

# Disposable flexible cystoscopes for removing double J catheter

## A budget impact analysis

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### ABSTRACT

**INTRODUCTION:** We conducted a budget impact analysis to evaluate the cost of removing double J catheters using single-use flexible digital cystoscopes compared to reusable cystoscopes at the CHU de Québec.

**METHODS:** The UETMIS of CHU de Québec estimated average costs per intervention for both reusable and single-use flexible cystoscopes in the endoscopy room. Costs included purchase, repair, reprocessing, and sterilization for reusable cystoscopes based on data from 2017–2019. For single-use cystoscopes, the unit price and technical platform costs were considered. Annual costs were calculated using the average cost per procedure and the annual volume of double J catheter removals.

**RESULTS:** The average cost per intervention for reusable flexible cystoscopes was estimated at \$148.55, while for single-use digital flexible cystoscopes, it was \$293.38. For 385 annual double J catheter removals, the total cost would be \$57 191.75 with reusable cystoscopes and \$1 12 951.30 with single-use cystoscopes. This represents an additional cost of \$144.83 per procedure or \$55 760 annually when using single-use cystoscopes.

**CONCLUSIONS:** The use of single-use flexible digital cystoscopes for double J catheter removal at CHU de Québec would nearly double the cost per procedure compared to reusable cystoscopes. This cost difference is primarily due to the purchase price of single-use devices. While cystoscope breakage is infrequent, the potential for higher breakage risk during double J catheter removal could reduce the cost differential. Future implementation of patient-focused financing might alter the economic evaluation of single-use cystoscopes.

### INTRODUCTION

Ureteral catheters are used frequently in urology. Usually, they can be extracted by the patient by pulling on a thread that is attached to the catheter. For some patients, the catheter must be extracted by a urologist using a reusable cystoscope in an endoscopy room or an operating room.

Recently, disposable cystoscopes have been developed, like the Isiris<sup>®</sup> from Coloplast or the NeoFlex<sup>™</sup> from Neoscope. There are others on the market, but they have not yet received Health Canada approval.

The flexible Isiris<sup>®</sup> was created especially for the extraction of ureteral catheters. On this cystoscope, there is no working channel; there are only pliers and a channel for irrigation and liquid aspiration. It is possible that tools such as this could reduce the number of reusable cystoscopes breaks of and the need for endoscopy room time to extract ureteral catheters.

We carried out a budget impact analysis to evaluate the unit cost of removing a double J probe in the endoscopy room with a single-use flexible digital cystoscope compared to a reusable one at the CHU de Québec (CHUQ).

### METHODS

The study was conducted by the Unité d'évaluation des technologies et des modes d'intervention en santé (UETMIS) of the CHUQ.

The average costs per intervention of reusable flexible cystoscopes and single-use digital flexible cysto-

## KEY MESSAGES

- Using single-use flexible digital cystoscopes for removing double J catheters would be nearly twice as expensive as reusable cystoscopes.
- For 385 double J catheter removals per year, the additional cost would be approximately \$55 760, primarily driven by the purchase price of single-use cystoscopes.
- Cystoscope breakage is an infrequent event, with only 204 repair requests documented across 19 615 cystoscopies in two financial years.
- While currently not cost-effective, the potential implementation of patient-focused financing in the future might change the economic evaluation of single-use cystoscopes.
- New disposable cystoscopes have been developed specifically for ureteral catheter extraction, potentially offering advantages in reducing maintenance and sterilization complexities.

scopes in the endoscopy room were estimated for the Quebec City university hospitals. For reusable flexible cystoscopes, the purchase cost (cystoscope and forceps for removing double J probes) and repair costs, as well as reprocessing and sterilization costs, were estimated from data collected during the financial years 2017–2018 and 2018–2019. The initial purchase costs of the reusable flexible cystoscopes and the forceps used to remove the double J catheters were transmitted by the procurement department and the outpatient consultation teams.

A six-year depreciation was applied to calculate the annual purchase cost of cystoscopes and a two-year depreciation was applied for forceps. The amortization period of the cystoscopes was determined according to the standardized lifespan as set by the Ministry of Health and Social Services of Quebec. The amortization period of the forceps for removing double J probes comes from an estimate of the useful lifespan recommended by the outpatient consultation teams of the CHUQ. The purchase costs of the sterilization boxes and the video monitor were not included in the calculations.

The Department of Biomedical Technologies identified the total cost of repairs of reusable flexible cystoscopes during the 2017–2018 and 2018–2019 financial years. The costs of reprocessing and sterilization, including the products used and human resources time, was included. The average cost per procedure was estimated for the flexible reusable cystoscopes in three hospitals of the CHUQ: Hôpital de l'Enfant-Jésus (HEJ), Hôtel-Dieu de Québec (HDQ), and Hôpital de Saint-François d'Assise (HSFA).

The average cost per intervention associated with the use of single-use flexible digital cystoscopes for the removal of a double J probe was estimated by considering the unit prices of the Isiris<sup>®</sup> cystoscope and the cost of the technical platform of endoscopy.

The total annual costs for the removal of double J catheters using a reusable flexible cystoscope and with a single-use cystoscope in the endoscopy room were calculated from the average cost per procedure and the annual volume of cystoscopies performed for the removal of a double J probe (data collected between September 16, 2018, and September 16, 2019).

## RESULTS

The estimated cost of purchasing reusable flexible cystoscopes for the cystoscopy rooms of outpatient consultations at the CHUQ is presented in Table 1. The total purchase cost of the 58 cystoscopes currently available at the HDQ, HEJ, and HSFA is \$687 600. Considering cost amortization over six years, the total annual cost of cystoscopes is \$114 600 or \$229 200 over two years. Considering the performance of 19 615 cystoscopies over a period of two years (2017–2019), the average cost per intervention is estimated at \$11.70.

The cost of purchasing the pliers needed to remove a double J probe vary from \$569–\$1200 per unit, depending on the model used. The cost of purchasing the 21 forceps currently available in the cystoscopy rooms of the Quebec university hospitals is \$14 091 or \$7045 per year. The lifespan of pliers is estimated at around two years.

The number of cystoscopies performed with the use of forceps is difficult to estimate, as forceps are not only used for the removal of double J probes but also for performing biopsies or for removing urolithiasis or foreign bodies. Assuming that the 21 clamps were used for the 385 double J catheter removals recorded between September 16, 2017, and September 16, 2018, the average cost per intervention relating to the clamp purchase component would amount to \$18.30.

Note that breakage and repair costs of the clamps would also have to be considered.

The cost estimate for repairs of reusable flexible cystoscopes for the 2017–2018 and 2018–2019 fiscal years is presented in Table 2. Of the 19 615 cystoscopies performed during these two years, 204 requests for repair were documented. The total cost of these repairs is \$738 014, or \$369 007 per year. The average cost of a repair is \$3618. The average cost of cystoscopy repairs is estimated at \$37.60.

At the HDQ, estimates include costs relating to preventive resurfacing, an approximate amount of \$90 000 per year. The unit cost for reprocessing and sterilization of a reusable flexible cystoscope is estimated at \$30.87. The cost of using the technical platform is estimated at \$68.38 per cystoscopy, including \$37.15 for the purchase of single-use equipment and \$31.23 in human resources.

Estimates of the annual cost and the average cost per intervention relating to the use of reusable flexible cystoscopes for the removal of double J probes in the endoscopy room at the Quebec university hospitals is presented in Table 3. The total cost related to the use of reusable flexible cystoscopes is estimated at \$57 191.75 per year, assuming 385 double J catheter removals are performed annually. The estimated average total cost per intervention is \$148.55. Note that the cost related to the use of forceps was not included in the calculations due to the lack of information regarding the number of cystoscopies performed with the use of forceps.

The unit price of a single-use flexible digital cystoscope (Isiris®) is \$225 (excluding taxes and delivery). The reusable video monitor would be on loan from the company. The cost of an intervention for the removal of a double J probe in the endoscopy room with a single-use flexible digital cystoscope is \$293.38 (includ-

**Table 1. Estimate of the average cost per intervention related to the purchase of reusable flexible cystoscopes at the CHU de Québec by hospital, financial years 2017–2018 and 2018–2019**

Hospital	Reusable flexible cystoscope			Intervention (n) <sup>2</sup>	Average cost per intervention (\$)
	n	Total cost of purchase (\$)	Total amortized cost (\$) <sup>1,2</sup>		
HDQ	35	462 000	154 000	7 990	19,30
HEJ	8	105 600	35 200	8 016	4,40
HSFA	15	120 000	40 000	3 609	11,10
<b>Total</b>	<b>58</b>	<b>687 600</b>	<b>229 200</b>	<b>19 615</b>	<b>11,70</b>

<sup>1</sup>Amortization over 6 years (\$). <sup>2</sup>Amortization over two years (2017–2019). Sources: Procurement and contract management department and Urology department of the CHU de Québec HEJ: Hôpital de l'Enfant-Jésus; HSFA: Hôpital de Saint-François d'Assise; HDQ: Hôtel-Dieu de Québec.

**Table 2. Estimate of the average cost of repair per intervention related to the use of reusable flexible cystoscopes at the CHU de Québec per hospital, financial years 2017–2018 and 2018–2019**

Hospital	Total repair cost (\$)	Repair			Intervention	
		n <sup>1</sup>	Average cost per repair (\$)	n <sup>1</sup>	Average cost per repair (\$)	
HDQ	460 857	135	3 414	7 990	5770	
HEJ	164 735	37	4 452	8 016	2060	
HSFA	112 422	32	3 513	3 609	3120	
<b>Total</b>	<b>738 014</b>	<b>204</b>	<b>3618</b>	<b>19 615</b>	<b>3760</b>	

<sup>1</sup>Over two years (2017–2019). Sources: Intéral Management System and Biomedical Technologies Department of the CHU de Québec HEJ: Hôpital de l'Enfant-Jésus; HSFA: Hôpital de Saint-François d'Assise; HDQ: Hôtel-Dieu de Québec.

ing the purchase cost of the cystoscope and the cost of the tray technique) for a total of \$112 951.30 for 385 double J catheter removals carried out annually.

**Table 3. Estimate of the average total cost per procedure and of the total annual cost related to the use of reusable flexible cystoscopes at the CHU de Québec per hospital**

Hospital (n double J catheter removal <sup>1</sup> )	Cost per double J catheter removal				Average total cost per intervention (\$)	Annual total cost (\$)
	Cystoscopes purchase	Cystoscopes reparation	Reprocessing and sterilization	Technical platform		
HDQ (n=103)	19.27	57.68	30.87	68.38	176.20	18 148.60
HEJ (n=161)	4.39	20.55	30.87	68.38	124.19	19 994.59
HSFA (n=121)	11.08	31.15	30.87	68.38	141.48	17 119.08
<b>CHU de Québec (n=385)</b>	<b>11.68</b>	<b>37.62</b>	<b>30.87</b>	<b>68.38</b>	<b>148.55</b>	<b>57 191.75</b>

<sup>1</sup>Number of double J catheters removed at HSFA, HDQ, and HEJ between September 16, 2018, and September 16, 2019. HEJ : Hôpital de l'Enfant-Jésus; HSFA : Hôpital Saint-François d'Assise; HDQ : Hôtel-Dieu de Québec.

## DISCUSSION

More than 10 500 cystoscopies are performed annually in the endoscopy rooms of the CHUQ, including 3.6% removals of double J probes.

Analysis of financial data suggests that the costs associated with single-use digital flexible cystoscopes to remove double J probes in the endoscopy room would be nearly double those associated with the use of reusable flexible cystoscopes. Considering the costs of using the fleet of available flexible cystoscopes (costs of purchases, repairs, reprocessing, and the endoscopy technical platform), it would cost \$144.83 more per intervention to remove the double J probes with a single-use flexible digital cystoscope at the CHUQ, representing an annual amount of \$55 760 for the removal of 385 double J probes per year.

Assuming that the breakage rate attributable to the removal of double J probs corresponds to the proportion of interventions carried out in cystoscopy for this same activity (3.6%), it would be necessary to subtract from the previous total amount the costs of repairs, which amount to \$13 284 per year. The cost differential between the use of single-use and reusable cystoscopes could be less if we assume that the risk of cystoscope breakage is higher during double J catheter removal procedures due to the insertion of pliers in the working channel and the level of physician experience.

We found two economic studies focused on the evaluation of costs related to the removal of a double J probe with a single-use digital flexible cystoscope in a clinical context other than an endoscopy room or an operating room. In one study, savings from the introduction of single-use cystoscopes were solely linked to reduced operating room costs.<sup>1</sup> These results cannot be applied directly to the context of the CHUQ since cystoscopy activities were already been transferred from the operating room to outpatient consultations in 2017.

The other study was carried out in a health system where hospitals are paid for activity.<sup>2</sup> In this context, the release of time slots in endoscopy for the removal of double J probes has made it possible to increase the number of interventions and the income generated annually in cystoscopy. The increase in revenue was much greater than the additional costs related to the purchase of single-use cystoscopes. These results would not be applicable to the current Quebec context; however, a patient-focused financing method could soon be implemented, representing an opportunity for a different analysis of improved access to care.

Another aspect that would be important to take into consideration is the environmental impact of

single-use cystoscopes. Currently, they generate 7.4% less procedural waste than reusable models (622 g vs. 671.5 g per case) but produce 353% higher lifecycle carbon emissions (2.40 kg vs. 0.53 kg CO<sub>2</sub>) due to manufacturing and incineration impacts. While single-use devices eliminate sterilization water needs, reusable systems conserve 235 200 L over their operational lifespan, highlighting critical tradeoffs between immediate resource use and long-term environmental burdens.<sup>3,4</sup> In a more recent literature review on this subject, the authors demonstrated disparate results depending on the calculation method used for carbon footprint analysis; still, the results trend toward a lower environmental impact of single-use devices.<sup>5</sup>

## Limitations

Certain limitations related to this evaluation should be considered when interpreting the results.

Data were collected manually from information recorded in the admission, discharge, and transfer management systems (for the volume of removal of double J catheters by cystoscopy) and the internal database (volume and costs of repairs) to estimate the volumes of intervention and breakage. Other cost components, such as those associated with the administrative management of cystoscopes (ordering, transport, storage, disposal), purchase and repair costs of forceps, and video monitors, were not considered.

Another limitation to take into consideration would be the cost of the single-use cystoscope. In this budget impact analysis, we compared the model Isiris<sup>®</sup> to reusable cystoscopes with a selling price of \$225 from 2017–2020. As of now, there is no other single-use cystoscope with integrated pliers, but this price will likely change in the future, as initial patents expire and more cystoscopes become available. Thus, this analysis will have to be revised.

Finally, for clinics performing fewer procedures, the initial capital outlay for reprocessing equipment and facility space costs for sterilization areas should be factored into the cost analysis. This consideration is particularly relevant for rural practices and new surgical centers, where the volume of procedures may not justify the fixed costs associated with reusable equipment.

Unfortunately, in our report, we did not explicitly state how many reusable cystoscope procedures are needed to be cost-effective compared to disposable ones; however, according to the 2022 study by Kim et al, reusable cystoscopes become more cost-effective than single-use cystoscopes if more than 1265 procedures per year are performed.<sup>6</sup> In this study, the cost of

the cystoscopes without pliers was similar to the cost of our cystoscopes with pliers. Therefore, the decision between reusable and disposable cystoscopes should be based on the specific circumstances of each clinic.

## CONCLUSIONS

According to the results of this financial impact analysis, the use of a single-use flexible digital cystoscope in the endoscopy room for the removal of double J probes would be associated with an increase in the per-procedure cost equivalent to almost double the current cost estimated with the use of reusable flexible cystoscopes.

This difference is mainly explained by the purchase cost of single-use cystoscopes and the impact of the high number of cystoscopies performed each year at the Quebec university hospitals on the unit cost of using reusable cystoscopes. The data collected as part of this report indicate that the occurrence of cystoscope breakage is an infrequent event, and thus, the cost of repairs per intervention with reusable cystoscopes remains low.

The available data does not make it possible to determine whether the removal of double J probes constitutes a significant source of breakage, thus limiting the possibility of making assumptions about reducing repair costs in connection with the use of single-use cystoscopes; however, the cost differential between the

use of single-use and reusable cystoscopes could be less if we assume that the risk of cystoscope breakage is higher during double J catheter removal procedures.

The decision to adopt single-use cystoscopes should balance financial, clinical, and environmental considerations.

COMPETING INTERESTS: The authors do not report any competing personal or financial interests related to this work.

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