

Short Report

Effectively reducing amylase testing using computer order entry in the emergency department: quality improvement without eliminating physician choice

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ABSTRACT

Background Amylase and lipase, pancreatic biomarkers, are measured in acute pancreatitis diagnosis. Since amylase testing does not add diagnostic value, lipase testing alone is recommended. Despite new recommendations, many physicians and staff continue to test both amylase and lipase.

Objective To reduce unnecessary diagnostic testing in acute pancreatitis.

Methods The pre-checked amylase test within the Emergency Department's Computerised Provider Order Entry (CPOE) abdominal pain order set was changed to an un-checked state but kept as an option to order with a single click. Amylase testing, lipase testing and cost were measured for one year pre- and post-intervention.

Results Simple de-selection intervention reduced redundant amylase testing from 71% to 9%, resulting in a percent of decrease of 87% and an annualised saving of approximately \$719,000 in charges.

Conclusion CPOE de-selection is an effective tool to reduce non-value added activity and reduce cost while maintaining quality patient care and physician choice.

Keywords: amylase, cost analysis, computerised physician order entry system

INTRODUCTION

The purpose of this study was to reduce utilization of amylase testing as a redundant biomarker in diagnosing pancreatitis to improve patient care and reduce institutional cost while minimizing the effect on physician choice. Acute pancreatitis hospitalizations in the United States cost \$2.2 billion in 2003, averaging \$9,870 per patient.¹ Acute pancreatitis is diagnosed when abdominal pain is present, serum amylase and/or lipase levels are elevated, and/or abdominal imaging meets the diagnosis criteria. Amylase and lipase, common pancreatic biomarkers, are released after the initial onset of acute pancreatitis and are commonly measured upon hospitalization.²

Amylase levels increase 3–6 hours after pancreatitis initiation and remain elevated for 3–5 days. Although high serum amylase levels can be reflective of pancreatic infarction, levels are also high in patients with gastroenteritis and acute liver failure. In addition, it is not uncommon for amylase levels to be within normal range in patients with acute pancreatitis. Lipase levels increase 3–6 hours after pancreatitis initiation but remain elevated for 1–2 weeks. Elevated serum lipase levels have also been reported in patients with non-pancreatic abdominal pain and other conditions.²

Previously, both amylase and lipase analyses were recommended in pancreatitis diagnostic testing. More recently, lipase testing alone was recommended since lipase testing is more specific and amylase testing does not add diagnostic value. Furthermore, since amylase levels fall back within the normal range more quickly than lipase levels following acute pancreatitis, lipases have an extended window available for biomarker measurement and analysis.² Despite the new recommendations, many physicians and staff continue to test both amylase and lipase in pancreatitis diagnosis. To promote the recommended change, institutions have implicated educational interventions and removal of amylase testing from computer ordering systems to decrease amylase test ordering in Emergency Departments (ED), decreasing patient charges.³ Therefore, our goal was to alter the computer order entry in the ED to reduce utilization of amylase testing as a redundant biomarker in diagnosing pancreatitis without eliminating the physicians' option to utilize amylase testing if desired. We hypothesized that altered computer order entry would increase value for our patients by reducing unnecessary utilization of diagnostic testing.

METHODS

This study was reviewed by our local Institutional Review Board and determined Non-Human Subjects Research, Reference #: 012633. Computerized Provider Order Entry (CPOE) process interventions and a modified Lean Six Sigma method were used to reduce non-essential steps and improve quality. The CPOE change was functionally

simple; the pre-checked amylase test in the ED order set for abdominal pain was changed to an un-checked state. The decision was made to leave amylase available in the order sets. If the physician wanted to include the test, they could simply recheck it. Baseline measurements of amylase and lipase testing were determined from January–December 2014, preceding the CPOE change, using the Cerner Discern Analytics program. Post-intervention, orders for amylase and lipase testing were measured from January–December 2015, the same months as the baseline measurements the previous year. Sustainability of change was followed through June 2016. Charges to perform amylase testing were calculated from the institution's Cost Accounting System. Minitab was used to evaluate the statistical significance of the intervention using a 2-tailed t-test, * $p < 0.0001$.

RESULTS

Our frontline physician leaders optimized the CPOE through the Test Utilization Committee and stakeholders to facilitate evidence-based ordering practice. In 2014, 10,843 ED patients had orders for a lipase test. Of those patients, 7,647 had simultaneous orders for amylase. The charge to the organization to perform an amylase test was \$109.00 per order. Because amylase was tested simultaneously with lipase 71% of the time, the opportunity for organizational charge reduction was approximately \$834,000 annually simply by removing or limiting a non-value added test (Table 1).

The simultaneous testing of amylase with lipase was measured during the same months in 2015 post-intervention. Simple de-selection intervention reduced redundant amylase testing from 71% to 9%, resulting in a percent of decrease of 87% in co-ordered testing (Table 1). Since the amylase test charge was \$109/test, a mean charge of \$2,283/day was determined pre-intervention. In 2015, post-intervention, amylase orders/day mean declined from 21 to 2.8 with charges dropping to a mean \$313/day with an annualized saving of approximately \$719,000 (Table 1). Monthly lipase and amylase testing was compared pre- and post-intervention. Reduction in amylase utilization was maintained post-intervention through June 2016 (Figure 1). To ensure our patients received quality care, we measured 3 and 30 day revisit rates for ED patients presenting with abdominal pain during the pre- and post-intervals. There were no significant differences in revisit rates. No harm in unchecking amylase was identified. No physician complaints resulted from the change.

DISCUSSION

Physician driven structural changes in our CPOE reduced unnecessary amylase testing by 87%. By simply un-checking the amylase test in the ED order set, financial burden to patients and payer was lessened and charge to the

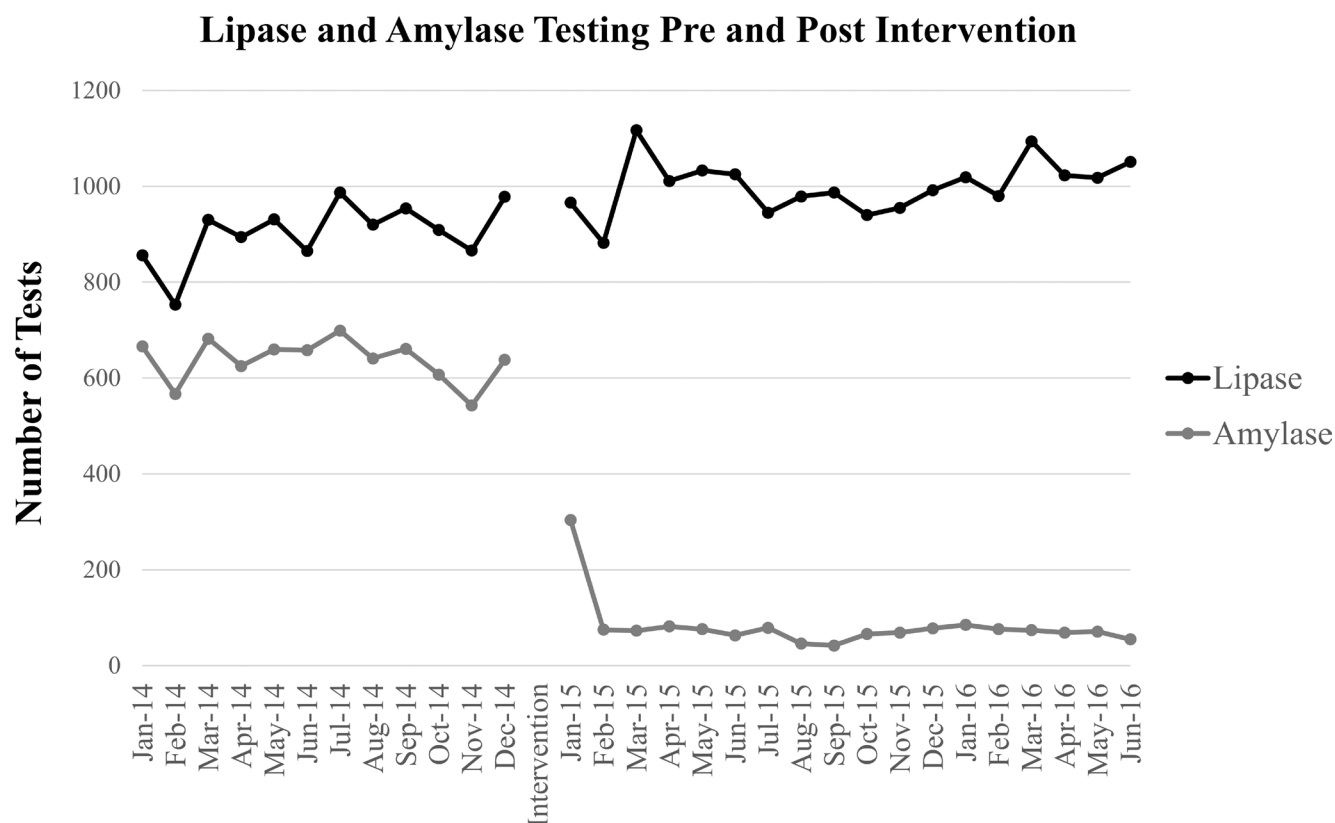


Figure 1. Sustainable reduction in redundant diagnostic testing through CPOE de-selection. Unchecking amylase from the CPOE abdominal pain order set significantly reduced unnecessary diagnostic testing, sustainable for 18 months post-intervention

system was reduced while maintaining quality patient care. In 2014, Thomas Jefferson University Hospital removed amylase from common order sets in the electronic medical record. Co-ordering of amylase and lipase decreased by 15.2% and with an average Medicare charge of \$35/test, patient charges were reduced approximately \$135,000/year.⁴ Additionally, in 2010, a trauma centre introduced an educational intervention, deletion of amylase from trauma order forms, and decoupled amylase and lipase in their computer ordering system. This effectively reduced co-ordering of amylase and lipase from 93% to 14.3% and decreased patient's charges approximately \$350,000/year.³ Our institution has previously been successful in reducing diagnostic testing with the cardiac biomarker creatine kinase-muscle and brain-type isoenzyme in acute myocardial infarction diagnosis through de-selection within the CPOE system.⁵

CPOE guides appropriate diagnostic testing choices. Although removing diagnostic tests from CPOE order forms is a successful strategy, it impacts physician freedom of practice. For example, Volz et al.³ removed the option to choose amylase on the order form, and amylase could only be ordered if specifically added. Additionally, Barbieri et al.⁴ removed amylase from order set forms, limiting amylase ordering to ad-hoc situations. Other institutions allow physicians to override reminders of redundant

testing and continue with their desired orders, a freedom that is thought to correlate with physician satisfaction with the electronic ordering system.⁶ Our design was unique in which amylase testing was not removed from CPOE order sets, only unchecked. Simply unchecking amylase was successful in reducing redundant diagnostic testing without eliminating physician's choice.

A limitation of this study was that only minor changes were made within the CPOE system at a single institution; therefore, results cannot be generalized to extensive conclusions. However minor the adjustments may seem, small accumulative changes promote significant changes over time. Moving forward, assessments of redundant laboratory testing will continue to be evaluated and Lean Six Sigma methods will be utilized to further reduce institutional cost.

CONCLUSION

We have demonstrated that the simple unchecking of a non-value added test can result in considerable savings while preserving physician choice.

Conflicts of Interest and Funding

The authors have nothing to disclose.

Table 1 Reduced amylase utilization in the Emergency Department by altered Computerized Provider Order Entries.

Pre-Intervention					Post-Intervention			
Month 2014	Lipase Tests	Amylase Tests	Percent Amylase/ Lipase	Amylase Test Charge	Month 2015	Lipase Tests	Amylase Tests	Amylase Test Charge
January	856	666	77.8%	\$72,594	January	966	304	\$33,136.00
February	753	567	75.3%	\$61,803	February	882	75	\$8,175.00
March	930	682	73.3%	\$74,338	March	1117	73	\$7,957.00
April	894	625	69.9%	\$68,125	April	1011	82	\$8,938.00
May	931	660	70.9%	\$71,940	May	1033	76	\$8,284.00
June	865	658	76.1%	\$71,722	June	1025	63	\$6,867.00
July	987	699	70.8%	\$76,191	July	945	79	\$8,611.00
August	920	641	69.7%	\$69,869	August	979	46	\$5,014.00
September	954	661	69.3%	\$72,049	September	987	42	\$4,578.00
October	909	607	66.8%	\$66,163	October	940	66	\$7,194.00
November	866	543	62.7%	\$59,187	November	955	69	\$7,521.00
December	978	638	65.2%	\$69,542	December	992	78	\$8,502.00

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