Original Article

Controlling Unnecessary Laboratory Investigation Requests for Inpatients of General Internal Medicine

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ABSTRACT

OBJECTIVE: To reduce unnecessary laboratory investigations by more than 15% over three months in the general internal medicine inpatient service at King Fahad Armed Forces Hospital (KFAFH), Jeddah, while maintaining patient safety and improving cost-effectiveness.

METHODOLOGY: A 12-week prospective interventional study was designed for January-March 2025, at KFAFH, Jeddah, Saudi Arabia. Patients admitted under internal medicine were included, while critically ill, surgical, or non-internal medicine admissions were excluded from analysis. A randomized sample of 200 patients was divided into two groups: 100 in the control group and 100 in the intervention group. For intervention groups, targeted education was provided to residents and registrars, with structured discussions during ward patient visit rounds, and the placement of visual reminders, including posters, banners, and images, in the clinical work area. The frequency of commonly requested laboratory investigations, including complete blood counts (CBCs), serum electrolytes, and liver function tests, was monitored throughout the study.

RESULTS: A comparative analysis showed a statistically significant reduction in laboratory investigation requests in the intervention group compared with the control ($p<0.0001$).

This was further observed in the cost-effectiveness, with savings of SAR 86,600 per 100 patients. Interestingly, the reduction in the number of investigations did not affect patient outcomes, indicating that the quality and safety of care were maintained.

CONCLUSION: The study demonstrates that straightforward, multidisciplinary interventions can substantially reduce the overutilization of laboratory tests while providing cost-effective healthcare delivery, aligned with principles of high-value without compromising safety.

KEYWORDS: Laboratory test overutilization, Cost-effective healthcare, Internal medicine, Quality improvement, Patient safety.

INTRODUCTION

The ever-increasing cost of healthcare is a national issue that has sparked heated debates over the best course of action to control spending. Experts predict healthcare expenditures will balloon to a staggering $7.1 trillion by 2031, raising concerns about affordability and sustainability[1]. One significant contributor to this financial strain is the rampant overuse of laboratory investigations. Studies indicate that a substantial portion of routine laboratory investigations - potentially up to 20% - may be unnecessary[2]. This overutilization creates a ripple effect. It burdens the healthcare system with wasted resources, drives up costs for both patients and insurers, and can even lead to unnecessary patient anxiety or discomfort from procedures. Eliminating unnecessary laboratory investigations is rapidly becoming a critical strategy. By implementing measures to curb this practice, we can work towards a more efficient and cost-effective healthcare system, ensuring both quality care and financial responsibility[1]. The detrimental effects of excessive laboratory testing extend far beyond just healthcare costs. This overreliance on these investigations creates a multitude of burdens for both patients and healthcare staff in both pathology labs and in wards. Studies have shown increased risks of errors and decreased patient satisfaction associated with this practice. Frequent sampling can cause patient discomfort and disrupt sleep, reflecting the broader adverse consequences of excessive reliance on laboratory investigations. Unnecessary investigations sometimes can lead to a cascade of adverse outcomes, including hospital-acquired anaemia and overwhelming healthcare professionals with irrelevant data[3,4]. Therefore, the primary objectives of this initiative are to reduce the number of unnecessary laboratory orders per patient per day by more than 15% within three months on the inpatient internal medicine service at King Fahad Armed Forces Hospital (KFAFH), Jeddah, this approach can help improving overall patient satisfaction, enhance cost-effectiveness, alleviate the workload on laboratory staff, and can help to minimize the possible risk of iatrogenic anemia which may result from frequent blood sampling in hospitalized patients.

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METHODOLOGY

To measure our progress, real-time data on the number of routine Laboratory investigations ordered per patient were recorded for three general medicine teams at KFAFH-JEDDAH. This was performed 3 times per week on a random sample of 6 patients on that team each day, using simple random sampling at the time of hospitalization at KFAFH-JEDDAH. The average was calculated for each team for the week. Data was recorded continuously, where the control and intervention groups were managed concurrently for 12 weeks. The laboratory investigations that were specifically monitored were CBC, biochemistry/ electrolytes, and liver function tests. These laboratory investigations were selected because they are among the most frequently ordered and considered routine tests.

The study protocol was reviewed and approved by the hospital's internal Institutional Review Board (IRB), under NCBE-KACST Registration No. H-02-J047, ensuring adherence to ethical standards and protection of patient confidentiality.

As part of the intervention to reduce unnecessary laboratory orders, a root cause analysis was conducted to identify the underlying factors contributing to the frequent, often redundant morning orders for laboratory investigations. This analysis served as a foundation for developing targeted strategies to optimize test ordering.

Firstly, an educational intervention was initiated by organizing a four-session workshop of 45 minutes each, attended by clinical residents and registrars from the department of internal medicine. The workshops were facilitated by heads of the clinical departments and experienced pathologists of the hospital. The primary focus of the workshops was to highlight the financial or economic impact of unnecessary testing, the patient burden from phlebotomy and test-related interventions, the clinical appropriateness of ordering, and, most importantly, the principles of high-value care. Small group interactive teaching and reflection sessions during the ward round, in which 10-15 minutes were dedicated to the structured discussions led by a physician focused on revisiting and justifying any laboratory investigation ordered for the day. These sessions were essential for questioning or discussing various points, including which investigation is indicated today. Will the investigation help in changing the management approach? Was the test suggested recently performed? This provided education on the financial and patient burden of unnecessary laboratory investigations. Additionally, residents' routine ordering of laboratory investigations without considering patient impact, treatment strategy, of test costs was addressed.

Our second intervention was directed more toward the attending physicians. Attending physicians were encouraged to conduct rounds dedicated to discussing daily laboratory orders and to set expectations for residents and registrars.

Inclusion and Exclusion Criteria

The study included adult patients admitted to the internal medicine ward. Patients were excluded if they were critically ill and required transfer to the intensive care unit or if they were under the care of specialists other than general internal medicine.

Collaboration and Implementation Strategy

Successful implementation of this pathway required collaboration with the administrative department to place reminder posters in the workrooms across the wards. These posters aimed to encourage interns and residents to prioritize their patients' best interests by weighing the benefits and risks before ordering routine morning laboratory tests. Interventions were strategically spaced approximately one month apart to assess the individual impact of each measure and to evaluate the cumulative effect over time.

Statistics

The descriptive data were reported as count (n) and percentages (%). In contrast, the numerical data are reported as medians and interquartile ranges (first quartile–third quartile). The Shapiro–Wilk test of normality showed that the data were not normally distributed. The Mann–Whitney U test was applied for univariate analysis of numerical data, whereas the *Chi* -square test was used for univariate analysis of categorical variables. Comparative analyses were performed using two-tailed tests, and $p<0.05$ was considered statistically significant. All data were analyzed using Stata 18.0 (StataCorp LLC, College Station, TX) for Windows.

RESULTS

A total of 200 patients were included in the analysis, with 100 in the control group and 100 in the interventional group (**Table I**). The median age of patients was 68 years in the control group and 68.5 years in the interventional group, showing no significant difference between the two groups (p = 0.9066). Approximately half of the participants were male, with 51% in the control group and 47% in the interventional group (p = 0.572).

Regarding primary discharge diagnoses, the most frequent condition overall was complicated urinary tract infection (UTI), followed by decompensated heart failure and pneumonia (aspiration and community-acquired types). A small number of cases involved stroke, epilepsy, bronchial asthma, gastroenteritis, and vaso-occlusive crises. There was no statistically significant difference in discharge diagnoses between the two groups (p = 0.058).

The median length of hospital stay was 6 days (IQR 4 –7) in the control group and 5 days (IQR 3–7.5) in the interventional group, also showing no significant difference (p = 0.2855). The number of complete blood count tests, urea/creatinine tests, liver function tests, and all laboratory tests was significantly reduced in the interventional group compared with the control

group (p<0.0001). **Table II** *summarises the percentage reduction observed in the intervention group compared to the control group for each test category and* for all investigations combined. There was a significant cost reduction observed in the intervention group (SAR 86,600/100 patients) (**Figure 1**).

Table I: Summary of the baseline and clinical outcomes between the control and intervention groups

Variables	Control Group n=100	Intervention Group n=100	*p* value
Age in years, median (IQR)	68 (54–79)	68.5 (55–79)	0.9066
Gender, n (%)			
Male	51 (51)	47 (47)	0.572
Female	49 (49)	53 (53)	
Discharge diagnosis			
Aspiration pneumonia	10 (10)	13 (13)	
Community-acquired pneumonia	14 (14)	12 (12)	
Complicated urinary tract infection	23 (23)	16 (16)	
Uncomplicated urinary tract infection	0 (0)	3 (3)	
Decompensated heart failure	21 (21)	21 (21)	0.058
Hemorrhagic stroke	1 (1)	0 (0)	
Ischemic stroke	8 (8)	19 (19)	
Gastroenteritis	8 (8)	5 (5)	
Epilepsy	1 (1)	5 (5)	
Bronchial asthma	1(1)	0 (0)	
Vaso-occlusive crisis	13 (13)	5 (5)	
Deep venous thrombosis	0 (0)	1 (1)	
Hospital stay in days, median (interquartile range)	6 (4–7)	5 (3–7.5)	0.2855
Number of complete blood count tests, median (interquartile range)	6 (4–8)	4 (2.5–5)	<0.0001
Number of urea/ creatinine tests, median (interquartile range)	5 (4–7)	3 (2–4)	<0.0001
Number of liver function test tests, median (interquartile range)	4 (3–6)	2 (1.5–3.5)	<0.0001
Number of all laboratory tests, median (interquartile range)	15.5 (12–21)	9 (6–12)	<0.0001

Table II: Summary of the percentage reduction for each test category, as well as the overall reduction in the control and intervention groups

Test Type	Median per patient (Control)	Median per patient (Intervention)	% Reduction
Complete Blood Count (CBC)	6	4	33.3%
Urea/Creatinine (Electrolytes)	5	3	40.0%
Liver Function Tests (LFTs)	4	2	50.0%
All Laboratory Tests Combined	15.5	9	41.9%

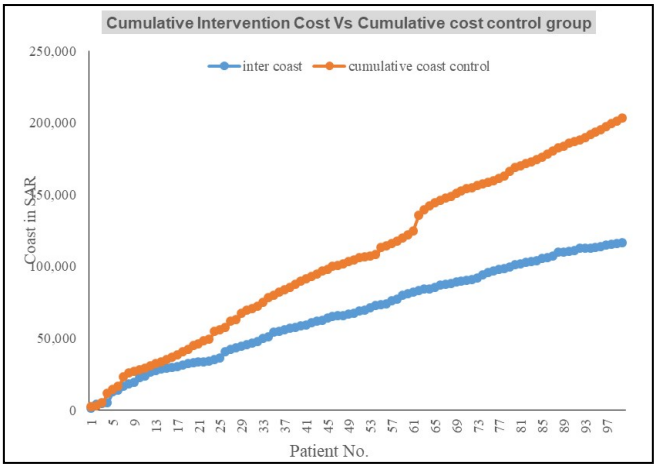

Figure 1*: The graph compares the cumulative hospitalization costs of 100 patients in the intervention group (blue line) and 100 patients in the control group (orange line)*

DISCUSSION

The overuse of routine blood tests is a significant global problem, with studies indicating that 45%-60% of these tests ordered in hospital settings provide no value in diagnosing or treating patients[5–7]. This translates to a substantial waste of resources and can negatively impact patient care.

Fortunately, there are strategies to address this issue. Making healthcare providers aware of costs can be a simple yet effective approach. A study by Feldman et al.[8] demonstrated a 9.1% reduction in test orders by simply displaying the fee data for laboratory tests. This suggests that cost awareness can play a significant role in modifying ordering behavior[9–11].

Requests for laboratory investigations, particularly those involving broad panels rather than specific tests, significantly burden the healthcare system at both the institutional and national levels. It acts as a major driver of healthcare costs through two main avenues: direct laboratory investigation costs and downstream effects. While our study didn't delve into downstream expenses, these can include additional procedures or treatments triggered by unnecessary test results.

The benefits extend beyond just cost savings. Reducing unnecessary blood draws improves the patient experience. Fewer tests mean fewer venipunctures, potentially leading to less pain and a decreased risk of phlebotomy-induced anaemia, a condition in which iron stores are depleted due to frequent blood draws[11]. Studies by Eaton KP et al.[12] observed a decrease in the number of patients undergoing venipuncture, highlighting this potential benefit. Further research is warranted to fully understand the impact on other aspects of patient experience, such as patient satisfaction and potential reductions in pain from phlebotomy

For nurses and phlebotomists, already stretched thin by demanding workloads, unnecessary tests add to their time and effort. These professionals face the challenge of scheduling and performing extra blood draws, further straining a system often operating at peak capacity. Furthermore, early morning drawing of a sample for the laboratory investigation disrupts patients' sleep and creates unnecessary discomfort, especially for those already battling illness. While the risk of infection associated with phlebotomy is generally low, reducing unnecessary draws minimizes even this minor hazard. More significantly, excessive blood draws can contribute to iatrogenic anaemia, a condition in which iron levels become depleted due to frequent bloodletting. This can worsen pre-existing anaemia or even create it for patients who were previously healthy[13].

Several factors contribute to the overuse of laboratory investigations. Inexperienced healthcare professionals may lack the knowledge to discern which tests are essential for accurate diagnosis. Additionally, disorganized patient files or cumbersome electronic medical records can make it challenging to review past test results, leading to redundant testing. The unintuitive design of electronic medical record systems can also make it difficult for medical professionals to order the most appropriate tests easily. Finally, fear of missing a critical diagnosis or of legal repercussions can lead some healthcare providers to order a broader range of tests than may be strictly necessary[14–16].

It's important to acknowledge that patients sometimes contribute to the overutilization of laboratory investigations. They may express a desire for additional testing, often mistaking more tests for better care[17]. Educating patients about the limitations and potential downsides of unnecessary testing is crucial to promoting a more efficient, cost-effective healthcare system.

CONCLUSION

The study highlights that an essential factor of increasing awareness among healthcare providers regarding laboratory investigation costs can lead to a meaningful reduction in unnecessary investigations while avoiding overuse. Such interventions not only reduce healthcare expenditures but also improve patient comfort by minimizing risks associated with samples. A collaborative strategy that incorporates patient participation, enhanced electronic medical record systems, and physician education is required to address the overuse of laboratory investigations.

Limitations

This study has certain limitations; first, it was conducted at a single centre, which may limit the generalizability of the findings to other institutions with different patient populations. Second, the study duration was short, allowing only assessment of immediate post-intervention outcomes. Therefore, the long-term sustainability of the observed changes remains uncertain. Additionally, patient-centred outcomes, such as satisfaction and quality of care, were not evaluated.

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AUTHOR CONTRIBUTION

Estaiteh O: Made substantial contributions to the conception and design of the work, as well as the acquisition, analysis, and interpretation of data, drafting the manuscript and revising it critically for important intellectual content. Final approval of the version to be published and agreed to be accountable for all aspects of the work.

Uddin N: Made substantial contributions to the conception and design of the work, as well as the acquisition, analysis, and interpretation of data, drafting the manuscript and revising it critically for important intellectual content. Final approval of the version to be published and agreed to be accountable for all aspects of the work.

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