BMJ Open Quality

Implementing effective test utilization via team-based evaluation and revision of a family medicine laboratory test requisition

Zahraa Mohammed-Ali ,[1] Seema Bhandarkar,[2] Shafqat Tahir,[3] Curtis Handford,[2,4] Drake Yip,[3] Daniel Beriault,[1,3] Lisa K Hicks[5,6,7]

To cite: Mohammed-Ali Z, Bhandarkar S, Tahir S, *et al*. Implementing effective test utilization via team-based evaluation and revision of a family medicine laboratory test requisition. *BMJ Open Quality* 2021;**10**:e001219. doi:10.1136/bmjoq-2020-001219

► Additional material is published online only. To view, please visit the journal online (http://dx.doi.org/10.1136/bmjoq-2020-001219).

Received 28 October 2020
Revised 16 February 2021
Accepted 28 February 2021

Check for updates

© Author(s) (or their employer(s)) 2021. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to
Dr Lisa K Hicks;
lisak.hicks@unityhealth.to

INTRODUCTION

Revision of laboratory test requisitions is a simple utilisation strategy that can reduce unnecessary testing.[1 2] The goal of this study was to improve test utilisation via a collaborative team-based evaluation and revision of a standardised lab requisition used by six large family medicine units.

METHODS

Revising the family requisition form

A historical laboratory requisition used by the Family Medicine Department at Unity Health, St. Michael's Hospital site, Unity Health Toronto, Toronto, Canada, was reviewed and modified by a steering committee comprised of family medicine clinicians (physicians and a nurse practitioner), lab medicine specialists and a quality improvement specialist. Decisions were made by consensus, and input was sought from the entire Department of Family Medicine via departmental rounds before changes were finalised. Laboratory tests were removed from the requisition if there was evidence in the literature of overuse (eg, Aspartate Aminotransferase (AST), folate, urea, Erythrocyte Sedimentation Rate (ESR),[3 4] if they were outdated (eg, amylase, Creatine Kinase (CK)),[3] or if there was consensus that they were infrequently needed in a family practice (eg, rheumatoid factor, direct bilirubin). The requisition was also revised to improve readability, and education was imbedded regarding some special tests such as urine toxicology screening and coagulation testing (changes in online supplemental table 1). Tests that were removed from the requisition remained orderable with longhand.

Data analyses

The primary outcome was the monthly volume of targeted tests ordered by the family medicine clinic 6 months pre- and 6 months post-requisition changes (September 2018 to September 2019). The proportion of abnormal test results and the ratio of Alanine Aminotransferase (ALT) (not targeted) to AST (targeted) were used as balance measures. Outpatient monthly laboratory test volumes for 20 tests were extracted from the laboratory information system. Process Control charts were generated using GraphPad Prism V.8.2.0. The proportion of abnormal results was calculated using R studio program V.1.2.5033. A two-tailed t-test was used to explore whether testing volumes were significantly different pre-requisition changes compared to post-requisition changes. Non-targeted tests (eg, ALT, total bilirubin, creatinine, haemoglobin) were used as negative controls. Cost analysis was performed using the Ontario Health Insurance Plan laboratory service fees as an estimate of true cost. The project was formally reviewed by institutional authorities at Unity Health Toronto and deemed to neither require research ethics board approval nor written informed consent from participants. Patients and/or the public were not included in the design, conduct, reporting, or dissemination of our research.

RESULTS

Ninety-nine thousand four hundred and thirteen laboratory tests were included in this analysis. Modifying the family medicine lab requisition resulted in a significant reduction in volume of targeted tests on AST (−50.8%), direct bilirubin (−68.2%), CK (−31.9%), amylase (−61.2%), urea (−79.9%), ESR (−31.3%), serum folate (−87.2%) and Red Blood Cell (RBC) folate (−76.8%) as depicted in figure 1 and online supplemental table 2. Although

BMJ Open Qual: first published as 10.1136/bmjoq-2020-001219 on 17 March 2021. Downloaded from http://bmjopenquality.bmj.com/ on April 20, 2024 by guest. Protected by copyright.

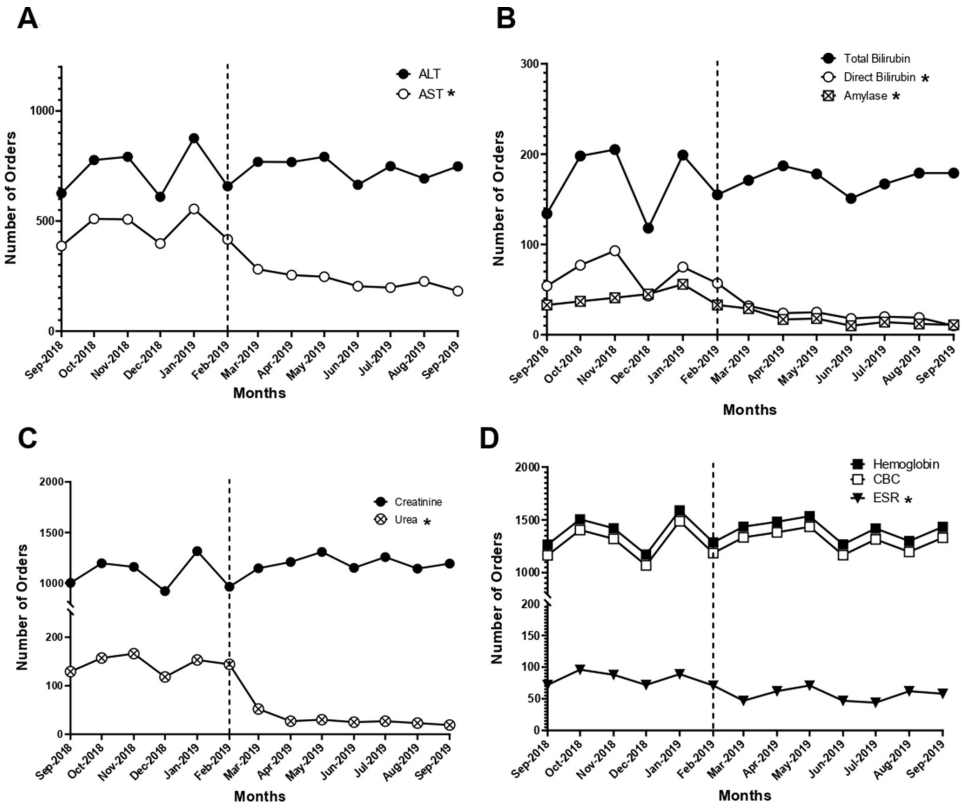

Figure 1 Decline in ordering of tests removed from the family medicine laboratory test requisition form over time. (A) AST and ALT, (B) amylase, total and direct bilirubin, (C) urea and creatinine and (D) ESR and negative controls, Haemoglobin and CBC (platelets and white blood cells). Dotted lines show the point of QI intervention. Asterisk denotes tests removed from the requisition. AST, Aspartate Aminotranferase; ALT, Alanine Aminotransferase; ESR, Erythrocyte Sedimentation Rate; CBC, Complete Blood Count.

there was a trend towards an increase in ordering ALT, total bilirubin, creatinine, haemoglobin over time, this change was not significant, except in the case of sodium (online supplemental table 2), and could reflect seasonal variation in overall clinic volume. The decrease in ordering resulted in cost savings each month. Online supplemental table 3 shows that the monthly cost of AST dropped by 50.8%, direct bilirubin by 68.7%, CK by 31.9%, amylase by 61.0%, urea by 80.0%, ESR by 30.9%, serum folate by 87.1% and RBC folate by 76.9%. On average, the cost of unnecessary testing used to be CAD 4687.41 per month prior to our quality improvement initiative and was reduced to CAD 2738.41 per month, amounting to an average of CAD 1949.00 in savings per month.

We performed a focused analysis on AST to evaluate whether the removal of AST from the family medicine lab requisition impacted the AST to ALT ordering ratio. A lower ratio of AST to ALT suggests more appropriate or targeted testing.[5–7] The AST:ALT ratio prior to our intervention was 0.6 whereas the average AST:ALT ordering ratio post intervention was 0.3 ($p<0.05$) (figure 2). The proportion of abnormal results in AST and ALT tests was then calculated as the proportion of results that were outside the reference intervals (ALT: 10–45 U/L, AST: 7–40 U/L) used for the tests. AST showed a significant increase of 40% (p value <0.05) in the percentage of abnormal results after it was removed from the requisition potentially indicating more targeted usage of this test. ALT, our negative control in this analysis, did not show any significant change in the percentage of abnormal results. This finding suggests that modifying the family

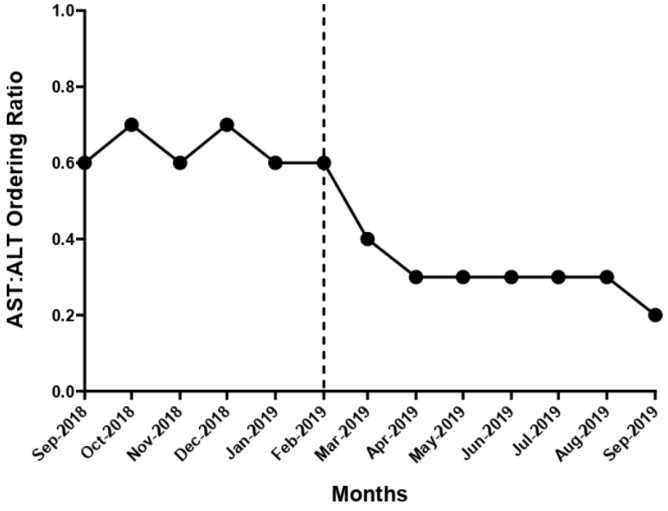

Figure 2 AST to ALT ordering ratio before and after removal of tests from family medicine laboratory tests requisition. A significant drop in AST:ALT ordering ratio was observed (p value <0.05) after removing AST from the family medicine test requisition. Dotted lines show the point of QI intervention. AST, Aspartate Aminotransferase; ALT, Alanine Aminotransferase; QI, Quality Improvement.

BMJ Open Qual: first published as 10.1136/bmjoq-2020-001219 on 17 March 2021. Downloaded from http://bmjopenquality.bmj.com/ on April 20, 2024 by guest. Protected by copyright.

medicine requisition only impacted the utilisation of the targeted tests removed.

CONCLUSIONS

Revision of a family medicine lab requisition was a simple, but effective strategy to decrease unnecessary laboratory testing and improve appropriate testing at our hospital. We recommend reviewing and revising historical requisitions and/or order sets as a way to encourage appropriate lab testing practices.

Author affiliations
[1]Department of Laboratory Medicine and Pathobiology, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada
[2]Department of Family and Community Medicine, St Michael's Hospital, Unity Health Toronto, Toronto, Ontario, Canada
[3]Department of Laboratory Medicine, Unity HealthToronto, Toronto, Ontario, Canada
[4]Department of Family and Community Medicine, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada
[5]Department of Medicine, St. Michael's Hospital, Unity Health Toronto, Toronto, Ontario, Canada
[6]Li Ka Shing Knowledge Institute, St. Michael's Hospital, Unity Health Toronto, Toronto, Ontario, Canada
[7]Department of Medicine, University of Toronto, Toronto, Ontario, Canada

Contributors ZM-A contributed to data analysis and drafted the manuscript. SB, ST and CH contributed to study design, study implementation, and reviewed and revised the manuscript. DY contributed to study design, study implementation, data collection, data analysis, and reviewed and revised the manuscript. DB and LH conceived of the study, contributed to study design, implementation and data analysis, and helped draft the manuscript.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iD
Zahraa Mohammed-Ali http://orcid.org/0000-0001-6771-1462

REFERENCES

1 Naugler C, Church DL. Clinical laboratory utilization management and improved healthcare performance. *Crit Rev Clin Lab Sci* 2018;55:535–47. doi:10.1080/10408363.2018.1526164
2 Corson AH, Fan VS, White T, *et al*. A multifaceted hospitalist quality improvement intervention: decreased frequency of common Labs. *J Hosp Med* 2015;10:390–5.
3 Wu AHB, Lewandrowski K, Gronowski AM, *et al*. Antiquated tests within the clinical pathology laboratory. *Am J Manag Care* 2010;16:e220–7.
4 Jose H, Salazar M. Overview of urea and creatinine. *Lab Medicine* 2014;45. doi:10.1309/LM920SBNZPJRJGUT
5 Ivica J, Hill S. The potential of reducing AST testing in hospital settings. *Clin Biochem* 2019;64:57–9.
6 Xu Q, Higgins T, Cembrowski GS. Limiting the testing of AST: a diagnostically nonspecific enzyme. *Am J Clin Pathol* 2015;144:423–6.
7 Mohammed-Ali Z, Brinc D, Kulasingam V, *et al*. Defining appropriate utilization of AST testing. *Clin Biochem* 2020;79:75–7.

BMJ Open Qual: first published as 10.1136/bmjoq-2020-001219 on 17 March 2021. Downloaded from http://bmjopenquality.bmj.com/ on April 20, 2024 by guest. Protected by copyright.