Intersurgeon comparison of quality of surgical care by a positive deviance method

Rizwan Awan, Jelena Ivanovic, MSc, Andrew J.E. Seely, MD, PhD, FRCSC

Department of Health Sciences, University of Ottawa, Department of Epidemiology, University of Ottawa, and Division of Thoracic Surgery, The Ottawa Hospital

Introduction

There is growing attention regarding quality of surgical care. An established quality improvement (QI) strategy for thoracic surgery implemented at The Ottawa Hospital (TOH) is the positive deviance (PD) approach. PD is based on the principle that the uncommon beneficial health behaviours of certain individuals enable them to attain greater success than their peers. The indicators of success in quality of surgical care have been identified to be hospital length of stay (LOS), operating time, readmission rates, and complication rates based on the Clavien-Dindo classification schema, and these indicators are integrated into TOH's TM&M (Thoracic Morbidity and Mortality) system [1].

However, in order to implement the PD method and enable intersurgeon comparison, success rates must be risk-adjusted based on pre-operative variables. This study aims to review the implementation of the PD approach of QI in a healthcare setting and provide individualized and risk-adjusted feedback to surgeons, in order to improve quality of surgical care. This includes an analysis of previous implementations of PD in the context of Canadian healthcare as well as a summarization of patient demographics and other pre-operative variables for patients undergoing major pulmonary resection surgeries in 2013.

Risk Factor	Procedure					Total
	Wedge Resection [total 80 pts]	Segmentectomy [total 15 pts]	Lobectomy [total 144 pts]	Extended Lobectomy [total 7 pts]	Pneumonectomy [total 12 pts]	Major Lung Resection Surgeries [total 258 pts]
Gender						
Female	37 (46.3 %)	10 (66.7 %)	86 (59.7 %)	3 (42.9 %)	3 (25 %)	139 (53.9 %)
Male	43 (53.7 %)	5 (33.3 %)	58 (40.3 %)	4 (57.1 %)	9 (75 %)	119 (46.1 %)
Age						
<49	7 (8.8 %)	0	5 (3.5 %)	1 (14.3 %)	1 (8.3 %)	14 (5.4 %)
50-59	15 (18.8 %)	2 (13.3 %)	31 (21.5 %)	0	3 (25 %)	51 (19.8 %)
60-69	36 (45 %)	8 (53.3 %)	46 (31.9 %)	4 (57.1 %)	5 (41.7 %)	99 (38.4 %)
70-79	18 (22.5 %)	5 (33.3 %)	48 (33.3 %)	2 (28.6 %)	3 (25 %)	76 (29.5 %)
>80	4 (5 %)	0	14 (9.7 %)	0	0	18 (7.0 %)
BMI						
Underweight: <18.5	3 (3.8 %)	0	5 (3.5 %)	0	0	8 (3.1 %)
Normal: 18.5-25	22 (27.5 %)	5 (33.3 %)	47 (32.6 %)	6 (85.7 %)	5 (41.7 %)	85 (32.9 %)
Overweight: 25-30	30 (37.5 %)	7 (46.7 %)	52 (36.1 %)	1 (14.3 %)	6 (50 %)	96 (37.2 %)
Obese: >30	22 (27.5 %)	3 (20 %)	39 (27.1 %)	0	1 (8.3 %)	65 (25.2 %)
ASA Class						
II – Mild Systemic Disease	3 (3.7 %)	0	15 (10.4 %)	1 (14.3 %)	0	19 (7.4 %)
III – Severe Systemic Disease	63 (78.8 %)	15 (100 %)	122 (84.7 %)	6 (85.7 %)	12 (100 %)	218 (84.5 %)
IV – Severe Systemic Disease with Constant Threat to Life	14 (17.5 %)	0	7 (4.9 %)	0	0	21 (8.1 %)
Smoking Status						
Never	28 (35 %)	6 (40 %)	36 (25 %)	3 (42.9 %)	2 (16.7 %)	75 (29.1 %)
Past	38 (47.5 %)	9 (60 %)	82 (56.9 %)	4 (57.1 %)	7 (58.3 %)	140 (54.3 %)
Current	14 (17.5 %)	0	26 (18.1 %)	0	3 (25 %)	43 (16.7 %)
Other Pre-Operative Risk Factors						
Steroid Use	13 (16.3 %)	0	28 (19.4 %)	0	1 (8.3 %)	42 (16.3 %)
Disseminated Cancer	31 (38.8 %)	4 (26.7 %)	8 (5.6 %)	1 (14.3 %)	5 (41.7 %)	49 (19.0 %)
Diabetic	15 (18.8 %)	6 (40 %)	30 (20.8 %)	0	0	51 (19.8 %)
Hypertension	34 (42.5 %)	9 (60 %)	80 (55.6 %)	4 (57.1 %)	2 (16.7 %)	129 (50 %)
Previous Cardiac Event	9 (11.3 %)	3 (20 %)	27 (18.8 %)	2 (28.6 %)	2 (16.7 %)	43 (16.7 %)
Dyspnea	22 (27.5 %)	1 (6.7 %)	37 (25.7 %)	3 (42.3 %)	1 (8.3 %)	64 (24.8 %)
COPD	21 (26.3 %)	5 (33.3 %)	45 (31.3 %)	1 (14.3 %)	4 (33.3 %)	76 (29.5 %)
Pulmonary Function Test Results						
Average DLCO (%)	70.4	75.2	73.3	65.3	72.1	72.3
Average FEV1 (%)	78.3	87.1	78.6	76.3	84.4	79.2
Average FEV1/FVC (%/%)	70.7	70.6	67.5	67	69.9	68.8

Table 1 - Summary of demographics and pre-operative risk factors for five major pulmonary resection surgeries (n=258)

Operative & Post-Operative Variables	Procedure					Total
	Wedge Resection (complicated 24 pts) [total 86 pts]	Segmentectomy (complicated 7 pts) [total 19 pts]	Lobectomy (complicated 93 pts) [total 152 pts]	Extended Lobectomy (complicated 7 pts) [total 7 pts]	Pneumonectomy (complicated 10 pts) [total 15 pts]	Major Lung Resection Surgeries (complicated 141 pts) [total 279 pts]
Complications						
Minor (Grade I-II)	16 (18.6 %)	4 (21.1 %)	65 (42.8 %)	6 (85.7 %)	9 (60 %)	100 (35.8 %)
Major (Grade IIIa-IVb)	8 (9.3 %)	2 (10.5 %)	25 (16.4 %)	3 (42.9 %)	1 (6.7 %)	39 (14 %)
Mortal (Grade V)	0	1 (5.3 %)	3 (2 %)	0	0	4 (1.4 %)
Operative Times						
Avg. Surgery Time (hr:min)	1:56	2:48	3:28	5:39	4:44	3:04
Standard Deviation	*(2:19)*	*(0:45)*	*(1:15)*	*(2:07)*	*(1:41)*	*(1:53)*
Avg. OR Time (hr:min)	2:57	4:04	4:50	7:25	6:28	4:21
Standard Deviation	*(1:31)*	*(0:55)*	*(1:26)*	*(2:19)*	*(1:49)*	*(1:50)*
Hospital Stay						
Average LOS	6.5 days	4.3 days	6.3 days	9.0 days	10.5 days	6.5 days
Standard Deviation	*(12.0 days)*	*(2.3 days)*	*(4.0 days)*	*(3.5 days)*	*(8.3 days)*	*(7.6 days)*
Prolonged LOS Rates	7 (8.1 %)	3 (15.8 %)	35 (23 %)	5 (71.4 %)	2 (13.3 %)	52 (18.6 %)
Readmission Rates	2 (2.3 %)	0	11 (7.2 %)	2 (28.6 %)	0	15 (5.4 %)

Table 2 – Complication rates and operative factors for five major pulmonary resection surgeries (n=279)

Methodology

Data was collected from patient records of 258 patients having undergone a major pulmonary resection surgery between October 2012 and January 2014. Data collected pertained to patient demographics, BMI, ASA class, smoking status, pulmonary function test results, and various other pre-operative variables, using the TOH's Thoracic Morbidity and Mortality (TM&M) system.

A literature review was conducted of Pubmed for references relating to implementation of a PD method in healthcare. MESH headings included: Humans, quality of health care, quality improvement, interventional studies, risk assessment, health care-associated infections, infection control, general surgery, hospital mortality, length of stay, incidence, and hygiene.

Literature Review – PD

In the context of healthcare, positive deviance (PD) is a method for quality improvement based on the dissemination of knowledge and strategies between "positive deviants" to their peers. These so-called positive deviants are identified based on their greater success rates due to uncommon practices which have enabled them to be more successful than their peers. With successful employment of collaborative interventions, the practices of these positive deviants can be implemented with the aim of improving standards of health care.

There are several instances of successful implementation of PD in literature for improving surgical site infection rates, improving hand hygiene compliance rates, reducing rates of myocardial infarction, and improving pregnancy outcomes. Lindberg et al., for example, successfully used a PD method to decrease the incidence of access-related blood stream infections (AR-BSIs) from 2.04 per 100 patients to 0.24 in US outpatient hemodialysis centres [2].

Successful implementation of a PD method entails collaborative interventions where the best medical practices can be discussed. These helpful practices must also be quantitatively verified through risk-adjusted data to have greater success rates. However, the PD method relies often on innovation and changing long-standing patterns of healthcare behaviour, which is a complex challenge. This unconventional orientation for healthcare depends on the understanding of healthcare professionals that organizational processes are not free of uncertainty.

The Division of Thoracic Surgery at TOH intends to employ the PD approach to improve surgical outcomes through the collection and analysis of pre-operative and intra-operative variables in the TM&M system. A evaluation study of the TM&M system which sent a 31-item questionnaire to all members of the Canadian Association of Thoracic Surgeons assessed that all Kappa statistics of inter-rater agreement indicated at least substantial agreement (87.0% indicated almost perfect agreement) and that the TM&M system was regarded as straightforward (98% of respondents), reproducible (94%) and useful (98%). [3]

Results

- Certain important trends emerge between the magnitude of the pulmonary resection surgery (wedge being the smallest, pneumonectomy being the largest) and operative factors.
- In Table 2, generally complication rates, OR times, LOS, and readmission rates tend to increase from left to right (with the exception of pneumonectomies in multiple cases).
- These factors must be risk-adjusted, however, with respect to the pre-operative variables summarized in Table 1.

Conclusions

The PD method has proven to be a successful intervention for improvement of quality of healthcare and can be quantitatively applied in the evaluation of surgical care in the Department of Thoracic Surgery through the continuous monitoring of post-operative complications. Risk-adjustment of these variables is done successfully through a summary of pre-operative variables of patients.

Going forward, it is hoped that these pre-operative variables can be inputted in equations to provide automatic risk-adjusted feedback and success rates to surgeons and that this approach can also be applied to the setting of thoracic surgery to reduce the number of post-operative adverse events.

Acknowledgements

Thanks to Jelena Ivanovic and Dr. Andrew Seely for their mentorship and direction in this project. Thanks also to Caitlin Anstee and the rest of the research staff of the Division of Thoracic Surgery at The Ottawa Hospital. Thank you to the Undergraduate Research Opportunity Program for the opportunity.

References

1. Seely, A., et al. "Systematic Classification of Morbidity and Mortality After Thoracic Surgery", The Annuals of Thoracic Surgery (2010) Vol. 90, pp. 936-942.
2. Lindberg C, et al. "Embracing Collaboration: A Novel Strategy for Reducing Blood Stream Infections in Outpatient Hemodialysis Centers", American Journal of Infection Control (forthcoming).
3. Ivanovic, J., et al. "Evaluating the Reliability and Reproducibility of the Ottawa Thoracic Morbidity and Mortality Classification System", The Annuals of Thoracic Surgery (2011) Vol. 91, pp. 387-393.

Rizwan Awan ♦ BHSc, University of Ottawa ♦ rawan092@uottawa.ca ♦ Tel: (613) 324-0242