Brief Report

Value-Based Intervention with Hospital and Pathology Laboratory Informatics: A Case of Analytics and Outreach at the Veterans Affairs

Gregory D. Scott[1,2], Thomas F. Osborne[3,4], Sang P. Gross[2], Dean Fong[1,2]

[1]Department of Pathology, Stanford University School of Medicine, Stanford, CA, USA, [2]Department of Pathology, Palo Alto Division, Veterans Affairs Health Care System, Palo Alto, CA, USA, [3]Department of Radiology, Stanford University School of Medicine, Stanford, CA, USA, [4]Department of Radiology, VA Palo Alto Healthcare System, Veterans Affairs Health Care System, Palo Alto, CA, USA

Submitted: 18-Dec-2019 Revised: 24-Jan-2020 Accepted: 05-Feb-2020 Published: 09-Mar-2020

Abstract

Background: Laboratory tests are among the most ordered tests and account for a large portion of wasted health-care spending. Meta-analyses suggest that the most promising interventions at improving health-care value and reducing cost are low investment strategies involving simple changes to ordering systems. The veterans affairs (VA) has a 2018–2024 strategic objective to reduce wasted spending through data- and performance-focused decision-making. **Methods:** VA Palo Alto Healthcare System laboratory utilization data were obtained from multiple sources, including the VA Corporate Data Warehouse and utilization reports from reference laboratory. Ordering volume, test results, and follow-up clinical impact data were collected and evaluated in partnership with the treating physicians and hospital informatics in order to optimize ordering sets. **Results:** Dextromethorphan (Dext) and synthetic cannabinoid testing were identified as the lowest value tests based on a three-tier score of negativity rate, volume, and cost. In partnership with the ordering physicians and hospital informatics, reflexive testing was eliminated, resulting in persistent decreases in the volume of Dext (162–10 tests/month) and synthetic cannabinoid tests (155–19 tests/month) ordered. The proportion of unnecessary repeat tests also dropped from 71.5% to 5.5%, the test positivity rate increased from 0.87% to 3.49%, and the approximate monthly cost of both tests decreased ten-fold from $21,250 to $2087 for a yearly savings of $229,000 at a single VA. **Conclusions:** Improved laboratory utilization is central to the VA' strategic objective to reduce waste. A relatively simple intervention involving partnership with the treating physicians and hospital informatics in combination with data- and performance-focused decision-making can yield substantial reductions in health-care waste.

Keywords: Informatics, utilization, value, veterans affairs

Introduction

"Unnecessary services" are the largest contributor to health-care waste in the United States, accounting for $210 billion or 30% of the total excess annual spending.[1] Laboratory tests are among the most commonly ordered tests in both the hospital and outpatient settings, and therefore improved laboratory utilization is critical to reducing waste.[2] Meta-analyses have shown that the most promising interventions at reducing health-care cost seem to be the straightforward low-investment strategies involving simple changes to ordering systems.[3] Pathologists overseeing clinical laboratories are thus strategically positioned to identify inefficient ordering patterns and collaborate with facility informatics and ordering physicians to reduce patient harm and waste with data-supported decision-making. Veterans affairs (VA) administration has proactively addressed the crisis of increased cost and decreased projected funding through the "2018–2024 strategic plan objective 4.4," which drives

Access this article online

Quick Response Code:

Website: www.jpathinformatics.org

DOI: 10.4103/jpi.jpi_67_19

Address for correspondence: Dr. Gregory D. Scott, Department of Pathology, Stanford University School of Medicine, Stanford, CA, USA.
E-mail: gscott2@stanford.edu

How to cite this article: Scott GD, Osborne TF, Gross SP, Fong D. Value-Based intervention with hospital and pathology laboratory informatics: A case of analytics and outreach at the veterans affairs. J Pathol Inform 2020;11:8.

Available FREE in open access from: http://www.jpathinformatics.org/text.asp?2020/11/1/8/280298

"data-supported and performance-focused decision-making … in order to effectively use taxpayer funds."[4]

Using the concept of value-driven outcome,[5] we identified high-volume tests and their clinical impact. Here, we report utilizing laboratory data analytics to identify two high-cost and low-yield send-out tests, dextromethorphan (Dext) and synthetic cannabinoid urine screening.

Methods

This study received institutional review board waiver (Stanford University, Stanford, CA, USA) and VA Research Committee approval (Palo Alto, CA, USA) to evaluate the medical records of consecutive patients who received drug testing at our institution (VA Palo Alto Health Care System, Palo Alto, CA, USA) from January, 2017, to December, 2018. The VA Palo Alto Health-Care System consists of three inpatient hospitals and seven outpatient clinics.

High-volume and low-yield send-out reference tests were initially screened by rank-ordering test volume, cost, and positivity rates. Detailed laboratory and ordering department data were acquired from two sources, including (1) utilization reports from our reference laboratory and (2) the VA Corporate Data Warehouse, a repository for VA medical data that is based on a relational structured query language (SQL) database. Custom scripts were written in the SQL query language that collected test data performed at the VA Palo Alto Health Care System with the matching test names such as "SYNTHETIC CANNABINOID, QUAL, and UR." Plotting and analysis of data was performed using RStudio (RStudio, available at http://www.rstudio.com). Focused manual chart reviews were completed to identify and confirm the impact of positive test results. Proportions of tests that were positive before and after intervention were compared using the Fisher's exact test implemented in RStudio. In collaboration with facility informatics department and other key clinical partners, a collaborative strategy was developed to educate providers and reconfigure automated ordering systems.

Results

Laboratory tests with the highest yearly cost for 2018 were as follows: qualitative urine testing for Dext, urine synthetic cannabinoid drug monitoring (Cann), urine buprenorphine drug monitoring (Bup), Quantiferon Gold® (Quant), urine amphetamine screening (Amph), stool Calprotectin (Calp), serum-free kappa/lambda light-chain levels (KapLam), Jak2 V617F mutation levels (JAK2), methylmalonic acid, and cyclic citrullinated peptide IgG antibody levels. The tests were rank ordered in terms of total cost (range: $119,000/year–$11,000/year), negativity/no abnormality test result rate (range: 39%–100% negative), and total test volume (range: 8899 tests/year–33 tests/year). The mean rank-ordered list identified the top two tests as Dext and synthetic cannabinoids [Table 1].

Table 1: Mean rank ordering of test volume, negative result rate, and cost

	Negative rate	Volume	Cost	Mean rank
Dextromethorphan	2	3	1	1
Synthetic cannabinoids	1	4	2	2
Buprenorphine	8	1	3	3
Quantiferon plus	7	2	4	4
Amphetamine	3	6	5	5
MMA	4	5	8	6
CCP IgG	6	7	10	7
Jak2 V617F mutation	5	10	9	8
Calprotectin	9	9	6	9
Free kappa/lambda ratio	10	8	7	10

MMA: Methylmalonic acid, CCP: Cyclic citrullinated peptide

In order to evaluate the clinical utility of the positive results for Dext and cannabinoids tests, chart reviews were performed from January, 2017, to July, 2018. Surprisingly, cannabinoid testing yielded zero positive results despite 3228 tests ordered during the evaluation period. During the same study period, 3118 Dext tests were ordered and 20 (0.6%) were positive for 17 patients. Focused manual chart reviews were performed for the 17 patients which revealed that there was no mention of the positive results in 13 of the subsequent progress notes. Of the four positive results that were discussed in the patient's chart, one patient had a previously known history of abuse, one had a cold with cough for which his wife gave him medication, and two patients obtained the Dext over the counter from the hospital store for cold symptoms.

To enhance our analysis and education efforts, we also identified the ordering providers who had ordered the largest number of these tests. For the 2-year duration from January, 2017, to December, 2018, six providers ordered 97% of the total number of these low-value and high-cost tests. These providers encompass addiction treatment services and mental health, and the ordered tests were part of grouped order sets developed for quick-order menus. In efforts to share knowledge and develop a collaborative solution, test costs, ordering volumes, and clinical utility data were reviewed with clinical teams via E-mails and person-to-person meetings. After evaluation of the data with clinical teams and department leadership, a unanimous consensus was reached to remove Dext and synthetic cannabinoids from automatic order sets (e.g., for addiction treatment services and mental health). Prior to this cross functional consensus, both Dext and synthetic cannabinoids were prechecked on the order set so that they would be automatically ordered by default [Figure 1]. This agreed-upon change to automated ordering required modifying the quick-order menu in the electronic health record (EHR), which was made in December 2018 and January 2019.

After the staff education and changes to the EHR, similar data were again collected for test ordering volume, positivity rate, and the percentage of patients with repeat testing from February 2019 to October 2019. After intervention, we found a durable and statistically significant ($P < 0.01$) decrease in ordering volumes of the low-value tests from

162 to 10 tests/month for Dext and 155 to 19 tests/month for synthetic cannabinoids [Figure 2, top]. There was also a decrease in the percentage of repeat tests; from 71.1% to 5.5% [Figure 2, bottom]. There was also an increase in the proportion of positive test results; 0.87%–3.49% of Dext cases. As a result of the changes, monthly send-out costs for Dext and synthetic cannabinoids decreased over ten-fold from $21,250 to $2,087. The data also demonstrate a preinterventional decrease in synthetic cannabinoid ordering which occurred in September 2018 when we began our initial discussion with the clinical teams. We noted a decrease in synthetic cannabinoid testing from an average of 169/month (January 2017 to August 2018) to an average of 90/month (September 2018 to December 2018) [Figure 2]. We surmise that the decrease was due to a combination of factors including education and recent order code change of introducing in-house oxycodone testing, which began in August 2018. Surprisingly, even after the provider education, and removing reflexive testing, the remaining synthetic cannabinoid testing did not yield a single positive result at follow-up evaluation [Table 2].

Conclusions

As health-care costs continue to rise, laboratory informatics and ordering physicians are central to redirecting hospital resources from volume- to value-based care.[5] The current study implemented a value-based intervention by targeting not only the classic measures used by pathology informatics of test volume and cost, but critically also gave weight to the overall test negativity rate and the real-world physician use of a positive test result. Considering the downstream clinical use of a test was critical as a screening step of mean-ranked test positivity rate, cost, and volume would otherwise produce potential false positives [e.g., Quantiferon, Table 1]. Importantly, these data, particularly clinical actions and negativity rate data, empowered buy-in from multiple stakeholder groups, which led to positive changes to ordering practices. Working with our clinical partners, we identified two top targets for testing value improvement (Dext and synthetic cannabinoids), conducted education of all stakeholders (including real-time feedback to laboratorians), and reconfigured automated ordering systems. We saw some improvement with education, however, the true and lasting impact required broad buy-in, collaboration, and reconfiguring the EHR in a way that supports more appropriate automated ordering practices. These interventions improved

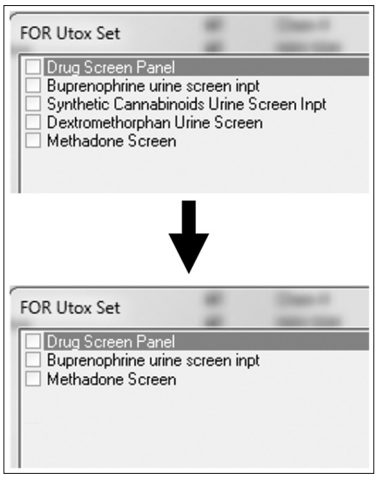

Figure 1: Order set change to remove Dext and synthetic cannabinoids from urine toxin screen order set. The top image is order set before change and the bottom image is order set after change

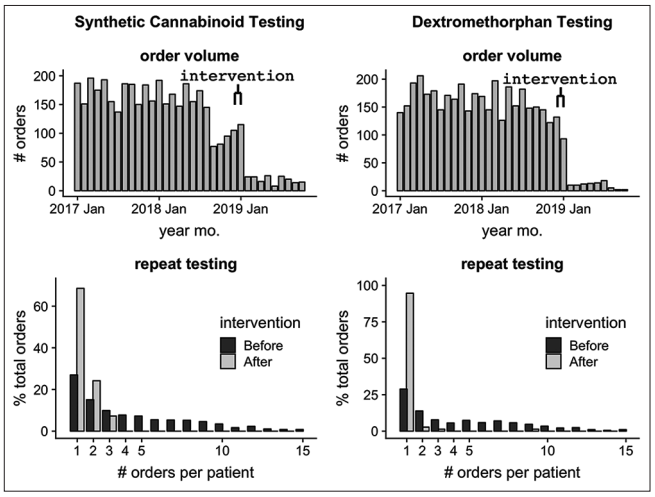

Figure 2: A relatively simple "intervention" of data analysis, provider education, and order set changes durably improve test utilization. Test volume (top) and the number of orders per patient (bottom) are shown for send-out tests, synthetic cannabinoids (left figures) and Dext (right figures). There is decreased test volume, decreased proportion of repeat testing per patient, and corresponding increased proportion of single test per patient

Table 2: Reduced ordering, reduced monthly cost of send-out testing and increased test positivity rate following an intervention to improve utilization of dextromethorphan and cannabinoid testing

	Before intervention (January 2017-December 2018)	After intervention (February 2019-October 2019)	Before versus after (*P*)
Dextromethorphan testing, total (monthly)	3885 (161.8)	86 (9.5)	<0.001
Synthetic cannabinoid testing, total (monthly)	3728 (155.4)	175 (19.1)	<0.001
Proportion of tests repeated on same patient (%)	71.5	5.5	<0.05
Main intervention outcomes			
Test positivity rate (%)	0.87	3.49	<0.05
Monthly send-out cost (for both tests)	$21,250 (±3337.8)	$2087 (±727.0)	<0.001
Projected savings		$229,900/year	

value by both increasing test positivity yield four-fold and by decreasing order volume and cost ten-fold. On a broader note, this project is an example of how utilizing the existing EHR data, in a thoughtful and methodological way, can improve the value of health care. When these types of collaborative data-informed approaches become integrated as a part of routine practice, pathology departments will be more empowered to direct the thoughtful development of order-set construction and clinical practice.

A limitation of this study was not quantifying secondary outcomes such as process improvement, staffing costs, and reduced patient harm in the form of mistaken diagnosis, false-positive results, needlesticks, and iatrogenic anemia. If VA pathology laboratory staff costs were calculated, there would be a far greater positive financial impact of the intervention. Based on the monthly data pre- and post-intervention, the intervention would improve workflow and provide increased capacity for our staff to perform other tasks by removing over 2000 urine pour-offs for send-outs and manual verification of approximately 4000 results/year. It is also important to note that each hospital system has a unique patient population and demands. Therefore, this approach may identify different high-value laboratory targets at different sites. In addition, reimbursement is not considered in the current study, but it is an important factor in the United States health-care system. We would expect reduced test volumes to negatively impact laboratory financials in a fee-for-service payment system and positively impact laboratory financials in a capitated model.

Thoughtful data-informed interventions, and intradepartmental collaborations oriented around value-based care, are an important part of improving health-care value.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Smith M, Saunders R, Stuckhardt L, McGinnis M, editors. Committee on the learning health care system in America, institute of medicine. Best Care at Lower Cost: The Path to Continuously Learning Health Care in America. Washington, DC: National Academies Press (US); 2013. Available from: http://www.ncbi.nlm.nih.gov/books/NBK207225. [Last accessed on 2019 Jul 17].
2. Sá L, Teixeira AS, Tavares F, Costa-Santos C, Couto L, Costa-Pereira A, *et al*. Diagnostic and laboratory test ordering in Northern Portuguese Primary Health Care: A cross-sectional study. BMJ Open 2017;7:e018509.
3. Kobewka DM, Ronksley PE, McKay JA, Forster AJ, van Walraven C. Influence of educational, audit and feedback, system based, and incentive and penalty interventions to reduce laboratory test utilization: A systematic review. Clin Chem Lab Med 2015;53:157-83.
4. Wilkie RL. Department of Veterans Affairs FY 2018 – 2024 Strategic Plan. Veterans Affairs; 2019. Available from: https://www.va.gov/oei/docs/VA2018-2024strategicPlan.pdf. [Last accessed on 2019 Jul 16].
5. Lee VS, Kawamoto K, Hess R, Park C, Young J, Hunter C, *et al*. Implementation of a value-driven outcomes program to identify high variability in clinical costs and outcomes and association with reduced cost and improved quality. JAMA 2016;316:1061-72.