Cost-Effectiveness Analysis of the Reusable and Disposable Bronchoscope in the Intensive Care Unit

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Introduction

- Bronchoscopes can pass on infection, prompting federal initiatives for protocols and regulation.
- A disposable bronchoscope (DB) can perform similar functions as a reusable bronchoscope (RB) for simple procedures such as secretion removal and bronchoalveolar lavage (BAL).
- There are no criteria for when to favor DB vs RB.

Specific Aims

- Assess the cost-effectiveness of DB vs RB for bedside bronchoscopy in the ICU.
- Assess the impact of repair rates, repair costs, wages, deployment times, and other variables in the use of RB.
- Establish parity thresholds for nosocomial infection cost and rate.

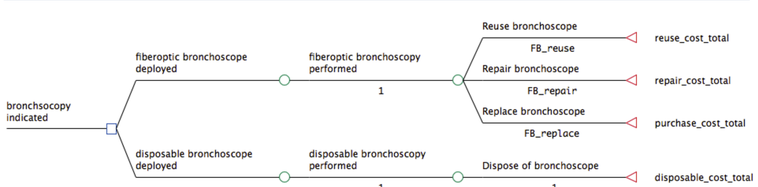
Methods

Study Criteria
Bronchoscopies done in the ICU (n = 137).
Diagnostic (BAL) or therapeutic (secretion removal).
Data collected between June 2014 and October 2015.

Table 1. Equipment and Wage Costs (in USD) *	
Disposable bronchoscope	300
Reusable bronchoscope	37,200
Single repair of reusable bronchoscope (mean)	1,273
LED screen for disposable bronchoscope	3,000
Cleaning-per-use of reusable bronchoscope (mean)	17.83
Respiratory therapist hourly wage	27.78
Respiratory technician hourly wage	23.90

* All costs taken from publically available sources.

Figure 1. Decision Tree for Deployment of RB versus DB



Results

Table 2. Patient Characteristics		
Characteristic	**Reusable (n = 78)**	**Disposable (n = 57)**
Age (years ± SD)	53.4 ± 18.5	50.0 ± 19.7
Female – no. (%)*	42 (53.8)	20 (35.1)
Type of bronchoscopy		
Diagnostic	36 (46.2)	26 (45.6)
Therapeutic	42 (53.8)	31 (54.4)
Isolation precautions – no. (%)		
No precautions	57 (73.1)	47 (82.5)
Contact	18 (23.1)	10 (17.5)
Droplet	5 (6.4)	1 (1.8)
Airborne	0 (0)	1 (1.8)

* Significantly different (P = 0.031), calculated using a 2-tailed z test.

Table 3. Bronchoscopy Time Intervals				
Time Interval (min)	**Reusable (n = 80)**	**Disposable (n = 57)**	**P value†**	**95% Confidence Interval†**
Start of deployment to start of bronchoscopy	43.3 ± 38.2	29.9 ± 17.3	0.015	2.6 to 24.1
Start of deployment to completion of cleanup	88.4 ± 51.4	51.5 ± 21.0	< 0.0001	22.7 to 51.2
Duration of bronchoscopy	15.9 ± 20.0	10.3 ± 5.8	0.043	0.2 to 11.0
Duration of cleanup	29.3 ± 15.0	11.3 ± 5.2	< 0.0001	13.9 to 22.2

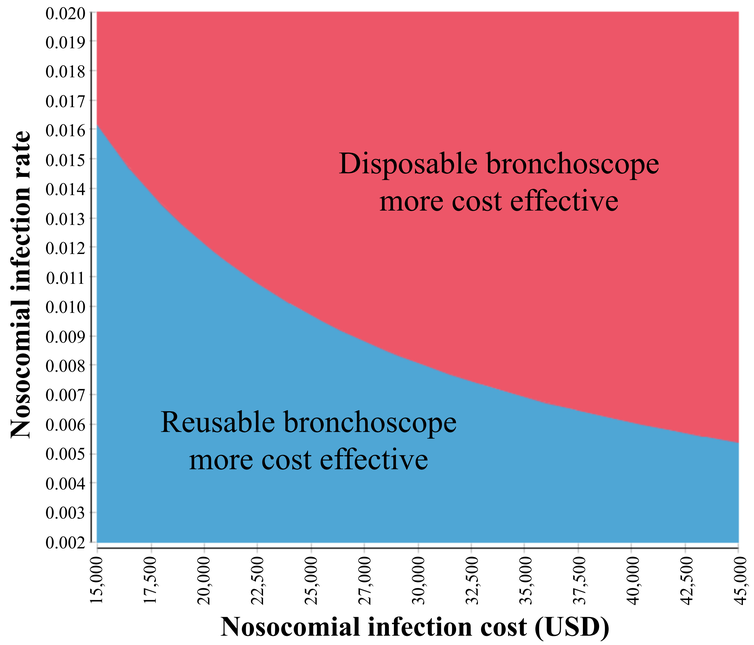
* All values reported as mean ± SD.
† P values and 95% confidence intervals calculated using an unpaired 2-tailed t test.

Table 4. Bronchoscopy Baseline, Boundary and Parity Values (USD)		
	Reusable	**Disposable**
At baseline*	291	333
At repair rate = 0%	274	333
At repair rate = 4.4%	333	333
At nosocomial infection rate = 0%	93	333
At nosocomial infection rate = 1.2%	333	333
At nosocomial infection cost = 24,261	333	333

* Baseline values: repair rate = 1.1%; nosocomial infection rate = 1.0%; nosocomial infection cost = 20,000. Baseline values are used unless a single variable is tested as noted above.

Results (continued)

Figure 2. Cost-Effectiveness Frontier for Nosocomial Infection Rate versus Cost



Strengths and Limitations

- Our data define a range of rates and costs at which DB is more effective than RB in avoiding nosocomial infection.
- Our model may be applied to a given center's internal data.
- Our sample size is small.
- Inherent difficulties in assessing workflow of bedside bronchoscopy.
- Clinical reasons to prefer one modality over another.

Conclusions

- DB may prove useful in scenarios that require rapid deployment and reduced bronchoscopy procedure time.
- DB is cost-effective in environments with a procedure-related risk of nosocomial infection greater than 0.5% to 1.6%.
- Internal repair rates of RB may factor into consideration of using DB but are likely less important than nosocomial infection rate in influencing cost-effectiveness.