

Data Impact Challenge

Challenge Question: **Choosing Wisely Canada Question – How frequently in the inpatient setting, is repeat CBC and chemistry testing conducted?**

Team: Ottawa Hospital Performance Measurement

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DATA

Data custodian: The Ottawa Hospital (TOH)

Data sources: The Ottawa Hospital Data Warehouse (TOHDW). TOHDW pulls together information from many different operational databases into a single repository with a clearly defined structure.

List of Datasets:

- Lab data from the OACIS Clinical Information System
- Inpatient admission data from SMS (Admitting, Discharge and Transfer data system)

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: Complete Blood Count (CBC), Hemoglobin (HGB), Albumin, Bilirubin, Creatinine, and Blood urea nitrogen (BUN) lab tests for adult inpatients at The Ottawa Hospital, Ottawa, Canada

Exclusions: Cancelled and deleted lab tests; Lab tests attached to cancelled and deleted admissions; Lab tests for inpatients with age at admission <18; Lab tests occurring on the day of discharge or the last day of the data timeframe.

Size of cohort: 1,079,114 lab tests representing 29,252 distinct admissions

Data timeframe: *Lab tests with a test date* occurring Apr 1, 2014 – Mar 31, 2015

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.

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ANALYSIS

Repeat CBC and chemistry testing:

$$\text{Proportion of Repeated Lab Tests} = \frac{\# \text{ Repeated Lab Tests}}{\# \text{ Tests Eligible to be Repeated}}$$

Lab tests: Includes Complete Blood Count (CBC), Hemoglobin (HGB), Albumin, Bilirubin, Creatinine, and Blood urea nitrogen (BUN) tests. Chemistry tests included were chosen based on previous work by the Performance Measurement team, including tests used in Laboratory-based Acute Physiology Score (LAPS) calculations. Tests are identified using keyword searches for codes and descriptions, with the help of hospital and laboratory staff.

Repeated test: Defined as an identical test with a lab test date occurring within one calendar day of the index test during a single admission. For example, an HGB test on Jan 1 at 8:00am followed by an HGB test on Jan 2 at 1:00pm is considered a repeated test. One day was chosen based on clinical practice and the distribution of the time between CBC tests.

Tests eligible to be repeated: Defined as any test not occurring on the day of discharge or the last day of the data timeframe.

Test date: Defined as the date the specimen arrives to the laboratory for analysis. There may be several time stamps associated with a single lab test (e.g., ordered, performed, verified, etc.); however, the only consistently populated time is when the specimen arrives to the lab. This date should match the specimen collection date.

This Challenge Question relates to CWC Internal Medicine Recommendation #4 (*In the inpatient setting, don't order repeated CBC and chemistry testing in the face of clinical and lab stability.*)¹; therefore, in addition to performing an analysis on all inpatients, our unique access to data allowed us to perform an **innovative** sub-analysis on lab tests from the General Internal Medicine (GIM) service and patients with a stable lab result.

Lab Stability: Defined as the absence of an "abnormal code" in the test result. These codes are automatically populated in the lab report and the presence of an abnormal code (e.g., high, low, or critical) is considered an unstable result. A CBC includes several individual results (e.g. HGB, RBC, Platelets, etc.) and therefore does not have an "abnormal code"; in these cases HGB is included as a proxy for a stable/unstable CBC result.

FINDINGS

Table 1: Repeat Inpatient CBC and Chemistry Testing

Lab Test	All Lab Results		Stable Lab Results	
	N	Repeated	N	Repeated
Complete Blood Count	222,780	171,904 (77.2%)	n/a	n/a
HGB	222,780	171,904 (77.2%)	53,386	37,677 (70.6%)
Albumin	84,620	51,201 (60.5%)	10,929	5,821 (53.3%)
Bilirubin Total	45,133	20,625 (45.7%)	32,728	12,794 (39.1%)
Creatinine	214,832	168,516 (78.4%)	114,211	85,965 (75.3%)
BUN	204,258	157,080 (76.9%)	116,486	86,165 (74.0%)

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/>

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At The Ottawa Hospital between Apr 1, 2014 and Mar 31, 2015 the proportion of inpatient lab tests that were repeated within one day was 77% for CBC, and 46% to 77% for other common chemistry tests (*Table 1*). When considering only stable lab results the proportion is 2-7 percentage points lower.

Table 2: General Internal Medicine Repeat Inpatient CBC and Chemistry Testing

Lab Test	All Lab Results		Stable Lab Results	
	N	Repeated	N	Repeated
Complete Blood Count	37,794	29,344 (77.6%)	n/a	n/a
HGB	37,794	29,344 (77.6%)	9,708	7,278 (75.0%)
Albumin	12,715	6,835 (53.8%)	1,535	777 (50.6%)
Bilirubin Total	6,153	2,833 (46.0%)	4,016	1,509 (37.6%)
Creatinine	37,918	29,504 (77.8%)	17,380	13,093 (75.3%)
BUN	10,693	7,200 (67.3%)	2,893	1,353 (46.8%)

GIM patients have similar results to the full inpatient population (*Table 2*). Some chemistry tests show lower proportions of repeated tests; however for CBC/HGB the proportion is almost identical to the full population and for tests with stable results the proportion is higher for GIM.

Limitations:

Point of care testing is not captured in the laboratory data and therefore omitted from this analysis. Lab stability is only considered for an individual test. In reality lab stability may depend on several test results. The clinical stability of the patient at the time of testing would also be of interest. This would require a more in depth analysis and a clear definition of clinical stability.