

Laboratory Stewardship and Repetitive Testing: Effect of a Minimum Retest Interval Alert at Order Entry

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Received: 31 December 2023; Accepted: 13 April 2024; Published: 31 July 2024

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Abstract

Repeat ordering of a laboratory test before a clinically meaningful change could plausibly have occurred -- a recognised, wasteful pattern sometimes called repetitive testing -- persists at most hospitals despite widespread awareness of it as a stewardship target. We implemented a minimum retest interval alert at order entry across twenty-two chemistry and haematology analytes, firing when a repeat order fell inside an analyte-specific interval with no override reason recorded, and measured its effect on repeat-order volume over twelve months against a twelve-month pre-implementation baseline. Repeat orders inside the minimum interval fell by 34.6% overall, with the largest reductions in analytes ordered as part of routine daily panels rather than in response to an acute clinical change, and clinicians overrode the alert with a documented reason in 11.2% of firings, most commonly citing a genuine acute change in the patient's condition. We report the alert design, the interval table by analyte, and the override pattern as a practical account of what a minimum retest interval intervention changes and what it does not.

Keywords: Laboratory stewardship; Repetitive testing; Clinical decision support; Minimum retest interval; Order entry

Introduction

Repetitive testing -- reordering a laboratory test before enough time has passed for its result to plausibly have changed in a way that would alter management -- is a well-described and persistent source of laboratory waste, driven less often by clinical urgency than by routine daily order sets, handover uncertainty about what has already been sent, and a general reluctance to remove a test from a standing order.^[1] Minimum retest interval rules, which block or flag a repeat order that falls inside an analyte-specific interval unless a reason is given, are one of the more directly actionable stewardship interventions available at order entry, though published effect sizes vary considerably by analyte set and by how strictly the interval is enforced.^[2]

We implemented a minimum retest interval alert across twenty-two chemistry and haematology analytes selected for a documented pattern of repetitive ordering in our own pre-implementation audit, and measured its effect on

repeat-order volume, override behaviour, and any unintended effect on the small minority of repeat orders that reflect a genuine acute clinical change rather than routine repetition.

Repetitive testing is distinct from, though sometimes confused with, genuinely clinically indicated serial monitoring: a troponin drawn at 0 and 3 hours to rule out myocardial infarction reflects an intentional, protocol-driven sampling interval, while a basic metabolic panel reordered daily as part of a standing post-operative order set, continuing unchanged well after the immediate post-operative period, reflects the kind of routine repetition this intervention specifically targets.^[1]

The persistence of repetitive testing despite widespread awareness of it as a stewardship target reflects, in large part, how standing order sets are constructed and maintained: an order set built for the acute phase of a clinical pathway is rarely revisited or trimmed as a patient's condition stabilises, and the path of least resistance for a busy clinical team is to leave the standing

order running rather than actively decide, each day, whether continued daily testing remains clinically indicated.^[5]

Clinical decision support at order entry -- intervening at the specific moment a repeat order is placed, rather than relying on retrospective audit and feedback alone -- has the practical advantage of acting before the unnecessary test is performed rather than only measuring the waste after the fact, which is why we chose an order-entry alert design over a purely retrospective audit-and-feedback approach for this intervention.^[7]

Methods

Twenty-two analytes were selected for inclusion based on a three-month pre-implementation audit identifying the highest-volume repeat-order patterns falling inside a clinically implausible interval for the requesting context. Each analyte was assigned an interval, ranging from four hours for potassium and glucose to seven days for lipid profile and vitamin D, set by consensus among laboratory medicine and the principal ordering specialties rather than a single fixed value across all analytes.^[3] The alert fired at order entry when a repeat order for a listed analyte fell inside its interval since the same patient's last result, requiring either cancellation of the order or a free-text override reason before submission was permitted.

Repeat-order volume inside the minimum interval was compared between the twelve months following go-live and the twelve-month pre-implementation baseline, and every override reason recorded during the post-implementation period was manually categorised by a clinical reviewer blinded to the ordering clinician's identity.^[4]

The alert was designed to interrupt order entry with a modal requiring explicit action -- cancel the order or provide a free-text override reason -- rather than a passive, dismissible banner notification, following published evidence that interruptive alerts requiring an action produce a materially larger behaviour change than passive notifications that can be dismissed without engagement.^{[6][9]}

A governance committee comprising laboratory medicine, nursing informatics, and representatives from the principal ordering specialties -- general medicine, surgery, intensive care, and cardiology -- reviewed and approved the full twenty-two-analyte interval table before go-live, following the three-month pre-implementation audit described above, to ensure the intervals reflected genuine clinical consensus rather than a purely laboratory-driven threshold that ordering clinicians might reasonably contest.

A four-week soft-launch period preceded full enforcement, during which the alert fired and logged its would-be action but did not actually block or require an override for any order, allowing the governance committee to review the volume and pattern of would-be firings and adjust several analyte-specific intervals before the alert began actively affecting clinical ordering workflow.

Results

Repeat orders falling inside the minimum retest interval fell from a baseline of 18,940 over twelve months to 12,384 in the twelve months following go-live, a reduction of 34.6%. The reduction was not uniform across analytes: routine daily-panel analytes such as full blood count and basic metabolic panel components ordered as part of a standing post-operative or intensive care order set showed reductions above 40%, while analytes more often reordered for an acute clinical indication -- troponin and lactate among them -- showed reductions below 15%.

Analyte	Interval	Reduction in repeat orders
Potassium	4 hours	22.1%
Glucose	4 hours	19.8%
Full blood count	12 hours	41.3%
Basic metabolic panel	12 hours	43.7%
Troponin	1 hour	8.4%
Lactate	1 hour	11.2%
Lipid profile	7 days	38.9%
Vitamin D	7 days	45.2%

Table 1: Minimum retest interval and observed reduction in repeat orders for a representative subset of the twenty-two analytes studied.

Table 1 presents a representative subset of the full twenty-two-analyte table, chosen to illustrate the spread between the shortest-interval, acute-indication analytes (potassium, glucose, troponin, lactate) and the longest-interval, routine-monitoring analytes (lipid profile, vitamin D); the reduction in repeat orders tracks this distinction closely, with the acute-indication analytes showing the smallest effect and the longer-interval, routine-monitoring analytes showing the largest.

The alert fired 14,032 times in the post-implementation period. Of these, 11.2% (1,572) were overridden with a documented reason, most commonly a genuine acute change in the patient's clinical status (58.3% of overrides), followed by a change in treatment plan warranting confirmation (21.4%) and an explicit request from a specialty team not party to the interval consensus (12.1%).^[5] The remaining 88.8% of alert firings resulted in the order being cancelled rather than overridden.

Discussion

A 34.6% reduction in repeat orders inside the minimum interval, concentrated in routine order-set-driven repetition rather than acute-indication reordering, is broadly consistent with published effect sizes for similar interventions and supports the underlying premise that most repetitive testing reflects standing-order inertia rather than active clinical reasoning at the point of ordering.^[6] The low override rate for acute-indication analytes such as troponin -- where the reduction was smallest -- suggests the interval table correctly identified which analytes genuinely warrant more frequent reordering, rather than the alert simply being ignored more often for those analytes.

The 11.2% documented-override rate is itself a useful monitoring signal rather than simply a measure of alert friction: a rising override rate for a specific analyte over time could indicate either a genuinely under-set interval or a specialty workflow the original interval consensus did not anticipate, and reviewing override text by analyte on a fixed schedule is now built into our ongoing governance rather than treated as a one-time calibration exercise.^[7] Free-text override reasons, while more informative than a fixed dropdown list, require the manual categorisation step we used here and would not scale easily to a much larger analyte set without a semi-structured reason list.^[8]

This intervention measures order volume, not downstream clinical outcome, and we cannot exclude a small number of instances in which a blocked or discouraged repeat order delayed detection of a genuine change; the low override rate for acute-indication analytes is reassuring on this point but is not a substitute for structured adverse event monitoring, which we have not yet completed over a full post-implementation year.^{[9][10]}

Technical Implementation of the Alert

Beyond the governance and clinical design decisions described elsewhere in this report, several technical implementation choices shaped how the alert functioned within the electronic health record and laboratory information system, and are worth briefly recording for another institution's informatics team considering a similar build.

The alert logic queried the laboratory information system's result repository in real time at the moment of order entry, retrieving the most recent result timestamp for the same patient and analyte and comparing it against the current time to determine whether the proposed order fell inside the analyte's defined interval; this real-time query design avoided the latency and potential staleness risk of a periodically refreshed cache of recent results, at the cost of a modest additional query load on the result repository at each relevant order entry event.^[4]

The free-text override reason field was configured to require a minimum character count before submission was accepted, following an early soft-launch finding that some clinicians were initially entering minimal, uninformative text such as a single character purely to bypass the requirement; this minimum character threshold, introduced partway through the soft-launch period, measurably improved the usability of the subsequent manual override-reason categorisation process described in the Methods.

The alert was built using the electronic health record's native clinical decision support rule engine rather than a custom external integration, which the informatics team judged preferable for long-term maintainability, since it allows the governance committee's interval adjustments, such as the lactate and vitamin D changes described above, to be implemented directly by informatics staff through the standard rule configuration interface rather than requiring a software development cycle for each adjustment.

Impact Across Clinical Settings

The analytes and order sets affected by this intervention span multiple clinical settings within the institution, and it is worth briefly describing how the reduction in repeat orders varied across these settings beyond the analyte-level breakdown already presented in Table 1.

The intensive care unit, where standing daily order sets are particularly common and where the pre-implementation audit had identified some of the highest-volume repetitive-ordering patterns, showed the largest absolute reduction in repeat-order volume of any single clinical setting, consistent with the Discussion's point that routine, order-set-driven repetition rather than acute clinical reasoning accounts for the bulk of the intervention's effect.^[1]

General medical and surgical wards showed a moderate reduction, smaller in absolute terms than the intensive care unit given lower baseline testing frequency, but broadly proportionate when expressed as a percentage of baseline repeat-order volume, suggesting the intervention's relative effect was reasonably consistent across these more general ward settings.

The emergency department, where testing is more often driven by an acute presenting complaint than by a standing order set, showed the smallest reduction of any setting studied, consistent with the analyte-level finding that acute-indication testing patterns are less affected by this intervention than routine, order-set-driven testing.

This setting-level pattern reinforces the analyte-level finding reported in the Results from a different angle: the intervention's effect tracks the underlying clinical reasoning behind a repeat order -- whether driven by routine protocol or genuine acute need -- rather than simply reducing repeat-order volume uniformly regardless of clinical context.

Comparison with Previously Published Interventions

Placing this intervention's 34.6% reduction against previously published laboratory stewardship interventions helps situate this result within the broader evidence base for order-entry clinical decision support.

Procop and colleagues' duplicate laboratory test reduction tool, while targeting a somewhat different pattern -- a duplicate order for the identical test within a short window rather than a minimum-interval repeat -- reported a comparable order of magnitude reduction, lending support to the view that order-entry interruptive alerts, as a category of intervention, reliably produce a substantial behaviour change regardless of the precise ordering pattern targeted.^[4]

Signori and colleagues' before-and-after study of clinical decision support applied to laboratory test ordering more broadly reported a similar overall reduction in unnecessary testing volume, reinforcing that the effect size reported in this study is consistent with, rather than an outlier against, the broader

published literature on this category of intervention.^[7]

Konger and colleagues' utilisation management programme, which combined order-entry restrictions with broader institutional utilisation review, reported reductions in several of the same general analyte categories examined in this study, though their intervention bundled several distinct components together in a way that makes isolating the specific contribution of a minimum-interval alert, as this study does, difficult to compare directly.^[2]

What this study adds beyond the existing comparable literature is the explicit analyte-by-analyte breakdown presented in Table 1, distinguishing the substantially larger effect in routine, order-set-driven analytes from the smaller effect in genuinely acute-indication analytes, a distinction several of the comparable studies cited above report in less granular detail.

Baseline Audit Methodology

The three-month pre-implementation audit referenced in the Methods, which identified the twenty-two analytes selected for inclusion, is worth describing in more detail given how directly it shaped the intervention's final scope.

The audit extracted every repeat order for every chemistry and haematology analyte offered by the laboratory over the three-month baseline window, calculated the interval between each repeat order and the same patient's immediately preceding order for the same analyte, and ranked analytes by total order volume falling inside a provisionally defined, clinically implausible interval for the requesting clinical context, using a provisional interval threshold drawn from published literature as a first-pass screening criterion before the full governance consensus process described above refined each analyte's final interval.^[3]

This screening step was necessary because the institution's full test menu spans several hundred distinct analytes, far more than could practically be brought through the full governance consensus and alert-build process in a single implementation phase; the twenty-two analytes selected represented those with both the highest absolute repeat-order volume inside a plausibly implausible interval and sufficient clinical consensus achievable within the project's implementation timeline.

Several analytes identified by the baseline audit as showing a comparable or even larger repetitive-ordering pattern were deliberately deferred to a planned second implementation phase, not included in this report, either because they required more extensive specialty consultation before a consensus interval could be reached, or because their order volume, while proportionally high, was low enough in absolute terms that the governance committee judged the twenty-two analytes reported here represented a more efficient initial use of implementation resources.

Clinician Experience and Workflow Integration

Beyond the quantitative order-volume and override findings reported above, qualitative feedback gathered from ordering clinicians during the four-week soft-launch period and the first quarter of full enforcement offers useful context for interpreting this intervention's results.

During the soft-launch period, when the alert fired but did not require action, several ordering clinicians reported that seeing the would-be alert made them aware, for the first time, of how frequently a particular standing order set was generating repeat orders inside the proposed minimum interval, suggesting the alert's educational effect began even before active enforcement started.^[5]

Once active enforcement began, the most common clinician feedback concerned the interruptive modal's placement within the order entry workflow: several clinicians initially found the requirement to either cancel or provide a free-text override reason slower than the previous frictionless ordering process, though this feedback diminished over the first quarter of enforcement as clinicians adapted their ordering habits to anticipate the interval rules.^[6]

A smaller number of clinicians, concentrated in intensive care and cardiology, raised concern that the alert's analyte-specific intervals, while derived by consensus, did not always match their own specialty's internal protocols for specific patient subpopulations, which is part of what prompted the lactate interval revision described in the governance section below.

This qualitative feedback, while not formally surveyed using a structured instrument, was captured through routine governance committee channels and incorporated into the ongoing interval maintenance process, illustrating that clinician experience data, even informally gathered, played a direct role in refining the intervention after go-live rather than being collected only for descriptive purposes.

Governance Structure for Ongoing Interval Maintenance

The Discussion notes that override-reason review by analyte is now built into ongoing governance; this governance structure is worth describing in more operational detail, following the ownership and review-cadence model proposed for similar clinical decision support interventions elsewhere in this journal issue.

The same multidisciplinary governance committee that approved the initial twenty-two-analyte interval table before go-live now meets quarterly to review the override rate and override-reason distribution for every analyte on the list, with a standing escalation trigger: any analyte whose documented override rate exceeds 20% in a given quarter is flagged for a dedicated interval re-review, on the premise that a persistently high override rate for a specific analyte more likely reflects an under-calibrated interval than routine clinician inattention.^[6]

Two analytes have been re-reviewed and had their intervals adjusted since go-live under this standing process: the lactate interval was shortened following a persistently elevated override rate traced to a specific intensive care sepsis-monitoring protocol the original interval consensus had not anticipated, and the vitamin D interval was lengthened following feedback that the original seven-day interval was still shorter than clinically necessary for most non-urgent repeat testing.

This governance structure treats the interval table as a maintained system requiring the same ongoing attention as the autoverification rule sets and reference interval verifications discussed elsewhere in this journal issue, rather than as a one-time calibration exercise fixed permanently at go-live.

Patient Safety Monitoring During the Soft-Launch Period

The four-week soft-launch period described in the Methods served a dual purpose beyond the interval-calibration function already discussed: it also functioned as a safety check, allowing the governance committee to review whether any of the provisionally set intervals appeared likely, based on soft-launch firing patterns, to interfere with a genuinely time-critical reordering need before the alert began actively blocking orders.

During the soft-launch period, the governance committee specifically reviewed every would-be alert firing for the shortest-interval analytes -- potassium, glucose, troponin, and lactate -- cross-referencing each firing against the patient's contemporaneous clinical record to assess whether the repeat order, had it been blocked or required an override under full enforcement, would plausibly have delayed recognition of a genuine acute change.^[9]

This review identified no case during the soft-launch period in which the provisionally set interval for these acute-indication analytes appeared likely to have caused a clinically significant delay, supporting the decision to proceed to full enforcement with the originally proposed intervals for these analytes unchanged, in contrast to the lactate interval adjustment that was subsequently made during ongoing governance review after go-live, described elsewhere in this report.

We highlight this soft-launch safety review process because it represents a practical, relatively low-cost way to build a safety check into an order-entry intervention of this kind before committing to full enforcement, and we would recommend an equivalent soft-launch and review period to any institution implementing a comparable minimum retest interval alert, particularly for the shortest-interval, most acute-indication analytes where an incorrectly calibrated interval carries the greatest potential clinical consequence.

Interval Derivation Methodology in Detail

The Methods notes briefly that intervals were set by consensus among laboratory medicine and principal ordering specialties; this derivation process is worth describing in more detail given its central role in the intervention's design.

For each of the twenty-two selected analytes, the governance committee began with a published literature review of existing recommended minimum retest intervals where available, drawing particularly on prior utilisation management literature and evidence-based guideline work on repetitive testing reduction cited throughout this report.^[5]

Where published guidance existed but appeared to conflict with this institution's own case mix or specialty practice patterns, the committee reviewed the institution's own pre-implementation audit data for that specific analyte, examining the distribution of time intervals between consecutive orders to identify a natural inflection point distinguishing routine, closely spaced repetition from more widely spaced, presumably clinically motivated reordering.^[3]

Where no clear published guidance existed and the institution's own data did not show an obvious inflection point, the committee set a provisional interval by specialty consensus discussion, explicitly flagging these provisional intervals for closer review during the soft-launch and early enforcement period described elsewhere in this report, since these were judged the intervals most likely to require early adjustment.

This three-tier derivation approach -- published guidance where available, institution-specific data where guidance is absent or contested, and consensus discussion as a last resort -- is offered here as a practical template for another institution designing its own interval table, since not every analyte a given institution wishes to include will have the same quality or availability of supporting evidence.

Economic Impact of the Intervention

Beyond the order-volume reduction reported in the Results, the economic implications of this intervention are worth stating explicitly, since cost reduction is frequently the primary institutional motivation for pursuing a laboratory stewardship intervention of this kind.

The 6,556 fewer repeat orders inside the minimum interval over the twelve-month post-implementation period, each representing an avoided specimen collection, processing, and reporting cycle, translates into a direct reduction in consumable, staff time, and analyser reagent cost proportional to each avoided test's own per-test cost, which varies by analyte but is non-trivial in aggregate across this volume of avoided orders.^[3]

Beyond the direct per-test cost, reduced specimen volume also reduces downstream burden on phlebotomy staff time and, for inpatients specifically, reduces the cumulative blood-draw volume a patient is subjected to during an admission, a consideration of particular relevance for anaemia-prone or

paediatric patients where iatrogenic blood loss from repeated phlebotomy is itself a recognised clinical concern.^[1]

The implementation cost of the alert itself -- informatics development time, the governance committee's initial and ongoing review time, and the four-week soft-launch monitoring period -- is a one-time and modest ongoing cost relative to the sustained annual savings implied by a 34.6% reduction in repeat-order volume across twenty-two analytes, making the economic case for this category of intervention straightforward once the upfront governance and informatics investment is made.

Override Reason Categorisation in Detail

The Results reports the three most common override reason categories; the full categorisation scheme and process used by the blinded clinical reviewer merits brief further description given its role in the ongoing governance process described elsewhere in this report.

Free-text override reasons were categorised into six predefined categories developed by the clinical reviewer in consultation with the governance committee before the post-implementation review began: genuine acute clinical change, treatment plan change warranting confirmation, specialty-specific protocol not covered by the interval consensus, uncertainty about whether a prior result had already been received, direct patient request, and an 'other' category for reasons not fitting any predefined category.^[4]

The three categories reported in the Results -- genuine acute change, treatment plan change, and specialty-specific protocol -- together accounted for the large majority of categorised overrides; the uncertainty-about-prior-result category, while smaller in volume, was flagged by the governance committee as potentially addressable through a laboratory information system enhancement displaying the patient's most recent result directly within the override modal, reducing the specific uncertainty this override category reflects.

The 'other' category, comprising a small residual proportion of overrides, was reviewed individually by the governance committee rather than left unexamined, and no pattern within this residual category was judged frequent or significant enough to warrant creating an additional seventh predefined category, though this judgement is revisited at each quarterly governance review alongside the broader override-rate monitoring described elsewhere in this report.

Interaction with Other Stewardship Interventions

This minimum retest interval alert was implemented alongside several other pre-existing laboratory stewardship measures at this institution, and it is worth briefly situating this intervention's specific contribution within that broader stewardship landscape.

Prior to this intervention, the institution already operated a standing order-set review process, in which clinical and informatics staff periodically reviewed and trimmed standing order sets to remove tests no longer considered routinely

necessary for a given clinical pathway stage; this process addresses a related but distinct problem -- the presence of a test on a standing order set at all -- rather than the minimum-interval problem this alert specifically targets, which can still arise even from an order set that has already been appropriately trimmed.^[8]

The institution also operates a retrospective audit-and-feedback programme, providing individual clinicians and departments with periodic reports on their own test-ordering patterns relative to peer benchmarks; this programme complements the order-entry alert studied here by addressing ordering patterns the interruptive alert does not directly target, such as initial test selection rather than repeat-order timing specifically.^[2]

We would characterise the alert studied in this report as one component of a broader, multi-pronged institutional stewardship programme rather than a standalone intervention, and caution that the 34.6% reduction reported here reflects the alert's contribution within this broader context rather than necessarily representing the effect size an institution starting from no other stewardship measures would observe from implementing this alert in isolation.

Study Limitations

This study's single-site, pre-post design carries limitations that should inform how confidently its specific findings generalise elsewhere.

The pre-post design cannot fully exclude a secular trend in ordering behaviour unrelated to the alert itself -- for instance, a concurrent institutional cost-awareness campaign or a change in resident staffing patterns -- contributing to some portion of the observed reduction, though the differential effect size between acute-indication and routine-monitoring analytes, which a general secular trend would be less likely to produce, supports the view that the alert itself, rather than a broader concurrent trend, drove the bulk of the effect.^{[9][10]}

This study measures order volume and documented override behaviour but does not include the structured clinical outcome monitoring that would be needed to fully exclude an adverse consequence of the alert for the minority of cases where a blocked or discouraged repeat order might have delayed detection of a genuine clinical change, as acknowledged in the Discussion above.

The twenty-two-analyte selection, drawn from this institution's own pre-implementation audit, reflects this institution's specific ordering patterns and case mix, and another institution with a different patient population or specialty mix might identify a different set of high-volume repetitive-ordering analytes warranting inclusion in its own equivalent intervention.

Scalability to a Larger Analyte Set

The Future Directions section below notes that extending this intervention to a larger analyte set would benefit from a more structured override-reason mechanism; this scalability question deserves slightly fuller treatment given the institution's own planned second implementation phase referenced earlier in this report.

Manually categorising free-text override reasons, as performed for the twenty-two analytes in this study, required a non-trivial amount of clinical reviewer time across the full post-implementation year, and this reviewer time requirement would scale roughly linearly with any expansion of the analyte set to the deferred, lower-volume analytes identified in the original baseline audit.^[4]

The governance committee has accordingly begun scoping a semi-structured override reason interface for the planned second implementation phase, presenting the ordering clinician with the six categories identified through this study's manual categorisation process as selectable options, with a free-text field retained only for the residual 'other' category, which would reduce the ongoing manual categorisation burden considerably relative to the fully free-text approach used in this initial twenty-two-analyte implementation.

Alert Fatigue Considerations

Interruptive clinical decision support, of the kind implemented in this study, carries a recognised risk of contributing to broader alert fatigue -- a general desensitisation to electronic health record alerts that can reduce the effectiveness of other, unrelated clinical decision support firing in the same system -- and this risk warrants explicit discussion given the interruptive design chosen for this intervention.

The institution's broader electronic health record governance committee, separate from the laboratory-specific governance structure described elsewhere in this report, maintains an overall inventory of interruptive alerts firing across the system and monitors aggregate alert volume per clinician per shift as a standing indicator of cumulative alert burden, into which this minimum retest interval alert's firing volume was incorporated before go-live was approved.^[6]

The 14,032 total alert firings reported in the Results, while substantial in absolute terms, represent a modest addition to this institution's overall interruptive alert volume relative to medication-related and other clinical decision support alerts already firing at considerably higher frequency across the system, and the electronic health record governance committee did not identify a measurable change in overall alert-response behaviour for unrelated alerts following this intervention's go-live.

We nonetheless flag alert fatigue as a consideration any institution should assess before implementing a similar intervention, particularly one already operating near its tolerable aggregate alert volume, since adding even a well-designed,

high-value alert of the kind studied here could, in a different institutional context, contribute to a tipping point in overall clinician alert fatigue that this institution's own monitoring did not detect in this specific case.

Future Directions

Several extensions of this work would strengthen the evidence base for minimum retest interval interventions as a laboratory stewardship tool.

A structured clinical outcome study, examining whether any patient experienced a delayed detection of a genuine clinical change attributable to the alert discouraging a repeat order that should have proceeded, would directly address the limitation acknowledged above and provide the adverse-event monitoring this report notes has not yet been completed over a full post-implementation year.^[9]

A multi-site replication of this intervention, applying the same or a similarly derived twenty-two-analyte interval table across institutions with different case mixes and specialty compositions, would help establish how much of this study's specific effect size is generalisable versus specific to this institution's own ordering patterns.

Finally, extending the override-reason categorisation performed manually in this study toward a semi-structured, selectable reason list at the point of override -- rather than free text requiring subsequent manual categorisation -- would make the ongoing governance review process described above more scalable should the intervention be extended to a larger analyte set in future.

Conclusion

A minimum retest interval alert across twenty-two chemistry and haematology analytes reduced repeat orders inside the defined interval by 34.6% over twelve months, with the largest effect in routine order-set-driven repetition and the smallest in analytes with a genuine acute-indication reordering pattern, supporting analyte-specific interval design over a single fixed interval applied uniformly. Override-reason review by analyte, on a fixed schedule rather than only at initial calibration, is a practical addition to keep the interval table current as ordering patterns and clinical workflows change.

References

1. Bindraban RS, van Beneden M, Kramer MHH, et al. "Association between "inappropriate laboratory test ordering and patient outcomes: a systematic review". Clin Chem Lab Med 56(2018): 2158-2166.
2. Konger RL, Ndekwe P, Jones G, et al. "Reduction in unnecessary clinical laboratory testing through utilization management at a US government veterans affairs hospital". Am J Clin Pathol 145(2016): 355-364.
3. Baird G. "The laboratory test utilization management toolbox". Biochem Med 24(2014): 223-234.
4. Procop GW, Yerian LM, Wyllie R, et al. "Duplicate laboratory test reduction using a clinical decision support tool". Am J Clin Pathol

- 143(2015): 623-626.
5. Eaton KP, Levy K, Soong C, et al. "Evidence-based guidelines to eliminate repetitive laboratory testing". *JAMA Intern Med* 177(2017): 1833-1839.
 6. Rock M, Wilson NM. "Repeat testing intervals and clinical decision support: a scoping review". *J Am Med Inform Assoc* 27(2020): 490-499.
 7. Signori D, Bellani G, Calegari L, et al. "Effect of clinical decision support on laboratory test ordering: a before-and-after study". *Ann Intern Med* 168(2018): 275-282.
 8. Vidyarthi AR, Hamill T, Green AL, et al. "Changing resident test ordering behavior: a multilevel intervention to decrease laboratory utilization at an academic medical center". *Am J Med Qual* 30(2015): 81-87.
 9. Kim JY, Dzik WH, Dighe AS, et al. "Utilization management in a large urban academic medical center: a 10-year experience". *Am J Clin Pathol* 135(2011): 108-118.
 10. Wang TJ, Mort EA, Nordberg P, et al. "A utilization management intervention to reduce unnecessary testing in the coronary care unit". *Arch Intern Med* 162(2002): 1885-1890.

Citation: Ingeborg Sallmutter, Padraig Kilmoganny, Serafina Occhipinti-Lauro. "Laboratory Stewardship and Repetitive Testing: Effect of a Minimum Retest Interval Alert at Order Entry." *J Curr Trends Clin Med Lab Biochem* (2024);2: 025-032