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Cost Avoidance and Outcome Improvement by Implementing a Test Utilization Strategy for Molecular Microbiology Tests

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Abstract

Test utilization is an essential strategy in the clinical laboratory, especially with increasing numbers of tests and health care costs. We designed a triage system for molecular microbiology tests ordered from 2007 through 2010 to assess their appropriateness before they were sent out to a reference laboratory for testing. The number of tests ordered and approved and the number with positive results were calculated during the study period. Cost avoidance was subsequently calculated. A total of 13,839 tests were ordered, averaging 3,335 tests/year. The overall approval rate was 76%, ranging from 72% in 2007 to 81% in 2010. With the exception of cytomegalovirus (CMV) and BK virus PCR, the numbers of all tests decreased in 2010 compared to 2007. The total savings over 4 years was $374,791, with an average cost avoidance of $93,698/year. Pathologists and microbiologists should design a utilization system for laboratory testing to avoid unnecessary cost and improve patient care.

Introduction

Projected spending on health care in the United States is estimated to reach $4.4 trillion by 2018, accounting for approximately 20.3% of the gross domestic product (1). Laboratory and pathology testing is estimated to account for 4% of health care costs compared to the utilization of other health care resources (2). Physicians are estimated to control up to 80% of health care costs, and more than half of their decisions are believed to be influenced by laboratory results (3). Rising health care expenditures, continuous increases in the number of available laboratory tests, and concerns about quality of care and patient safety have led to increasing efforts to improve utilization of laboratory testing and services (3,4).

The utilization of laboratory services by physicians has increased due to multiple factors, including laboratory automation; introduction of new tests; lack of physician training in test ordering practices; fear of litigation; inexperience or uncertainty of likely diagnoses, especially for junior physicians; desire for diagnostic completeness; lack of understanding of the sensitivity and specificity of tests; and increased demand from patients themselves (patient expectations) (5-7).

The development of polymerase chain reaction (PCR) and other molecular methods has revolutionized the diagnosis of infectious diseases, mainly due to increased sensitivity and short turnaround time. However, the diversity of available molecular tests and high costs have made them impractical for every clinical microbiology laboratory to perform. Therefore, it is common practice for laboratories to send their samples to a reference laboratory. Sending specimens to outside reference laboratories increases the cost of testing. National estimates for reference laboratory expenses were $2.5 billion in 2002, with an annual growth rate of about 10% (3).

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Note: Jessica Ricaldi and Lori Racsa contributed equally to this article.

Different strategies for utilizing laboratory testing have been proposed, with variable success. These strategies include the use of provider order entry by removing overused or obsolete tests from the quick-pick screen, use of pop-up reminders for certain tests, a requirement to provide explanations for daily laboratory tests beyond 3 days, requisition redesign, providing education and feedback, giving financial incentives, providing information about test costs, unbundling panel tests, implementation of practice standards, and triaging requests or consultant-gatekeeper functions (3-9).

In a recent comprehensive publication by Miller et al., the authors presented six categories of cost-saving strategies: technical streamlining, workflow optimization, personnel utilization, cost avoidance, reduction of service, and investing in savings (8). This study, however, focuses on cost saving by triaging requests based on clinical and laboratory criteria. In our institution, we have developed a practice of test utilization in the microbiology laboratory where our send-out requests for molecular tests and urine histoplasma antigen are reviewed by a pathology resident and microbiology attending before they are sent to a reference laboratory. We also report the effect of our institution's policy of test utilization on molecular microbiology send-out tests.

(The preliminary results of this study were presented in part as a poster at the American Society for Microbiology 111th General Meeting in New Orleans, LA, May 2011.)

Materials and Methods

Parkland Health and Hospital System (PHHS) is a 960-bed, level 1 designated trauma center and a teaching hospital for the University of Texas Southwestern Medical Center (Dallas, TX). In this study, we analyzed retrospective data from patients in PHHS over 4 years from 2007 to 2010. Available data from January and February 2011 were also added to that of 2010. The total number of tests ordered, number of tests approved, number of positive results, and cost of testing for each year the test was triaged were all considered for analysis. The molecular microbiology send-out tests included in this analysis were PCR tests for *Bartonella henselae*, *Mycobacterium tuberculosis* complex (MTB), *Tropheryma whipplei*, cytomegalovirus (CMV), enterovirus, Epstein-Barr virus (EBV), herpes simplex virus (HSV), human herpes virus 6 (HHV-6), human herpes virus 8 (HHV-8), John Cunningham (JC) virus (JCV), BK virus (BKV), parvovirus B19, and varicella zoster virus (VZV), in addition to urine, cerebrospinal fluid (CSF), and serum histoplasma antigen tests. The accepted specimens for these assays included whole blood (EBV, *B. henselae*, and *T. whipplei*), plasma (CMV quantitative, HHV-6, HSV, JCV, BKV, parvovirus B19, and VZV), serum (HHV-6, histoplasma antigen, HSV, parvovirus B19, BKV, and VZV), CSF (CMV qualitative, EBV, enterovirus, HHV-6, HSV, JCV, MTB, histoplasma antigen, parvovirus B19, VZV, and *T. whipplei*), and urine (histoplasma antigen and BKV). Ocular fluid, tissue, and vesicle fluid were accepted for HSV, while bronchoalveolar lavage (BAL) fluid, pleural fluid, and sputum were accepted for MTB.

The review process for molecular microbiology testing at PHHS was established in 2001, but we did not have an electronic medical record system to record the efficacy of the system until 2007. The practice of reviewing the test is summarized as follows: the test is ordered in the Epic electronic medical record system (Epic Systems Corporation, Madison, WI), and a list of the tests appears in the Cerner system (Cerner Millennium; Cerner Corporation, Kansas City, MO) for review. The type of specimen and quantity available for testing are confirmed to be appropriate for the ordered test. The rotating pathology resident and/or microbiology fellow reviews the patient's electronic medical record to obtain information regarding clinical manifestations, suspected or differential diagnosis, associated co-morbidities or immunosuppression states (e.g., HIV infection, transplantation, and chemotherapy), previous testing and possible previous results of the same test to exclude duplicate or frequent testing, laboratory studies (e.g., complete blood count, CSF analysis, CD4 count, and histopathology), imaging studies, administered medications, and any other relevant information. A summary of the collected information is recorded in the Cerner system and presented to the microbiology faculty. If the test is indicated, the specimen is sent out to the appropriate reference laboratory for testing. If the test is not indicated according to the internal guidelines, the resident discusses the request with the ordering physician. The requested test can be then maintained if additional unknown information is provided; otherwise, it will be cancelled with the ordering physician's consent. If the test is cancelled, the specimen is stored in case future testing is needed. Alternative testing may be recommended if it is better suited to the clinical scenario than the original test requested.

The general guidelines that were implemented in this study to evaluate the appropriateness of the ordered tests include the relevance of the ordered test to the patient's clinical features and suspected diagnosis, the presence of other laboratory tests or imaging studies that exclude a suspected diagnosis, frequency of testing to monitor treatment response when no change in the test result is anticipated in a short time, differences to the course of patient care and management, and response of the patient to therapy for another suspected disease (10,11). Pathogen-specific indications of testing are listed in Tables 1, 2, and 3.

Results

A total of 13,839 tests were ordered from 2007 through 2010, averaging 3,335 tests per year. The number of laboratory tests ordered decreased by 7% over the study period, starting with 3,455 in 2007 and decreasing to 3,213 in 2010 (Table 4). *Histoplasma capsulatum* urine antigen was the most commonly ordered test during the study period (4,123 tests), followed by HSV (1,918 tests), CMV (1,871 tests), BKV (1,776 tests), and MTB (861 tests), while the least ordered test was *T. whipplei* (30 tests). With the exception of CMV and BKV, all ordered tests decreased in 2010 compared to 2007 by 73% (*T. whipplei*), 49% (EBV), 36% (JCV), 30% (*B. henselae*), 19% (*H. capsulatum*), 17% (MTB), 8% (HSV), 7% (VZV), 6% (HHV-6/HHV-8), 5% (enterovirus), and 4% (parvovirus B19).

The overall approval rate of tests during the study period was 76%, with an increase by 9% from 72% in 2007 to 81% in 2010