Data Impact Challenge

Challenge Question:	***Choosing Wisely Canada Question*** **– How frequently is preoperative testing (such as chest X-rays, echocardiograms, or cardiac stress tests) conducted for patients undergoing low risk surgeries?**
Team:	Ottawa Hospital Performance Measurement
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Team Submission:	**How frequently is preoperative testing (such as complete blood counts, type and screens) conducted for patients undergoing Caesarian deliveries?**
Rationale:	This Challenge Question relates to CWC Internal Medicine Recommendation #5 (*Don't routinely perform preoperative testing (such as chest X-rays, echocardiograms, or cardiac stress tests) for patients undergoing low risk surgeries.*)[1]. We chose to interpret this question for the obstetrical population following a consultation with a physician quality leader in the Department of Obstetrics, Gynecology & Newborn Care. This physician suggested that we inquire about unnecessary pre-operative tests ordered in an obstetrical population undergoing C-sections since the majority of these procedures are low-risk. She recommended that we examine frequency of CBC, blood type and screens. This submission is **innovative** because the issue of pre-operative testing in C-sections has not been widely explored and the results may inform hospital policy.

DATA

Data custodian:	The Ottawa Hospital (TOH)
Data sources:	The data were extracted from The Ottawa Hospital Data Warehouse (TOHDW). The Ottawa Hospital is a 1,117-bed tertiary-care teaching hospital in Ottawa, Ontario with five campuses. TOHDW pulls together information from many different operational databases into a single repository with a clearly defined structure.
List of Datasets:	• DAD (Discharge abstracts) to obtain coded diagnoses and interventions • SMS (Patient registration system) to obtain encounter information • OACIS (Clinical information system) for information on lab tests
Data Quality:	The TOHDW contains high quality data. TOHDW incorporates administrative, clinical, and patient information from various source systems, thus capturing **complete** information for each hospital encounter. The diagnostic and procedural coding is **consistent** with international classifications. The datasets have a normalized data structure, with **standard** naming conventions and formats across systems. Each record is **time-stamped** and updated on a nightly basis. The data is highly **accurate** and has been used extensively to support decision-making, report to the Ministry of Health, and in several high-impact research publications.
Inclusions:	Cohort members were defined by pregnancy diagnostic codes accompanied by a caesarean section delivery.

[1] Source: Choosing Wisely Canada. Internal Medicine - Five Things Physicians and Patients Should Question (Released April 2, 2014) http://www.choosingwiselycanada.org/recommendations/internal-medicine/

Exclusions:	• Lab tests were excluded if they were cancelled, deleted, or ordered after the C-section. • Abortions, other terminations of pregnancies and abandoned procedures.
Nature of cohort:	The Ottawa Hospital serves a population of 1.2 million residents, and is the primary hospital for caesarean deliveries.
Size of cohort:	11,549 C-sections performed at both inpatient campuses of the hospital in data timeframe
Data timeframe:	Inpatients admitted and discharged between April1, 2009 –March 31, 2015 who had a C-section that resulted in a delivery.
Representativeness:	TOH is one of the largest academic health sciences centres in Canada and serves a population of 1.2 million residents. The hospital and its associated institutes provide a number of acute care services, including cardiovascular, surgical and trauma programs. The hospital is the main referral centre for those requiring complex care in the region, and therefore the patient population is representative of other tertiary care centres. From 2011 – 2012, there were 13,546 hospital births in the Champlain LHIN, of which 3,915 (28.9%) were delivered through C-sections. The average annual number of C-sections performed at the Ottawa Hospital from 2009 – 2015 was 1,925 thus accounting for 50% of all C-sections in the LHIN.

ANALYSIS

Cohort formation: Using CIHI methodology, we first identified all pregnancies that resulted in a delivery using ICD-10 codes from the inpatient discharge abstract. The cohort was then restricted to deliveries accompanied by the principal procedure (CCI code 5MD60*) of "Caesarean section delivery".

Patient characteristics and outcomes:

Patient age – Calculated at admission, based on date of birth.

Charlson scores[2] – Used to measure comorbidity burden and baseline risk of 1-year mortality

Length of stay – Calculated as number of days from admission until discharge.

Bleeding/hemorrhage complication – To determine presence of a complication during the C-section, we examined any type 2 diagnosis (indicative of a post-admission complication) with an ICD-10 code for a haemorrhage or bleeding episode. These codes were provided by a health records analyst.

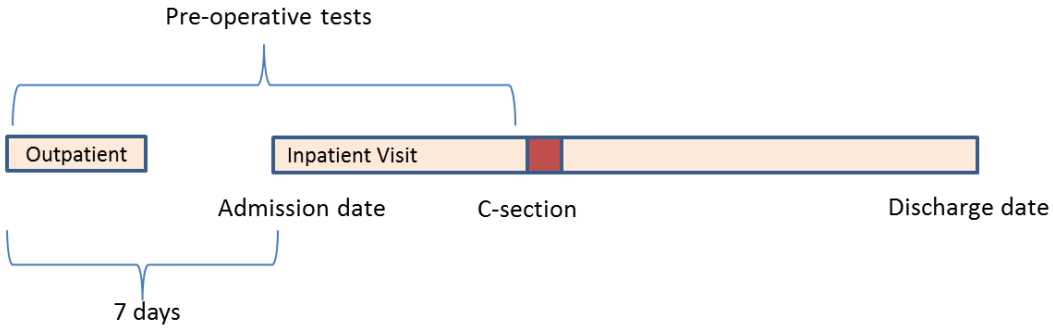
Identifying pre-operative lab tests:

Lab tests – Codes for Complete blood counts (CBC), blood typing (ABO Rh) and screens (Antibody screens). A new lab test record is generated each time a physician orders a test, thus allowing us to count up total number of tests ordered (while excluding cancelled tests).

Pre-operative test (Figure 1) – Tests ordered during the encounter, before the C-section was performed, or up to 7 days before the date of admission. We included these additional tests because some patients received their tests during an outpatient visit prior to their scheduled C-section and this was confirmed in consultation with an obstetrician.

[2] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: developmentand validation. J Chronic Dis 1987;40:373–83.

Figure 1: Pre-operative test definition



FINDINGS

Results: From Apr 1, 2009 – Mar 31, 2015 a total of 11,549 C-sections were performed on pregnant women at The Ottawa Hospital and 9,455 (81.8%) had a pre-operative test ordered. Amongst those with a pre-operative test, almost all had a CBC (99.3%), whereas 43.5% had an ABO Rh and 67.3% had an antibody screen (Table 1). When comparing frequency of tests ordered, the majority of patients had 1 test. However, for ABO Rh and Antibody screens, 8 – 10% of patients had 2 or more tests ordered, and this proportion was even higher for those with a CBC (23.4).

When stratifying the results by campus, more ABO Rh tests and antibody screens were ordered at Campus A than at Campus B (47.3% vs 36.9% and 67.7% vs 66.5% respectively). This is interesting because patients who received their C-section at Campus A had less comorbidities, shorter length of stays and lower rates of bleeding complications.

Relevance: Overall, the rates of pre-operative testing for C-sections range from 43.5% for ABO Rh (blood typing) to almost 100% for CBCs. These estimates need to be compared with current guidelines on pre-operative testing to determine whether these rates are appropriate for low-risk procedures such as C-sections. In the stratified analysis, the results suggest that Campus B typically treats higher risk patients, as indicated by a higher comorbid burden, greater length of stays and higher rates of bleeding complications post-surgery. However, Campus B orders less ABO Rh and antibody screens as compared to Campus A. This has implications for hospital pre-operative testing policies, and warrants further investigation into why this inter-campus variation exists.

Limitations:

These findings must be considered in light of limitations. First is the potential that not all blood typing and antibody screening test codes were captured. Our search for test codes may have precluded ones that did not contain the keywords used to identify these tests (e.g. “CBC/Complete blood count”, “ABO/Blood type”, “Antibody screen”), which would result in an underestimate of the pre-op testing rate. Second, we may not have captured all pre-op tests if the patient had a pre-op visit to the hospital more than 7 days before their C-section. However, the majority of patients (90%) had their test during their encounter so this would likely represent very few missed tests. Third, about 5% of C-sections did not have a procedure time, thus an imputed time of midnight was used. This may result in some tests that were ordered during or after the time of surgery to be misclassified as pre-operative tests, but since it represents so few cases, it is also unlikely to significantly change the results.

Table 1: Frequency of pre-operative testing amongst Caesarian deliveries that received at least 1 of the tests of interest, by campus

		Campus A	Campus B	TOTAL
		N=6046	N=3409	N=9455
Baseline Characteristics and Outcomes				
Patients	Distinct	5281	3177	8383
Advanced Maternal Age	Age < 35	3860 (63.8%)	2175 (63.8%)	6035 (63.8%)
	Age >= 35	2186 (36.2%)	1234 (36.2%)	3420 (36.2%)
Charlson Score	Mean ± SD	0.05 ± 0.32	0.07 ± 0.40	0.06 ± 0.35
Total LOS (days)	Mean ± SD	3.62 ± 2.00	4.24 ± 3.65	3.84 ± 2.73
	Median (IQR)	3.0 (3.0-4.0)	3.0 (3.0-4.0)	3.0 (3.0-4.0)
Complication of bleeding/ hemorrhage		399 (6.6%)	255 (7.5%)	654 (6.9%)
Frequency of pre-operative tests ordered				
Complete blood count (CBC) test ordered		6030 (99.7%)	3363 (98.7%)	9393 (99.3%)
# Ordered	1	4846 (80.4%)	2350 (69.9%)	7196 (76.6%)
	2	678 (11.2%)	490 (14.6%)	1168 (12.4%)
	3	210 (3.5%)	179 (5.3%)	389 (4.1%)
	4	110 (1.8%)	100 (3.0%)	210 (2.2%)
	5 or more	186 (3.1%)	244 (7.3%)	430 (4.6%)
ABO Rh test ordered		2859 (47.3%)	1257 (36.9%)	4116 (43.5%)
# Ordered	1	2658 (93.0%)	1116 (88.8%)	3774 (91.7%)
	2 or more	201 (7.0%)	141 (11.2%)	342 (8.3%)
Antibody screen ordered		4094 (67.7%)	2268 (66.5%)	6362 (67.3%)
# Ordered	1	3773 (92.2%)	1945 (85.8%)	5718 (89.9%)
	2 or more	321 (7.8%)	323 (14.2%)	644 (10.1%)