster University / St. Joseph’s Healthcare Hamilton, Hamilton, Ont. (Adili).

**Competing interests:** W. Hanna reports a grant and stock or stock options from Intuitive Surgical, consulting fees from AstraZeneca, and honoraria from Minogue Medical. He also participates on the advisory board of Roche/Genentech. No other competing interests were declared.

**Contributors:** All authors contributed substantially to the conception, writing and revision of this article and approved the final version for publication.

**Content licence:** This is an Open Access article distributed in accordance with the terms of the Creative Commons Attribution (CC BY-NC-ND 4.0) licence, which permits use, distribution and reproduction in any medium, provided that the original publication is properly cited, the use is noncommercial (i.e., research or educational use), and no modifications or adaptations are made. See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>

**Table 4. Characteristics of patients willing to pay \$2000 for robotic-assisted thoracoscopic surgery compared with those unwilling to pay**

Characteristic	Willing to pay, no. (%) n = 290	Unwilling to pay, no. (%) n = 121	p value
Age at surgery			0.818
≥ 65	169 (58.28)	72 (59.50)	
< 65	121 (41.72)	49 (40.50)	
Gender			0.991
Males	120 (41.38)	50 (41.32)	
Females	170 (58.62)	71 (58.68)	
Ethnicity			0.458
White	274 (94.48)	112 (92.56)	
Non-white	16 (5.52)	9 (7.44)	
Insurance at the time of surgery			0.007
Solely private, both private and OHIP	128 (44.14)	36 (29.75)	
Solely OHIP, no insurance	162 (55.86)	85 (70.25)	
Overall experience with robotic surgery			< 0.001
< 8 out of 10	25 (8.62)	33 (27.27)	
≥ 8 out of 10	265 (91.38)	88 (72.73)	
Experience with the wait time for robotic surgery			0.887
Too short, short, long, too long	132 (45.52)	56 (46.28)	
Adequate	158 (54.48)	65 (53.72)	
Overall postoperative experience in the hospital			0.061
Very unsatisfied, unsatisfied, neutral	27 (9.31)	19 (15.70)	
Satisfied, very satisfied	263 (90.69)	102 (84.30)	
Overall postoperative experience after discharge from the hospital			0.004
Very unsatisfied, unsatisfied, neutral	31 (10.69)	26 (21.49)	
Satisfied, very satisfied	259 (89.31)	95 (78.51)	
Education level*			0.114
Elementary school, high school	169 (59.09)	79 (67.52)	
Postsecondary (college, university undergraduate, university graduate, professional school)	117 (40.91)	38 (32.48)	
Annual income at the time of surgery†			0.034
\$0–\$59 999	179 (74.90)	78 (85.71)	
≥ \$60 000	60 (25.10)	13 (14.29)	

OHIP = Ontario Health Insurance Plan.  
 \*Patients who chose "prefer not to answer" were removed from the analysis (patients unwilling to pay, n = 117; patients willing to pay \$2000, n = 286).  
 †Patients who chose "prefer not to answer" were removed from the analysis (patients unwilling to pay, n = 91; patients willing to pay \$2000, n = 239).

## References

- Oh DS, Reddy RM, Gorrepati ML, et al. Robotic-assisted, video-assisted thoracoscopic and open lobectomy: propensity-matched analysis of recent premier data. *Ann Thorac Surg* 2017; 104:1733–40.
- Ho C, Tsakonas E, Tran K, et al. *Robot-assisted surgery compared with open surgery and laparoscopic surgery: clinical effectiveness and economic analyses*. Ottawa: Canadian Agency for Drugs and Technologies in Health; 2011 (Technology report no. 137). Available: <http://www.cadth.ca/en/products/health-technology-assessment/publication/2682> (accessed 2011 Sept. 20).
- Robotic Program Locator*. Montreal: Robot Assisted Surgery Patient Education & Engagement; 2021. Available: <https://robotassistedurgery.ca/robotic-program-locator/> (accessed 2021 Mar. 26).
- Parackal A, Tarride JE, Xie F, et al. Economic evaluation of robot-assisted radical prostatectomy compared to open radical prostatectomy for prostate cancer treatment in Ontario, Canada. *Can Urol Assoc J* 2020;14:E350–7.
- Kaur MN, Xie F, Shiwcharan A, et al. Robotic versus video-assisted thoracoscopic lung resection during early program development. *Ann Thorac Surg* 2018;105:1050–7.