



Short Communication

Estimated costs of 51 commonly ordered laboratory tests in Canada

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ABSTRACT

Introduction: Test cost display has been shown to reduce inappropriate laboratory test ordering practices in the United States. Unfortunately, such a system is limited in the Canadian publically funded healthcare environment. Many Canadian physicians inaccurately estimate the cost of laboratory tests, which may contribute to misutilization. Here, we provide an estimated cost of over 50 commonly ordered laboratory tests in Canada as an educational tool for physicians.

Methods: Test volume data was collected from Calgary Laboratory Services' Laboratory Information System in order to determine which laboratory and diagnostic tests are most commonly ordered in Calgary and its surrounding area. Reference median cost (RMC) of fifty one commonly ordered test was calculated by determining the price list of all-inclusive indirect costs from six different clinical laboratories across Canada.

Results: Of the 51 laboratory tests included, the minimum RMC was \$5 CAD (eg: albumin, calcium, urea), and the maximum RMC was \$300 (surgical pathology report).

Conclusions: A caveat to the provided list of test costs is that it is only an estimate and may differ from what each individual clinical laboratories charges to third parties or for research purposes. However, this list can serve as an educational tool and raise awareness for Canadian physicians on the relative costs of laboratory tests.

1. Introduction

Although laboratory costs comprise only about 5% of the healthcare budget in the United States, it is estimated that laboratory services drive up to 70% of all downstream medical decisions, which encompass a substantial portion of the budget [1]. Rapidly increasing laboratory test volumes has resulted in increased scrutiny of the appropriateness of test ordering. For example, in Calgary, Alberta, laboratory test volume increased 6–8% annually from 2004 to 2014, but there was only an annual increase in population of 2.2% [2]. Furthermore, it is estimated that up to 30% of laboratory tests are repeated inappropriately [3]. Ultimately, these laboratory mis-utilization practices lead to patient harm and low quality of care [4]. As such, mitigation of unnecessary laboratory testing can present itself as an opportunity for cost savings in an unsustainable healthcare environment, without jeopardizing patient care.

Although the concept of laboratory utilization management is not novel, mis-utilization still exists, in part due to the lack of knowledge of how much tests cost. In a review on the effect of cost display on laboratory test ordering practices, it has been demonstrated by multiple

studies that cost display reduced the number of tests ordered by anywhere between 4.5% and 30% [5]. Importantly, price display has been shown to significantly reduce inappropriate laboratory, imaging and procedural tests without compromising patient safety when shown to practitioners in an outpatient setting [6–8]. Unfortunately, in a publically funded environment such as in Canada, a question that commonly arises amongst healthcare providers is the relative cost of laboratory tests, due to limited cost display to physicians. The lack of awareness is demonstrated by the fact that Canadian family physicians, and emergency department physicians tend to underestimate the costs of expensive tests, while overestimating the costs of inexpensive laboratory tests that are ordered regularly [9–11].

To attach a cost to a single test or a panel of tests is not a straightforward task due to many factors, including the variability between direct and indirect/overhead costs, proprietary information from vendors on how consumables and equipment costs are broken down, service contracts, and the variability of how each clinical laboratory processes their laboratory tests across Canada [12,13] (for a detailed demonstration, see Table 1). Furthermore, once the arduous task of presenting a test cost has been completed, would one decide to display

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Table 1

Various costs associated with laboratory testing, including when determining RMC of all-inclusive indirect costs (Adapted from [12,13]).

		Pre-analytical	Analytical	Post-analytical
Direct expenses	<i>Operating Budget</i>	<ul style="list-style-type: none"> ● Phlebotomy (labour) ● Consumables ● Accessioning ● Processing (centrifuging) 	<ul style="list-style-type: none"> ● Calibration Materials ● QC Materials ● Maintenance Leases ● Reagents/Consumables ● Technician Labour ● Purchase of Instrument 	<ul style="list-style-type: none"> ● Reporting Labour ● QA Labour
	<i>Capital Budget</i>	<ul style="list-style-type: none"> ● Refrigerators ● Centrifuges 		<ul style="list-style-type: none"> ● Instrument Interface
Indirect/overhead expenses	<i>Operating Budget</i>	<ul style="list-style-type: none"> ● Supervisor Labour ● Transport Labour 	<ul style="list-style-type: none"> ● Administration Labour ● Maintenance/Leases ● Supervisor Labour 	<ul style="list-style-type: none"> ● Information Systems Labour
	<i>Capital Budget</i>	<ul style="list-style-type: none"> ● Cost of Space ● Transport Equipment 	<ul style="list-style-type: none"> ● Cost of Space ● Automation Equipment 	<ul style="list-style-type: none"> ● Information Systems/Upgrades

the marginal costs of a laboratory test (eg: estimated costs of the reagent), or an all-in cost (eg: both direct and indirect/overhead costs across all 3 analytical phases of test processing) [12]? Although studies have presented “actual costs” of laboratory tests that are hospital- or province-specific [10,11], an “actual cost” of performing a laboratory test varies tremendously across hospitals, cities and provinces. [10].

Here, we present the reference median costs (RMC) of commonly ordered laboratory tests in a Canadian setting as a first step towards raising physician awareness in order to help enhance selective and appropriate laboratory test ordering practices.

2. Methods

Calgary Laboratory Services' (CLS) is the sole laboratory service provider for Calgary and surrounding area in Alberta, with a catchment population of approximately 1.4 million individuals, performing an average of 29 million tests annually. Laboratory test volume data in Calgary and surrounding area was determined by collecting all laboratory tests processed within a centralized Laboratory Information System of CLS by order mnemonic and test encounter from the LIS [14]. Fifty one laboratory and diagnostic tests were chosen to be included in this list as they were the most commonly ordered tests by volume in Calgary and its surrounding area in 2015.

Calculating the cost of a laboratory test is complicated as there are a number of fluctuating factors associated with the costs of performing each test sample and the production of the laboratory test result. Direct costs are related to the production of the laboratory test result (eg: labour, reagents), and can be divided into fixed, variable and semi-variable costs. Direct fixed costs are often the highest and are independent of test volumes (eg: equipment, space, maintenance costs), variable fixed costs vary based on test volumes (eg: reagents, consumables), and semi-variable fixed costs may vary based on test volume but with incremental changes (eg: technologist salaries, transportation costs). Meanwhile, indirect/overhead costs are not directly related to the production of the laboratory test result, but are required for the testing environment (eg: administrative costs, supervision, building maintenance, utilities) [12,13]. See Table 1 for examples of direct and indirect costs associated with laboratory testing. Due to the variability of direct expenses relating to the production of a test result, and variable volumes of tests processed between clinical laboratories, the RMC of each test presented here was determined by compiling price lists of all-inclusive indirect costs from six different clinical laboratories across Canada, rounded to the nearest Canadian dollar, as described previously [15].

3. Results

In the 2015 calendar year, the three most commonly ordered laboratory tests by total test volume in Calgary and surrounding area were: complete blood count, creatinine, and electrolyte panel. For a

complete list of each test's volume by testing encounter (community, inpatient and emergency settings), see Supplemental Table 1 [14]. Fifty one commonly ordered laboratory and diagnostic test by test volume were chosen to determine the reference median costs of each test (see Table 2).

From this list, it is obvious that there is a wide range of RMC of various diagnostic tests, from RMC of \$5 CAD per test (eg: glucose fasting, thyroid stimulating hormone), \$30 CAD per test (eg: electrocardiogram, gynecology cytology report), to \$300 CAD per test (eg: surgical pathology report). See Table 2 for a complete list of RMC for 51 commonly laboratory tests.

4. Discussion

To our knowledge, we are the first to report the Reference Median Cost of over 50 commonly ordered laboratory and diagnostic tests that can assist in raising physician awareness in a publically funded environment, such as those in Canada. Previously, when we manually constructed a look-up table of all physicians in Calgary, Alberta, and referenced this against the College of Physicians and Surgeons of Alberta's public database, it was demonstrated that family physicians are one of the major groups of laboratory test users, ordering 58% of all laboratory tests [16]. In the past, costs for diagnostic tests were not provided to healthcare providers due to proprietary reasons, complexity of cost accounting and fluctuating costs. However, we feel such information is important to allow informed decisions about value versus cost of specific tests. As physicians generally inaccurately predict the costs of laboratory test they request [9–11], perhaps this list will assist in shedding some light on relative costs of most commonly ordered investigations. By presenting relative tests costs, physicians may be able to enhance their test ordering selectivity when deciding which appropriate tests to order for their patients.

As Canadian clinical laboratories commonly receive requests for costs of tests, a list of top 51 estimated test cost was provided here as a resource for physicians practicing in a publically funded setting, and can be used not only as an educational tool, but can also be used to support audit and feedback initiatives, or other uses where costs to the medical system information is requested. A caveat to this list is that the RMC is only an estimate, and may differ from what each individual clinical laboratory charges to third parties, or for research purposes. Due to the large variations in direct costs related to production of the laboratory test results between clinical laboratories, only the all-inclusive indirect costs were used in the RMC. Therefore, this reference list should only be used for educational purposes or raising physician awareness of the relative costs of diagnostic tests, and not to be used for cost accounting budgets, research or test utilization intervention savings.

Table 2
Reference Median Cost (RMC) of 51 tests commonly ordered at a Canadian diagnostic laboratory.

Test name	RMC (\$ CAD) ^a
ABO & Rh (Instrument)	23
Albumin	5
Albumin Random-Urine	22
Alkaline Phosphatase	5
Alanine Aminotransferase (ALT)	5
Aspartate Aminotransferase (AST)	5
Bilirubin Total	5
Bilirubin Total and Direct	10
Blood Culture	15
Blood Scan with Morphology	10
Calcium	5
Chlamydia/Gonorrhoeae (GC) Test	20
Complete Blood Count	7
C-Reactive Protein	9
Creatine Kinase	15
Creatinine	5
Electrocardiogram (ECG)	30
Erythrocyte Sedimentation Rate (ESR)	6
Fecal Immunochemical Test (FIT)	9
Ferritin	8
Free T4	6
Gamma Glutamyl-Transferase (GGT)	5
Glucose Fasting	5
Glucose Random	5
Gynecology Cytology Report	30
Hemoglobin A1c	7
Hepatitis B Surface Antigen	20
Hepatitis C Antibody	10
HIV Serology (Mixed Ag/Ab Detection)	50
Iron and Total Iron Binding Capacity (TIBC)	5
Lactate Dehydrogenase (LD)	5
LDL Cholesterol	15
Lipase	5
Magnesium	5
Microscopy for Bacterial Vaginosis (BV)/Yeast	15
Phosphate	5
Prostate Specific Antigen (PSA)	14
Prothrombin Time (INR)	8
INR and Activated Partial Thromboplastin Time (APTT)	15
Surgical Pathology Report	300
Syphilis Antibody (EIA)	30
Throat Beta Strep Test	15
Thyroid Stimulating Hormone (TSH)	5
Troponin-T	10
Type and Screen	23
Urate	5
Urea	5
Urinalysis with Microscopic	10
Urine Culture	15
Vitamin B12	7

^a Costs presented are all inclusive Reference Median test Costs (RMC) from 6 Canadian diagnostic laboratories. RMC are based on accounting formulas and multiple variables that may be subject to change. RMC values are for reference purposes only and are not applicable for use in research and third party service costing. RMC should not be used for cost accounting utilization interventions/projections. Cost methodologies may vary across provinces in Canada and within each province.

5. Conclusions

Although Canadian physicians are not able to view the relative costs

of each laboratory or diagnostic test they order, the list provided here can serve as a first step towards raising awareness for healthcare providers in any jurisdiction based on estimated laboratory test costs.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.clinbiochem.2018.12.013>.

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