Reducing low-value testing in the emergency department through cost-effective physician education and personalised audit and feedback scorecards

Rohit Gandhi¹ · Raphael Lessard² · Sebastien Landry³

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Abstract

Objectives Delivery of low-value healthcare impacts patients, resources, and overall healthcare sustainability. In Canada, an estimated 30% of tests, treatments, and procedures are unnecessary. As primary decision-makers, physicians have a major influence on healthcare utilisation. Despite numerous approaches to reduce low-value testing, success has been limited. Audit and feedback strategies have demonstrated variable effects in changing physician practice and often do not consider resource requirements. The objective of this study is to evaluate a resource-effective approach to decrease low-value testing in the emergency department (ED) through online education and personalised audit and feedback scorecards for two common ED tests.

Methods A single-centre, prospective pre–post trial of 31 ED physician's ordering rates of urine cultures and rib X-rays was conducted at an academic community hospital in Ottawa, Ontario. The study included educational interventions on appropriate ordering guidelines and personalised audit and feedback scorecards from 2019 to 2020.

Results There was a 36.9 and 81.6% relative reduction in urine culture and rib X-ray ordering, respectively, between the baseline intervention and the 12-month post-scorecard period ($p < 0.01$). The group dispersion in ordering rates during the post-scorecard period was smaller compared to the wide dispersion at baseline. The rate of return ED visits for both tests remained unchanged. Variable cost analysis demonstrated \$53,300 in cost-savings from reduced testing rates during the study period. The total study cost was \$15,000.

Interpretation The combination of online education and personalised audit and feedback scorecards may present a resource-effective approach to change physician practice and reduce low-value testing in the ED. Further studies are needed to examine this approach in other departments and clinical topics in Canada.

Keywords Audit and feedback · Choosing wisely · Physician behaviour · Scorecards · Changing physician behaviour

Résumé

Objectifs La prestation de soins de santé de faible valeur a un impact sur les patients, les ressources et la durabilité globale des soins de santé. Au Canada, on estime que 30 % des tests, des traitements et des procédures sont inutiles. En tant que principaux décideurs, les médecins ont une influence majeure sur l'utilisation des soins de santé. Malgré de nombreuses approches visant à réduire les tests de faible valeur, le succès a été limité. Les stratégies de vérification et de rétroaction ont

✉ Rohit Gandhi
rohitgandhi66@gmail.com

¹ Department of Emergency Medicine, Montfort Hospital, 713 Montreal Road, Ottawa, ON K1K 0T2, Canada

² School of Medicine, Faculty of Medicine, University of Ottawa, Ottawa, ON, Canada

³ Montfort Hospital, 713 Montreal Road, Ottawa, ON K1K 0T2, Canada

démontré des effets variables sur l'évolution de la pratique des médecins et ne tiennent souvent pas compte des besoins en ressources. L'objectif de cette étude est d'évaluer une approche efficace en termes de ressources pour réduire les tests de faible valeur dans le service des urgences grâce à une formation en ligne et à des fiches d'audit personnalisés et de rétroaction pour deux tests courants aux urgences.

Méthodes Un essai prospectif avant-après dans un seul centre portant sur les taux de prescription de cultures d'urine et de radiographies des côtes par trente et un médecins du service d'urgence a été mené dans un hôpital communautaire universitaire à Ottawa, en Ontario. L'étude comprenait des interventions éducatives sur les directives de commande appropriées et des fiches d'audit et de retour d'information personnalisées de 2019 à 2020.

Résultats Il y avait une réduction relative de 36,9 % et 81,6 % de la culture d'urine et de la commande de radiographies des côtes respectivement, entre l'intervention de base et la période de 12 mois après la fiche de notation ($p < 0,01$). La dispersion des groupes dans les taux de commande au cours de la période post-bilan était plus faible par rapport à la large dispersion au départ. Le taux de retour des visites aux urgences pour les deux tests est resté inchangé. L'analyse des coûts variables a montré que la réduction des taux de dépistage pendant la période d'étude a permis de réaliser des économies de 53 300 dollars. Le coût total de l'étude s'est élevé à 15 000 dollars.

Interprétation L'association d'une formation en ligne et de fiches d'audit et de retour d'information personnalisées peut constituer une approche efficace en termes de ressources pour modifier les pratiques des médecins et réduire les tests à faible valeur dans les urgences. D'autres études sont nécessaires pour examiner cette approche dans d'autres départements et sujets cliniques au Canada.

Clinician's capsule

What is known about the topic?

Effectiveness of audit and feedback strategies is variable and resource-use and ease of implementation of multi-model strategies are seldom considered.

What did this study ask?

Can education and personalised audit and feedback scorecards provide an effective and resource-conscious approach to reduce low-value testing in the ED?

What did this study find?

Our multimodal, resource conscious, audit and feedback intervention led to a significant reduction of urine cultures and rib x-rays.

Why does this study matter to clinicians?

Our approach provides a resource-effective multimodal audit and feedback strategy to reduce low-value testing and improve care in the ED.

and procedures are unnecessary [2]. As emergency department (ED) visits are predicted to increase 40% by 2037 [3], reducing low-value care in the ED may significantly impact patient care and healthcare sustainability.

Physicians are primary decision-makers, and their actions greatly impact resources. However, ordering practices vary and are often not evidence-based [4]. Despite the abundance of educational materials, changing physician practice patterns is difficult and efforts to address this have had limited success [5]. Audit and feedback are a widely published method [6], which provides a summary of individual performance designed to help translate knowledge into improved practice. The effectiveness of audit and feedback strategies, however, is variable and the resource use and ease of implementation of these strategies are seldom considered [6].

Our study aims to evaluate the effectiveness of a resource-conscious multimodal audit and feedback intervention in the ED. Using online education and personalised audit and feedback scorecards, our goal is to provide physicians with tools that help them reduce low-value care. To evaluate our approach, we targeted two commonly over-ordered tests in the ED: urine cultures and rib X-rays [7, 8]. Urine culture ordering is part of Choosing Wisely Canada's toolkit for decreasing low-value testing in the ED. They represent the most over-ordered ED microbiological investigation, and its reduction is associated with decreased antimicrobial use [9]. Rib fractures are the most common thoracic injuries, and when suspected, rib X-rays are frequently ordered despite the literature demonstrating limited diagnostic value [7].

Introduction

With annual healthcare spending predicted to increase from \$144.3 to \$362.6 billion by 2030, the sustainability of healthcare resources has become a priority for Canadian hospitals [1]. In Canada, an estimated 30% of tests, treatments,

Methods

Study design and time period

Single-centre, prospective pre–post trial of ED physician ordering rates for urine cultures and rib X-rays, from May 2019 to October 2020.

Study setting

The study took place at Hôpital Montfort, an academic hospital in Ottawa, Ontario, with a patient census of > 60,000 ED visits per year.

Population

Our study population consists of 31 certified emergency medicine physicians. The principle investigator and three physicians without baseline data were excluded. Hôpital Montfort Research Ethics Board approval was obtained (protocol 18-19-02-041).

Intervention

The initial interventions of education and personalised audit and feedback took place simultaneously on May 2, 2019 via e-mail. The educational intervention consisted of two 2-min online animated videos highlighting the evidence and recommended ordering guidelines for each test.

Personalised scorecards accompanied the videos (Supplemental Appendix A). For each study test, the scorecards contained: (a) personal ordering rates, (b) comparison to group average, (c) rank compared anonymously to all physicians, and (d) personalised chart audit and feedback. The audit and feedback component contained personalised examples of patient encounters for each test. Feedback contained written summaries of encounters, whether the study test was indicated, test results, and outcomes.

Physicians were required to submit read receipts after reviewing the educational videos and scorecards. After a 10-day ‘grace’ period, where no data were collected, performance data were monitored, and two subsequent scorecards were sent at 2-month intervals for ongoing feedback.

Outcome measures

The primary outcome was a reduction in ordering rates among physicians for each test. The secondary outcome was a reduction in the dispersion of group ordering rates. Return visits within 72 h for the diagnosis of urinary tract infections (UTI)/pyelonephritis or rib/chest injury was used as a balancing measure. Variable costs of study tests, physician

time, and departmental resources and personnel required were used to evaluate resource-effectiveness.

Data analysis

Hôpital Montfort Medical Records provided a total of 208 random charts to provide a minimum of six charts per physician (three for each study test) during the pre-intervention baseline period (May 2018–May 2019). Chart audits were conducted by the investigators who were blinded to physician identification. The following data were extracted and reviewed for predefined variables: medical history, examination, diagnosis, results, and follow-up encounters.

Data were collected using the hospital’s health record system, MEDITECH. Data were extracted as a percentage of tests ordered per number of patients seen over the same period.

A cost analysis based off the Eastern Ontario Regional Laboratory Association fees for urine cultures, in conjunction with hospital case costing for rib X-rays, was used to measure variable cost-saving resulting from reduced testing rates compared to baseline ordering. Fixed costs were not considered.

Variables were checked for normality. Baseline descriptive statistics were performed, and continuous variables were presented as mean $\pm$ standard deviation and categorical variables as number (%). Linear mixed-model analyses were performed to determine main effects on ordering rates by timeline audit (within-subject factor). Mean change with 95% CI were reported. *P* values ≤ 0.05 were considered significant. SPSS 22.0 (SPSS Inc.) was used to perform statistical analyses.

Results

All 31 physicians submitted read receipts and participated in the study. On average, there was a 36.9% and 81.6% relative reduction in urine culture and rib X-ray ordering rates between the baseline intervention and 12-month post-scorecard period (Table 1). The total number of tests performed in the ED during the 12-month baseline period compared to the 12-month post-intervention period decreased from 3110 to 2195 and 539 to 78 for urine cultures and rib X-rays, respectively.

A significant effect of time was observed for both tests. Based on pairwise comparisons for urine cultures, significant differences were observed between baseline and 12-month post-intervention period (5.4 to 3.4% 95% CI = 0.9–3.0; $p < 0.01$). For rib X-rays, significant differences were also observed between baseline and 12-month post-intervention period (0.8 to 0.1% 95% CI = 0.4–0.9; $p < 0.01$). The group’s standard deviation from baseline to the post-intervention

Table 1 Percentage of urine cultures and rib X-rays ordered per patients at the emergency department at various points in time ($n = 31$)

	Baseline scorecard #1 (initial intervention)	Scorecard #2 (Month 0–2 post-interven- tion)	Scorecard #3 (Month 2–4 post-interven- tion)	Post-scorecard period (Month 5–17 post-interven- tion)	<i>P</i> value
Urine culture (%)	5.4 ± 2.3	4.0 ± 2.3^a	3.8 ± 2.0^a	3.4 ± 1.8^a	< 0.01
Rib X-ray (%)	0.8 ± 0.5	0.1 ± 0.2^a	0.1 ± 0.2^a	0.2 ± 0.0^a	< 0.01

Values are presented as mean $\pm$ standard deviation^aSignificantly different from baseline

period decreased for urine cultures (2.3 to 1.9%) and rib X-rays (0.5 to 0.2%).

Return visits within 72 h did not change from the baseline period (0.1%) to the post-intervention period (0.1%). The total study cost was \$15,000. Throughout the study, \$53,300 in variable cost-savings from reduced testing rates, compared to baseline, was realised. No operational/system-level changes, physical materials, or nursing/administrative time was required. Approximately 15–20 min of physician time was required throughout the study for education and scorecard interpretation.

Discussion

Interpretation of findings

This study demonstrated a significant reduction in ordering rates of urine cultures and rib X-rays using a combination of online education and personalised audit and feedback scorecards. Physicians demonstrated a greater relative reduction in rib X-ray ordering (81.6%) compared to urine culture ordering (36.9%), likely due to the wider clinical indications for urine culture testing. The secondary outcome, ordering dispersion among the group, demonstrated improvement over time with each scorecard. A significant reduction in the group's standard deviation suggests that ED physicians adopted a unified approach to ordering and that study guidelines were followed. Given unchanged ED return visit (safety metric), these reductions in ordering may have led to decreased wait-times, resources, unnecessary antimicrobial treatment [9], and radiation [7]. The use of a conservative, solely variable cost analysis demonstrated \$53,000 in savings from reduced testing. This proved favorable when compared to the relative intervention cost (\$15,000) considering the modest time, administrative, and material requirements.

Comparison to previous studies

Cochrane database systematic reviews of audit and feedback studies have demonstrated a widely varied, but overall small median effect on audit and feedback outcomes [6]. More

recent complex audit and feedback studies are demonstrating greater median effects on audit and feedback intervention results, as seen with our study [10]. However, many of these studies have failed to consider resource use, and speculation remains on the relative cost and effectiveness of different multimodal approaches [6].

Strengths

Our approach employed audit and feedback best practices which were anonymous, non-punitive, and required limited resource and physician time [11]. The personalisation of data facilitated greater self-reflection compared to group-level information, which is often discounted. Personalised chart audits provided concrete examples of non-indicated tests and highlighted how these tests did not improve patient management. This feedback helped reduce physician likelihood of overlooking their data and helped improve understanding of the educational intervention.

Limitations

The modest sample size of our single-centre study may not be generalizable. The study does not include a control, but baseline ordering data helps address this. The study does not evaluate if tests ordered post-intervention were indicated. Without prospective chart audits, we cannot be certain if inappropriate reductions in ordering occurred or if those instances led to harm. However, a surrogate safety measure (% return visits) did not change. Cost and resource considerations are based on our particular study size and selected tests. This makes it difficult to extrapolate findings to different clinical scenarios.

Clinical implications

The positive return on investment from a resource and harm-reduction perspective [7, 9] may enable other centres to replicate more easily a resource-effective approach to reduce low-value testing in the ED.

Research implications

Our study provides insight on the effectiveness of a multi-modal audit and feedback approach in the ED that considers the resources associated with implementation.

Conclusion

Combining online education and personalised audit and feedback scorecards proved to be an effective and resource-efficient method of optimizing physician practice to reduce low-value testing in the ED. Further studies are needed to examine whether this approach will work in other departments and clinical settings elsewhere in Canada.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s43678-021-00220-w>.

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Declarations

Conflict of interest There are no conflicts of interest to report.

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