

»» Successful Models for Shaping Test Utilization Patterns in Academic and Community Hospital Settings

ABSTRACT: As the demand increases for more successful utilization of laboratory tests, laboratory directors are tasked with finding new ways to provide higher quality laboratory testing at lower cost. This involves decreasing the overuse and misuse of laboratory tests. We describe two successful models for improving laboratory utilization, one at an academic medical center with a large reference laboratory and another model at a large integrated community hospital health care system in the Midwest. We provide specific examples of steps that can be implemented at other academic medical center and community hospital laboratories in working with clinicians to improve laboratory test utilization. Both models used practice-specific test algorithms and evidence-based medicine to inform optimal test utilization patterns. The challenges of changing practice patterns are described.

With increasing demands for accountability in medical laboratories in both academic and community hospital practices, interest in successful laboratory test utilization models has intensified.¹⁻⁵

A Successful Academic Center Model: The Clinical Practice Committee

Since 2004, physicians at Mayo Clinic (Rochester, Minnesota) in the Department of Laboratory Medicine and Pathology (DLMP) have addressed clinical practice issues with the departmental Clinical Practice Committee (CPC), which meets twice a month. In Mayo Clinic's large, integrated, academic group practice, all the other departments, including medical and surgical specialties, have similar CPCs. The CPCs are the main resources for communicating global intradepartmental and intradivisional practice issues. The primary goal is not to reduce costs but to implement the highest quality, most cost-effective strategies of testing patterns in the care of patients.

The charge of the CPC in the DLMP is to have general oversight of patient care-related activities in the DLMP, with a focus on setting standards and expectations, including the promotion of best clinical practice in a fiscally responsible manner for the purpose of ensuring quality patient care.

The CPC in the DLMP strives to do the following:

1. Develop, advance, and sponsor short- and long-range goals for clinical patient care related to DLMP activities, including activities that affect the extramural practice.
2. Promote and facilitate practice optimization opportunities in a fiscally responsible manner, including best practices and utilization parameters and practice guidelines.
3. Provide direction and oversight to DLMP clinical activities, including but not limited to
 - a. test utilization by ordering clinicians
 - b. test elimination—review before test elimination
 - c. test implementation—notation only (not approval)
 - d. test validation studies (clinical)
4. Work in conjunction with the DLMP Executive Committee to approve clinical programs and to support operational planning of divisions and laboratories.
5. Serve as a forum for general practice discussions related to both the internal practice and the extramural reference laboratory clinical activities.
6. Communicate with other CPCs within the group practice.

Decision-making processes are driven by literature-supported, evidence-based medicine. For example, algorithms are commonly suggested as a way to communicate recommendations for optimizing patterns of test ordering. In addition, the CPC members frequently review the laboratory medicine and pathology aspects of proposed practice guidelines from the Institute for Clinical Systems Improvement.⁶

CPC members include pathologists, medical and laboratory directors, several division chairs, senior medical technologists, and a cardiologist with expertise in cardiovascular laboratory medicine. An administrator, a project manager, and an administrative assistant are specifically assigned to the CPC and the respective chair and vice chair comprise the CPC Executive Committee, which is responsible for setting the agenda to meet departmental goals. Because the CPC meets the Accreditation Council for Graduate Medical Education goals for systems-based practice, residents and fellows are routinely invited to observe the deliberations of the CPC. In addition, physicians from clinical areas are frequently asked to attend CPC meetings. This allows proactive support by the clinical areas for proposed changes in test-ordering patterns and permits the laboratorians to understand how changes affect the clinical practice. Frequently, the director of information technology, lawyers specializing in medical affairs, quality and regulatory

experts, and the chair of the department will also attend.

The CPC meets bimonthly to discuss each topic brought to the CPC with defined goals, objectives, and expected outcomes, thus ensuring that the discussions are open but focused. From these regular CPC meetings, working groups are frequently formed to address specific issues that arise. For instance, a working group may be formed to address overuse, underuse, or misuse of a specific test. The recommendations of the working group are reviewed at meetings of the full CPC.

The agendas of the CPC meetings are set according to the following guidelines:

- Agenda topics are derived from departmental planning objectives and goals and are focused on issues related to clinical practice. The topics are reviewed by the chair and secretary of the CPC to determine whether the CPC is the appropriate forum for discussion.
- Agenda topics are investigated by the proponents and recommendations are developed before the meeting.
- Agenda materials, including supporting literature, are provided to the CPC secretary no later than 7 workdays before the committee meeting so that agendas can be prepared and sent out in advance for adequate committee review.
- Requests to present agenda topics are submitted in advance for review by the CPC chair and secretary before granting a presentation date.

In addition, Web-enabled telephone conferences allow communication with colleagues in other states to simultaneously obtain their unique perspectives. For example, this has allowed us to ensure that our list of critical values is synchronized across all our practices.

A list of the issues addressed by the CPC from 2004 through 2007 and the outcomes includes the following:

- Development, implementation, and communication of minimum test sample volumes.
- Institution of a system-wide allergy screening evaluation for the primary care physicians in the primary care medical system.
- Successful standardization and integration of all the laboratories in order to establish a laboratory hematology oversight group.

- Streamlining of the routine and stat laboratory requests.
- Review of mitochondrial respiratory chain complex defects and the significance of developing the clinical tests, guideline, and algorithm for the evaluation of mitochondrial disorders.
- Establishment of a reliable system to contact all providers about critical laboratory values.
- Discontinuation of the bleeding time test as an orderable test across our practice.
- Examination of the use of the inflammatory disease panel as an example of how to successfully communicate optimal use of a new test.
- Use of informatics to examine the implications of the digital ordering system and how it may affect ordering patterns and how the laboratory can influence ordering patterns.
- Establishment of test-naming standards for genetic tests.
- Establishing principles using literature-supported, evidence-based medicine in creating testing algorithms based on sound methodology.
- Identification of the optimal way to diagnose Wilson's disease and to avoid false-positive diagnoses due to possible copper contamination from paraffin-embedded liver biopsy specimens.
- Quality and medical decision analysis, including the use of middleware and medically relevant quality control for laboratory tests.
- Discussion of the next level beyond critical values—ie, "significant findings"—and how laboratories can best define them and communicate them.
- Determining the optimal pathway for diagnosing alpha1-antitrypsin deficiency with establishment of an algorithm.
- Standardizing methodologies for performing serum creatinine and implementation of the estimated glomerular filtration rate.
- Planning for potential avian and pandemic influenza with a system-wide plan to ensure proper functioning of the laboratories in the event of a catastrophic event.

Issues raised at CPC meetings are fully vetted by working groups that may or may not include CPC members. Each working group is given a specific time-limited charge and scope to bring recommendations back to the CPC for implementation. For example, much of the work done to eliminate the bleeding time test was accomplished by the Bleeding Time Working Group. The number of ordered bleeding time tests decreased from more than 600 per month to 0 in less than 1 year. Because input was sought from all the affected clinical areas, the bleeding time test was discontinued without fanfare.

Mechanisms for Implementation

Physicians are quite autonomous and often require the persuasion from the Chair in order to accept the recommendations from the CPC. The use of literature-supported, evidence-based medicine allows these recommendations to be based on an acceptable standard. The CPC does not strive for unanimous agreement, merely consensus. Objections are noted and challenges are deliberated. After consensus is reached, all members are expected to support the group's decision. To avoid hallway discussions of the topics after a decision has been made, time is taken during the CPC meeting to discuss objections. If consensus cannot be reached, a working group may be assigned with a focused, time-limited charge to bring forth recommendations to the full CPC. Ad hominem arguments are not permitted. Efforts are taken to hear the perspectives of the soft-spoken members and to limit the objections from the more forceful members. All CPC members are expected to represent the views of their respective divisions and to lay aside personal biases or preferences. On occasion, a well-timed patient vignette or humorous anecdote will relieve the inevitable tensions that arise from discussing contentious issues. With experience, the CPC members accept more representative roles on behalf of their divisions, more ownership of the CPC's outcomes, and pride in reaching collective practice goals.

Operational personnel and administrators help track compliance with CPC recommendations. The project manager accounts for initiatives with Gantt charts and periodic reports on the progress or lack of progress on initiatives.

The first meeting of every year is used to review and celebrate the CPC accomplishments of the previous year. Some successes are celebrated as reaching Sisyphean goals.

A Successful Community Hospital Model

Saint Luke's Hospital in Kansas City, Missouri, is a tertiary care hospital that serves as the reference laboratory for the ten other hospitals in the Saint Luke's Health System. Approximately 50% of the ordered tests originate within Saint Luke's facilities and 50% come from outreach clients within a 100-mile radius of Kansas City. The laboratory

offers more than 300 tests and performs more than 2 million per year. The management team consists of an administrative director, medical director, two other clinical pathologists, and section managers. This team is primarily responsible for overseeing laboratory test utilization.

Clinical pathologists together with the administrative director and the section managers identified areas of potential improvement, paying special attention to tests that were high volume, expensive, difficult to perform, or of questionable medical benefit or had an unusual number of abnormal results.

The general approach was to target problems that appeared to be most easily solvable and had readily accessible utilization data in either the laboratory or the hospital information system. These data were collated and presented to influential physicians who were most familiar with the targeted area of testing. These experts were recruited to become the laboratory's advocates and to help communicate proposed changes to the general medical staff. Laboratory managers and clinical pathologists also collaborated with nurses, physicians, pharmacists, and hospital committees and departments to ensure that test ordering was medically appropriate and cost-effective.

Clinical pathologists made presentations at medical staff departmental meetings and at meetings of the hospital Performance Improvement Committee. They also prospectively reviewed laboratory tests included in physician order sets and clinical pathways before their implementation. Relevant articles were published in the monthly "Clinical Laboratory Letter," which was distributed to all physicians and house staff. Previous issues were also archived on the health system's Web site⁷. The effect of these changes was subsequently monitored, and the data were presented to the medical staff and hospital departments.

Many different projects have been undertaken during the past 10 years. The following lists summarize the initiatives that the laboratory implemented to reduce excessive, ineffective, unnecessary, and redundant testing.

General

- Standardized instrumentation and procedures throughout the health system.
- Educated physicians about appropriate test utilization on a continual basis with a laboratory newsletter.
- Responded promptly to physician calls about test ordering and interpretation.
- Designed test requisitions to encourage optimal test ordering.
- Discontinued the use of obsolete tests.
- Discontinued the use of low-volume tests, especially if quality control samples outnumbered patient samples.
- Reviewed laboratory tests incorporated into physician order sets.
- Published evidence-based algorithms for laboratory testing.
- Reviewed physician orders for esoteric tests sent to reference laboratories.
- Renegotiated pricing annually for esoteric tests sent to reference laboratories.
- Reviewed the annual number of tests sent out and performed high-volume tests in-house.
- Stored specimens in the laboratory for 1 week to facilitate add-on testing and reduce the need for additional phlebotomy.
- Eliminated replicate testing of normal and abnormal results.
- Eliminated large-volume venipuncture tubes as part of a blood conservation program.
- Decreased the laboratory error rate to reduce the number of repeated test orders.
- Set allowable time intervals for subsequent testing in the hospital information system.
- Implemented autoverification whenever feasible.
- Merged outpatient and inpatient electronic medical records to reduce the number of tests ordered on admission.

- Discouraged writing daily orders and set limits for mandatory rewriting of orders.
- Compared physician test utilization for a specific diagnosis related group among peers.
- Discouraged routine ordering of preoperative screening tests.
- Improved turnaround times to reduce the tendency to reorder pending tests.
- Determined which confirmatory tests should be performed during inpatient evaluation and which should be performed during outpatient evaluation.
- Evaluated reference ranges periodically to decrease follow-up testing for slightly abnormal results.
- Established guidelines to determine the medical necessity of new test requests.
- Implemented time limits on standing orders for laboratory tests.
- Asked clinicians to refer point-of-care vendors to the medical director of the laboratory.
- Decreased specimen identification errors by introducing bar-coded patient wrist bands.

Chemistry

- Changed immediate urine medical drug screens from a comprehensive drug screen to a Triage (Biosite Inc, San Diego, California) drug screen.
- Eliminated large chemistry panels except for Medicare-approved panels.
- Required separate orders for arterial blood gases and co-oximetry.
- Changed antinuclear antibody cutoff from 1:40 to 1:160.
- Eliminated vancomycin peak levels for therapeutic monitoring.
- Eliminated total creatine kinase from the cardiac marker panel.
- Replaced the AmnioStat-FLM-PG (Irvine Scientific, Santa Ana, California) and the 2-dimensional lecithin to sphingomyelin ratio with the FLM II (Abbott Laboratories, Abbott Park, Illinois).

- Stopped performing immunofixation without prior serum protein electrophoresis.
- Changed quality control for precise automated instruments by adopting the single 3–standard deviations rule.
- Screened for thyroid disease with thyrotropin and, if results were abnormal, performed assay for free thyroxine.
- Stopped performing blood chemistry panels on body fluids and limited testing to protein, lactate dehydrogenase, pH, glucose, amylase, and triglyceride levels as needed.
- Set limits for maximal dilutions of elevated results, such as for enzymes.
- Performed in-house cystic fibrosis screen and hepatitis C genotyping.
- Replaced a comprehensive drug screen with Triage Drugs of Abuse Panel (Biosite Inc).

Microbiology

- Discontinued the use of rapid bacterial antigen tests for meningitis.
- Changed diarrhea work-up from full ova and parasite examination to tests for *Giardia* antigen and *Clostridium difficile* toxins A and B as indicated.
- Shortened the duration of urine culture incubation from 48 to 24 hours.
- Published urine culture guidelines for urinary tract infections in females.
- Developed urinalysis algorithm that recommends microscopic examination only if dipstick results were positive for blood, protein, or leukocyte esterase.
- Introduced urine culture as the next test if leukocyte esterase or microscopic examination results were abnormal.
- Converted *Chlamydia* testing from a non-amplified to an amplified DNA test.
- Modified the hepatitis C confirmatory tests to recommend that positive enzyme immunoassay samples be tested with polymerase chain reaction (PCR) instead of recombinant immunoblot assay.
- Established hepatitis C virus genotyping in-house.

- Decreased the blood culture contamination rate.
- Deleted the Epstein-Barr virus early antigen test from the Epstein-Barr panel.
- Streamlined the immunocompromised respiratory panel by deleting 4 tests, including the *Legionella* direct fluorescence assay, the respiratory syncytial virus antigen test, the influenza antigen test, and fungal smear for *Pneumocystis*.
- Replaced *Pneumocystis* special stains with PCR.
- Discontinued the use of a Sabouraud dextrose agar slant from the initial fungal culture setup.
- Eliminated the use of acid-fast bacillus smears for tissue samples.
- Converted 70% of the viral cultures to PCR, including cultures for cytomegalovirus, herpes simplex virus, varicella zoster virus, and enterovirus.
- Replaced virology tube cultures with enhanced shell vial cultures.
- Replaced group B streptococci culture with PCR.
- Replaced group A streptococci culture with PCR.
- Introduced immediate *Enterovirus* PCR testing for patients admitted to emergency department.
- Replaced wet mounts with DNA probe hybridization for *Gardnerella*, *Candida*, and *Trichomonas*.
- Began automatically testing stool bacterial cultures for Shiga toxin and *Campylobacter* antigen.

Hematology

- Discontinued the use of the bleeding time test, resulting in 450 fewer tests per year.
- Discontinued the use of numerical band counts in patients older than 3 months.
- Substituted the D-dimer assay for fibrin degradation products testing and soluble fibrin monomer testing for disseminated intravascular coagulation testing.
- Standardized the heparin protocol to weight-based dosing.
- Reduced the number of manual white blood cell differential counts 71%.

- Eliminated total protein S from the protein S screen (leaving only free protein S).
- Discontinued testing for proteins C and S in patients receiving warfarin.
- Automated reticulocyte counts and eliminated manual counts.
- Discontinued the use of thrombin time testing as part of the lupus anticoagulant panel.
- Developed a new algorithm for lupus anticoagulant testing and eliminated use of the dilute Russell viper venom test unless the hexagonal phase phospholipid test was negative.
- Eliminated the use of flow cytometry isotype control reagents.
- Published flow cytometry criteria for appropriate use.
- Implemented autoverification for urinalyses and prothrombin time tests.

Transfusion Medicine

- Began monitoring surgeon-specific use of blood components for open heart surgery annually.
- Established a thawed plasma policy to decrease waste of fresh frozen plasma.
- Discontinued the collection of shed blood after open heart surgery.
- Established a blood conservation program.
- Discontinued testing for weak D antigen.

The effectiveness of these initiatives was measured by reviewing monthly revenue and usage reports before and after changes were implemented. Test volumes for individual diagnosis related groups were obtained from the hospital's decision support system.

Conclusion

We offer these models from an academic medical center with a large integrated group practice and from a large community hospital practice in the Midwest as examples of successful efforts in laboratory medicine testing utilization.

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The authors have no conflicts of interest to disclose.

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