Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

A departmental quality-officer system was associated with faster critical-value response

Yunxiao Lyu
Affiliated Dongyang Hospital of Wenzhou Medical University
Zhong Lyu
dylz3399@163.com

Affiliated Dongyang Hospital of Wenzhou Medical University

Research Article

Keywords: Critical values, patient safety, quality improvement, accountability, audit and feedback, health services

Posted Date: November 13th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11486740/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Timely response to critical results depends on reliable communication and clear accountability. We evaluated a departmental quality-officer programme and response performance after officer appraisal and its linked allowance were withdrawn.

Methods

We analysed 25,627 critical-value events from six departments in one tertiary hospital between 2017 and 2024. The three phases were preparation; officer posts with monthly appraisal and a linked allowance; and retention of posts and duties after appraisal and the allowance ended. Outcomes were completion within 10 minutes and mean report-to-response-completion time. Phase contrasts used monthly heteroskedasticity- and autocorrelation-consistent intervals with Holm correction.

Results

Completion within 10 minutes was 79.1%, 94.5% and 97.8% across the three phases; corresponding mean times were 11.9, 4.8 and 3.2 minutes. Fifteen of 18 department-level contrasts for completion within 10 minutes remained statistically significant after correction; all exceptions were in orthopaedics. Responses taking more than 30 minutes fell from 4.34% to 0.76% and were 0.39% in the final phase. Adjusted analyses found lower odds of delays over 10 and 30 minutes in the appraisal phase than in preparation; no clear difference was found between the appraisal and post-appraisal phases.

Conclusions

Faster critical-value response was associated with the programme. Performance did not deteriorate during 19 months after appraisal and the allowance were withdrawn, while officer posts and feedback duties continued. The observational, single-centre design precludes causal inference.

Background

Problem and available knowledge

Critical-value management depends on a sequence of recognition, communication, acknowledgement and clinical response. Research has largely evaluated communication technologies, including text alerts, call centres and closed-loop systems [1–6]. Less is known about the departmental arrangements that support action after a result is received. A designated quality officer may provide a local point of responsibility, while monthly appraisal adds a formal review and accountability process [7]. Audit and

feedback can improve professional practice, although effects vary and interventions often include other components [8].

Healthcare champions are commonly described as informal facilitators, and evaluations often define them by presence rather than by formal appointment, training or measurable outcomes [9, 10]. Quality-link roles have also been described in infection prevention [11]. Evidence on formally appointed and credentialed departmental roles is limited. Evidence after financial incentives are removed is mixed: quality declined in some settings [12, 13], while performance was largely maintained in others [14, 15]. Sustainability frameworks emphasise continuing adaptation to intervention, organisational and policy changes [16–21].

A hospital programme that withdrew officer appraisal and its linked allowance while retaining the posts and monthly feedback duties provides an opportunity to examine response patterns across these phases. We compared critical-value response in six departments during preparation, implementation with appraisal and allowance, and a later phase without them. We asked whether the programme was associated with faster response and whether performance persisted after appraisal and the allowance ended.

Methods

Context and intervention

The study was conducted at a 1,500-bed tertiary Grade A general hospital in eastern China. Critical-value handling was nonetheless already audited: the hospital's monthly quality examination scored each ward on the proportion of critical values handled within 10 minutes, and the department head was answerable for the result. The programme introduced part-time departmental quality officers to engage clinicians in routine quality management.

Each department used a three-tier structure: the department head held overall responsibility, a quality secretary coordinated processes, and officers managed specific quality domains. Six role categories covered medical records, core safety systems, patient safety and adverse events, clinical pathways and efficiency, infection prevention, and staff credentials. Critical-value management was part of the core-systems category, with one designated officer in each department (Fig. 1).

Training began in October 2017 and combined lectures, workshops, mentoring and simulation. The programme became operational in April 2018. From September 2018, officers completed online coursework and an in-person examination before certification. Seven examination rounds produced 3,044 passes from 3,138 attempts (97.0%) by August 2019; a comprehensive examination replaced the role-specific arrangement in 2022. Officers were subject to continuing education and periodic certificate review. Their work counted towards departmental appraisal and awards, and poor performance could lead to reassignment or suspension of certification.

The critical-value officer monitored report-to-response-completion intervals and presented delayed cases at monthly departmental meetings, analysed causes and proposed corrective actions through a plan–do–study–act cycle [22]. In Phase B, a monthly 100-point assessment covered records, meeting reports, improvement work and end results; wards lost points when critical values were not handled within 30 minutes. An allowance was linked to officer scores. In March 2023, the hospital withdrew the assessment and allowance, while the posts and monthly feedback duties continued. Quality examination sheets from 2023–2024 retained aggregate ward rankings but no officer assessment or separate critical-value item.

The phases were January 2017 to March 2018 (A, preparation; 15 months), April 2018 to February 2023 (B, posts with appraisal and allowance) and March 2023 to September 2024 (C, posts and duties without appraisal or allowance). The programme logic model and timeline are provided in Additional file 1: Figures S1 and S2. We describe the intervention using the Template for Intervention Description and Replication and the Standards for Quality Improvement Reporting Excellence [23, 24].

Study design and data

This retrospective longitudinal study included event-level records from six departments with continuous data from 1 January 2017 to 30 September 2024: respiratory medicine, cardiology, gastroenterology, general surgery, urology and orthopaedics. Gastroenterology had three ward-name labels; each other department had one. Analyses were conducted at department level. The study design is summarised in Additional file 1: Figure S3. Reporting followed the Standards for Quality Improvement Reporting Excellence and Strengthening the Reporting of Observational Studies in Epidemiology guidelines [23, 25].

Measures

The data included department, ward label, report date and time, analyte, patient age, and the interval from report to response completion. Timing began when laboratory or radiology staff issued a critical-value report and ended when the treating clinician acknowledged receipt and documented the clinical response. This endpoint represents documented disposition, not time to treatment or a patient outcome [26]. All eligible records with the required fields were included; 25,627 events had no missing analysis fields or exclusions, and no separate sample-size calculation was performed.

The prespecified co-primary outcomes were completion within 10 minutes and mean report-to-response-completion time in each department-phase cell. The complementary proportion exceeding 10 minutes was also reported. After primary analyses, the proportion exceeding 30 minutes was added as an exploratory measure of prolonged delay; this threshold matches the hospital's audit standard. Other descriptive measures were completion within 5 and 1 minutes, delays over 60 minutes, and the 90th and 95th percentiles. Nineteen intervals exceeded 360 minutes. All were retained for counts, proportions and

full-sample means; medians and quartiles excluded them as prespecified, with alternative caps examined in sensitivity analyses (Additional file 1: Table S1 and Additional file 1).

Analysis

We summarised event counts, rates and mean intervals by department and phase. Planned contrasts were A versus B, B versus C, and A versus C, expressed as later minus earlier phase. Confidence intervals and tests used monthly influence functions with heteroskedasticity- and autocorrelation-consistent errors and a three-month lag. Holm correction was applied across 18 department-by-phase contrasts separately for each outcome; confidence intervals were not multiplicity-adjusted. We examined whether departments with worse baseline performance had larger reductions.

Exploratory analyses assessed analyte case mix, adjusted associations, department differences and within-Phase-A trends. Logistic regression for delays over 10 and 30 minutes adjusted for department, analyte category, age, time of day, weekend, calendar month and the COVID-19 period. Additional analyses included a restriction to analyte labels present in all phases, department-by-phase interaction, dispersion, medical-versus-surgical comparisons and quarterly Phase A rates. Supplementary interrupted time-series models described monthly patterns around April 2018 and March 2023, with COVID-period terms; estimates were not treated as isolated causal effects [27]. Further details and sensitivity analyses are in the Additional file 1.

AI-assisted manuscript preparation

An AI language-processing tool assisted with manuscript restructuring and language editing. The authors reviewed the manuscript and take responsibility for its content.

Ethical considerations

The study used routinely collected, de-identified quality-management records and was approved by the Hospital Ethics Committee (approval no. 2026-YX-0728). The requirement for informed consent was waived by the committee.

Results

Primary outcomes

The analysis included 25,627 events: 3,272 in Phase A, 16,688 in B and 5,667 in C. Completion within 10 minutes occurred in 2,588/3,272 (79.1%), 15,765/16,688 (94.5%) and 5,545/5,667 (97.8%), respectively (Table 1). The rate increased from A to B and again from B to C in all six departments. Fifteen of 18 planned department-level contrasts remained statistically significant after Holm correction; the three exceptions were in orthopaedics (Table 2; Fig. 2). Departments with worse Phase A performance

improved more: the A-to-B reduction ranged from 5.7 percentage points in respiratory medicine to 24.3 points in urology.

Table 1
Completion within 10 minutes and mean report-to-response-completion interval by department and phase

Department	Phase	Events (n)	Completed within 10 min, n (%)	Mean interval, min (95% CI)
Respiratory medicine	A	1,175	90.5 (86.3, 94.7)	10.37 (4.36, 16.37)
Respiratory medicine	B	5,231	96.2 (95.4, 97.0)	4.39 (3.30, 5.48)
Respiratory medicine	C	1,757	98.8 (98.4, 99.3)	2.52 (2.18, 2.85)
Cardiology	A	903	73.9 (65.8, 81.9)	10.98 (6.23, 15.73)
Cardiology	B	4,528	94.2 (92.6, 95.9)	4.86 (4.00, 5.71)
Cardiology	C	1,563	98.8 (98.3, 99.4)	2.61 (2.43, 2.80)
Gastroenterology	A	565	70.1 (59.3, 80.9)	12.03 (7.49, 16.58)
Gastroenterology	B	2,835	94.0 (92.6, 95.5)	4.88 (4.17, 5.59)
Gastroenterology	C	940	97.1 (96.1, 98.2)	3.43 (3.14, 3.71)
General surgery	A	346	74.9 (67.3, 82.4)	9.30 (7.62, 10.98)
General surgery	B	2,303	92.8 (91.0, 94.7)	5.07 (4.44, 5.71)
General surgery	C	745	96.5 (95.4, 97.6)	3.88 (3.22, 4.54)
Urology	A	193	68.9 (55.2, 82.6)	23.99 (8.20, 39.79)
Urology	B	1,395	93.2 (91.5, 94.8)	5.24 (4.76, 5.72)
Urology	C	518	96.1 (95.0, 97.2)	5.27 (3.62, 6.93)
Orthopaedics	A	90	77.8 (59.1, 96.5)	25.21 (-7.70, 58.12)
Orthopaedics	B	396	91.7 (88.2, 95.2)	6.02 (4.35, 7.69)
Orthopaedics	C	144	93.1 (90.3, 95.8)	5.17 (3.96, 6.38)

Note. Completion within 10 minutes is defined as a recorded report-to-response-completion interval of 10 minutes or less. The interval runs from report issuance by laboratory or radiology staff to documented clinical response completion. Means include all valid records.

Table 2
Pairwise contrasts in completion within 10 minutes

Department	Contrast	Difference in completion within 10 min, percentage points (95% CI)	Ratio of completion within 10 min (95% CI)	Holm-adjusted P
Respiratory medicine	B vs A	5.73 (1.47, 9.98)	1.06 (1.01, 1.11)	0.033
Respiratory medicine	C vs B	2.61 (1.72, 3.49)	1.03 (1.02, 1.04)	< 0.001
Respiratory medicine	C vs A	8.34 (4.13, 12.55)	1.09 (1.04, 1.14)	0.001
Cardiology	B vs A	20.35 (12.12, 28.58)	1.28 (1.14, 1.42)	< 0.001
Cardiology	C vs B	4.63 (2.88, 6.39)	1.05 (1.03, 1.07)	< 0.001
Cardiology	C vs A	24.98 (16.90, 33.06)	1.34 (1.20, 1.49)	< 0.001
Gastroenterology	B vs A	23.95 (13.05, 34.85)	1.34 (1.15, 1.57)	< 0.001
Gastroenterology	C vs B	3.09 (1.30, 4.87)	1.03 (1.01, 1.05)	0.005
Gastroenterology	C vs A	27.04 (16.18, 37.89)	1.39 (1.19, 1.62)	< 0.001
General surgery	B vs A	17.98 (10.23, 25.73)	1.24 (1.12, 1.37)	< 0.001
General surgery	C vs B	3.67 (1.54, 5.81)	1.04 (1.02, 1.06)	0.005
General surgery	C vs A	21.65 (14.04, 29.27)	1.29 (1.17, 1.43)	< 0.001
Urology	B vs A	24.28 (10.44, 38.11)	1.35 (1.11, 1.65)	0.005
Urology	C vs B	2.95 (0.97, 4.93)	1.03 (1.01, 1.05)	0.018
Urology	C vs A	27.23 (13.45, 41.01)	1.40 (1.14, 1.70)	0.001
Orthopaedics	B vs A	13.89 (-5.11, 32.89)	1.18 (0.92, 1.50)	0.338
Orthopaedics	C vs B	1.39 (-3.06, 5.83)	1.02 (0.97, 1.07)	0.540
Orthopaedics	C vs A	15.28 (-3.60, 34.15)	1.20 (0.94, 1.52)	0.338

Note. Differences and ratios are later phase minus/divided by earlier phase. Positive differences and ratios above 1 indicate higher completion within 10 minutes in the later phase. This outcome is the exact complement of the > 10-minute outcome; Holm correction is applied once across the 18 planned department-by-phase contrasts for this binary endpoint. Confidence intervals are 95% monthly HAC intervals and are not adjusted for multiplicity.

Mean report-to-response-completion times were 11.9, 4.8 and 3.2 minutes in A, B and C. The pattern was not uniform across departments; the mean in urology was slightly higher in C than B. Department-level mean contrasts and sensitivity analyses are reported in Additional file 1: Table S2.

Prolonged responses and department differences

Responses exceeding 30 minutes numbered 142 (4.34%), 127 (0.76%) and 22 (0.39%) in A, B and C; those exceeding 60 minutes numbered 50 (1.53%), 37 (0.22%) and 12 (0.21%) (Additional file 1: Table S3). From A to B, the relative reduction was 82% for delays over 30 minutes and 85% for delays over 60 minutes, compared with 74% for delays over 10 minutes. The proportion over 30 minutes fell a further 49% from B to C, while the proportion over 60 minutes changed little. The 90th and 95th percentiles were 18.0 and 27.4 minutes in A, 7.0 and 11.0 in B, and 5.0 and 7.0 in C.

The range in department-level rates exceeding 10 minutes narrowed from 21.6 percentage points in A (9.5% to 31.1%) to 4.5 in B (3.8% to 8.3%) and 5.8 in C (1.2% to 6.9%). Between-department standard deviation fell from 7.8 to 1.5 and was 2.1 in C. The phase effect differed by department (interaction χ^2=60.0, 10 degrees of freedom, P < 0.001), and departments still differed in C (χ^2=46.6, 5 degrees of freedom, P < 0.001). Surgical departments had higher rates than medical departments in each phase (26.6% versus 19.6% in A, 7.2% versus 5.0% in B, and 4.0% versus 1.5% in C). Department-level patterns are shown in Additional file 1: Figures S5 and S6.

Case mix and monthly trends

The mix of critical values changed over time, including the addition of procalcitonin after Phase A and bedside glucose in Phase C (Additional file 1: Figure S4). Restricting analyses to 20 harmonised analyte labels present in all phases, rates exceeding 10 minutes were 19.1%, 5.5% and 2.0%; rates exceeding 30 minutes were 2.8%, 0.76% and 0.31% (Additional file 1: Table S4). After adjustment, the odds of delays over 10 minutes were lower in B than A (odds ratio 0.38, 95% confidence interval 0.26 to 0.55) and in C than A (0.29, 0.14 to 0.62); the B-to-C difference was unclear (0.77, 0.48 to 1.23). Adjusted results for delays over 30 minutes are in Additional file 1: Table S5.

Monthly rates and fitted interrupted time-series trajectories are shown in Fig. 3. In COVID-adjusted models, five of six April 2018 level-change estimates were not statistically clear. Orthopaedics had higher odds of delay at that point (odds ratio 10.73, 95% confidence interval 1.70 to 67.82), based on small monthly counts. Before training began, Phase A quarterly rates exceeding 10 minutes were 29.9%, 25.2% and 24.7%; they were 15.8% and 11.6% during the two quarters of preparatory training. In February 2023, the last month of Phase B, the rate was 10.5% (Additional file 1: Tables S6 and S7).

Discussion

Statement of principal findings

Across six departments, the quality-officer programme was associated with faster critical-value response. Completion within 10 minutes increased from 79.1% in preparation to 94.5% during appraisal and allowance, and 97.8% after they ended. Delays exceeding 30 minutes fell particularly sharply

between A and B. No deterioration was observed during the 19-month post-appraisal phase, when officer posts and feedback duties continued.

Strengths and limitations

The study used event-level records over nearly eight years, covered six departments and examined a real-world withdrawal of appraisal and a linked allowance while roles remained. The long follow-up and multiple timing measures help describe both common and prolonged delays.

The single-centre observational design, absence of a concurrent control and short 15-month Phase A preclude causal attribution. Rates were already declining during preparation, and other changes—including national quality guidance—overlapped the programme [28, 29]. Staffing, workload, case mix, policies and technology may also have changed. The six departments and eight ward labels limit multilevel inference. The endpoint records documented response completion, not treatment or patient outcomes; timestamp validity and clinical appropriateness were not independently verified. Changes in analyte mix, incomplete historical extraction details and lack of workload denominators may affect comparisons. Transferability beyond similar hospitals is uncertain. Accordingly, the results describe associations and patterns, not an isolated programme effect.

Interpretation within the context of the wider literature

A designated officer may provide a clear local point of responsibility, while appraisal creates a forum for reviewing performance and consequences [7]. Persistence after appraisal ended is consistent with maintenance of a role and its routine feedback process; it does not show that accountability was internalised or that the posts alone caused improvement. The findings complement reports of both decline and sustained performance after financial incentives were removed [12–15].

The narrowing of departmental differences is compatible with a structured role and feedback cycle supporting weaker-performing departments. However, this interpretation is uncertain: regression to the mean, changing case mix and other concurrent changes could also contribute. The study adds longitudinal evidence on formal, trained departmental roles, an area where evaluations remain limited [9–11].

Implications for policy, practice and research

Hospitals considering departmental quality roles could define responsibilities, train and credential officers, and link routine feedback to local improvement cycles. The continued duties after appraisal withdrawal may be operationally relevant, but the findings do not establish that incentives can be removed without risk. Future controlled or multi-centre studies should measure implementation fidelity, staffing and workload, patient outcomes, and the separate contributions of appointment, training, feedback and incentives.

Conclusions

In six departments of one tertiary hospital, introduction of a departmental quality-officer system was associated with faster critical-value response. Performance remained high during follow-up after officer appraisal and its allowance were withdrawn while posts and feedback duties continued. Controlled studies are needed to determine which programme components contribute to these patterns.

Abbreviations

COVID-19
Coronavirus disease 2019

Declarations

Ethics approval and consent to participate

This study was approved by the Medical Ethics Committee of Affiliated Dongyang Hospital of Wenzhou Medical University (approval no. 2026-YX-0728) and was conducted in accordance with the Declaration of Helsinki. The ethics committee waived the requirement for informed consent because the study used routinely collected, de-identified quality-management records.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Clinical trial number

Not applicable.

Funding

This study received no specific funding.

Author Contribution

YL and ZL conceived the study. YL designed the methodology, curated and analysed the data, prepared the figures and drafted the manuscript. ZL supervised the study, provided resources and administrative support, and critically revised the manuscript. Both authors read and approved the final manuscript.

Acknowledgements

Not applicable.

Availability of data and materials

The datasets analysed during the current study are not publicly available because they are institutional quality-management records, but de-identified data are available from the corresponding author on reasonable request, subject to institutional approval.

References

1. Liebow EB, Derzon JH, Fontanesi J, et al. Effectiveness of automated notification and customer service call centers for timely and accurate reporting of critical values: a Laboratory Medicine Best Practices systematic review and meta-analysis. Clin Biochem. 2012;45(13–14):979–987. doi:10.1016/j.clinbiochem.2012.06.023.
2. Park H-I, Min W-K, Lee W, et al. Evaluating the short message service alerting system for critical value notification via PDA telephones. Ann Clin Lab Sci. 2008;38(2):149–156. PMID:18469361.
3. Li R, Wang T, Gong L, et al. Enhance the effectiveness of clinical laboratory critical values initiative notification by implementing a closed-loop system: a five-year retrospective observational study. J Clin Lab Anal. 2020;34(2):e23038. doi:10.1002/jcla.23038.
4. Lacson R, O'Connor SD, Sahni A, et al. Impact of an electronic alert notification system embedded in radiologists' workflow on closed-loop communication of critical results: a time series analysis. BMJ Qual Saf. 2016;25(7):518–524. doi:10.1136/bmjqs-2015-004276.
5. Wongkrajang P, Leelanuwatkul S, Nuanin S, Laiwejpithaya S. The effect of laboratory critical value reporting on patient management at Siriraj Hospital—Thailand's largest national tertiary referral center. PLoS One. 2025;20(6):e0324594. doi:10.1371/journal.pone.0324594.
6. Aponte EM, Shemesh AJ, Kalomeris T, et al. Accelerating time from result to clinical action: impact of an automated critical results reporting system. Clin Chem Lab Med. 2025;63(12):e272–e274. doi:10.1515/cclm-2025-0711.
7. Bovens M. Analysing and assessing accountability: a conceptual framework. Eur Law J. 2007;13(4):447–468. doi:10.1111/j.1468-0386.2007.00378.x.
8. Ivers N, Yogasingam S, Lacroix M, et al. Audit and feedback: effects on professional practice. Cochrane Database Syst Rev. 2025;3:CD000259. doi:10.1002/14651858.CD000259.pub4.
9. Santos WJ, Graham ID, Lalonde M, Demery Varin M, Squires JE. The effectiveness of champions in implementing innovations in health care: a systematic review. Implement Sci Commun. 2022;3:80. doi:10.1186/s43058-022-00315-0.

10. Miech EJ, Rattray NA, Flanagan ME, Damschroder L, Schmid AA, Damush TM. Inside help: an integrative review of champions in healthcare-related implementation. SAGE Open Med. 2018;6:2050312118773261. doi:10.1177/2050312118773261.
11. Dekker M, van Mansfeld R, Vandenbroucke-Grauls C, et al. Infection control link nurses in acute care hospitals: a scoping review. Antimicrob Resist Infect Control. 2019;8(1):20. doi:10.1186/s13756-019-0476-8.
12. Minchin M, Roland M, Richardson J, Rowark S, Guthrie B. Quality of care in the United Kingdom after removal of financial incentives. N Engl J Med. 2018;379(10):948–957. doi:10.1056/NEJMsa1801495.
13. Lester H, Schmittdiel J, Selby J, et al. The impact of removing financial incentives from clinical quality indicators: longitudinal analysis of four Kaiser Permanente indicators. BMJ. 2010;340:c1898. doi:10.1136/bmj.c1898.
14. Benzer JK, Young GJ, Burgess JF Jr, et al. Sustainability of quality improvement following removal of pay-for-performance incentives. J Gen Intern Med. 2014;29(1):127–132. doi:10.1007/s11606-013-2572-4.
15. Reid RO, Kommareddi M, Paddock SM, Damberg CL. Does removing financial incentives lead to declines in performance? A controlled interrupted time series analysis of Medicare Advantage Star Ratings programme performance. BMJ Qual Saf. 2021;30(2):167–172. doi:10.1136/bmjqs-2019-010253.
16. Chambers DA, Glasgow RE, Stange KC. The dynamic sustainability framework: addressing the paradox of sustainment amid ongoing change. Implement Sci. 2013;8:117. doi:10.1186/1748-5908-8-117.
17. Scheirer MA, Dearing JW. An agenda for research on the sustainability of public health programs. Am J Public Health. 2011;101(11):2059–2067. doi:10.2105/AJPH.2011.300193.
18. Wiltsey Stirman S, Kimberly J, Cook N, et al. The sustainability of new programs and innovations: a review of the empirical literature and recommendations for future research. Implement Sci. 2012;7:17. doi:10.1186/1748-5908-7-17.
19. Damschroder LJ, Aron DC, Keith RE, et al. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. Implement Sci. 2009;4:50. doi:10.1186/1748-5908-4-50.
20. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Q. 2004;82(4):581–629. doi:10.1111/j.0887-378X.2004.00325.x.
21. Taylor MJ, McNicholas C, Nicolay C, et al. Systematic review of the application of the plan–do–study–act method to improve quality in healthcare. BMJ Qual Saf. 2014;23(4):290–298. doi:10.1136/bmjqs-2013-001862.
22. Moore GF, Audrey S, Barker M, et al. Process evaluation of complex interventions: Medical Research Council guidance. BMJ. 2015;350:h1258. doi:10.1136/bmj.h1258.

23. Ogrinc G, Davies L, Goodman D, et al. SQUIRE 2.0: revised publication guidelines from a detailed consensus process. BMJ Qual Saf. 2016;25(12):986–992. doi:10.1136/bmjqs-2015-004411.
24. Hoffmann TC, Glasziou PP, Boutron I, et al. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. BMJ. 2014;348:g1687. doi:10.1136/bmj.g1687.
25. Vandenbroucke JP, von Elm E, Altman DG, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Med. 2007;4(10):e297. doi:10.1371/journal.pmed.0040297.
26. Mitra P, Sharma P. From notification to clinical disposition: closing the loop for critical laboratory results. Indian J Clin Biochem. 2026;41(5):645–647. doi:10.1007/s12291-026-01453-1.
27. Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. Int J Epidemiol. 2017;46(1):348–355. doi:10.1093/ije/dyw098.
28. National Health Commission of the People's Republic of China. Notice on issuing the key points of core medical quality and safety systems (Guo Wei Yi Fa [2018] No. 8). 18 April 2018.
29. General Office of the State Council of the People's Republic of China. Opinions on strengthening performance assessment of tertiary public hospitals (Guo Ban Fa [2019] No. 4). 16 January 2019; published 30 January 2019. Available from: https://app.www.gov.cn/govdata/gov/201901/30/434680/article.html. Accessed 17 Oct 2026.

Figures

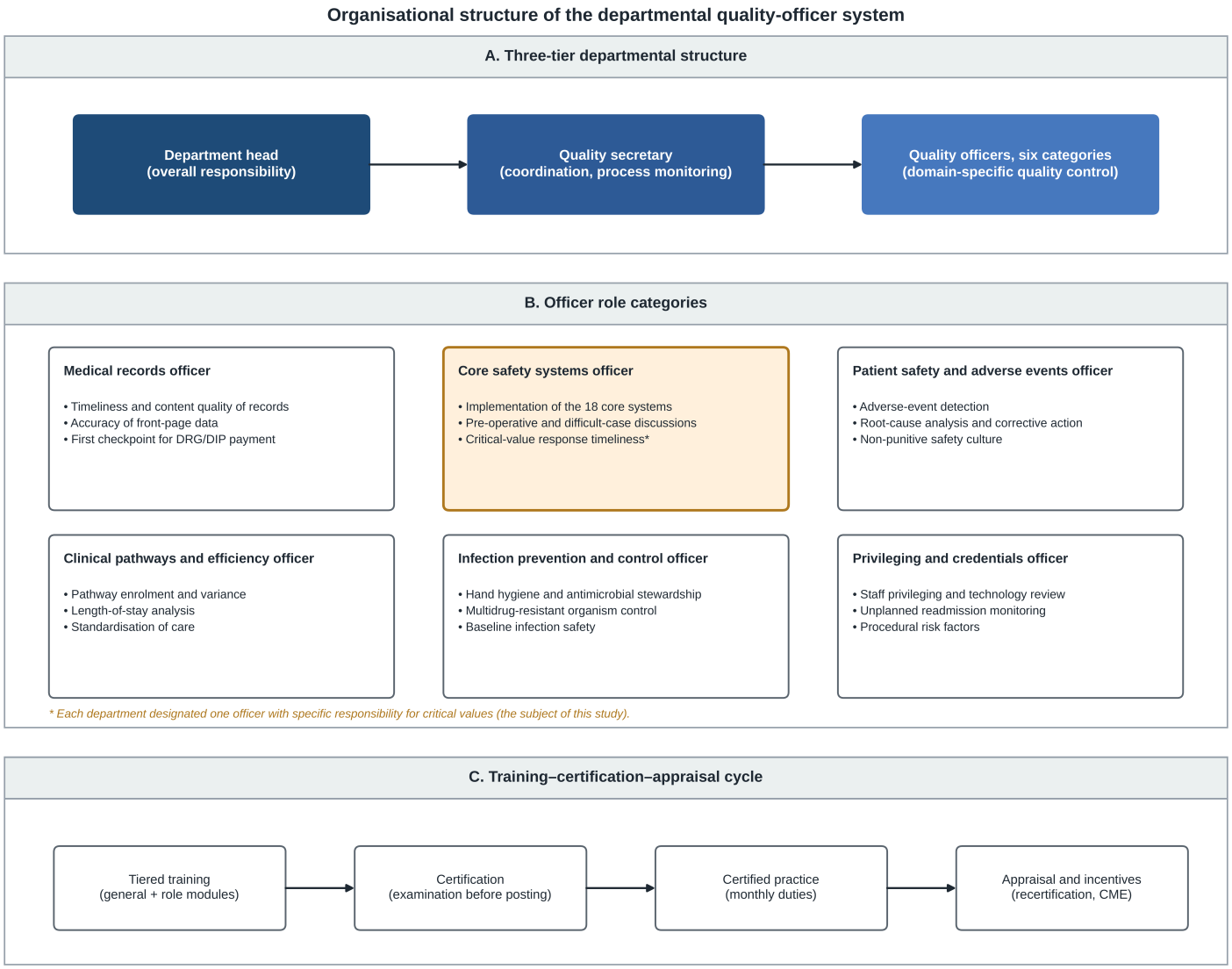


Figure 1

Organisational structure of the departmental quality-officer system. The diagram shows the department head, quality secretary and domain officers, including the designated officer for critical-value management.

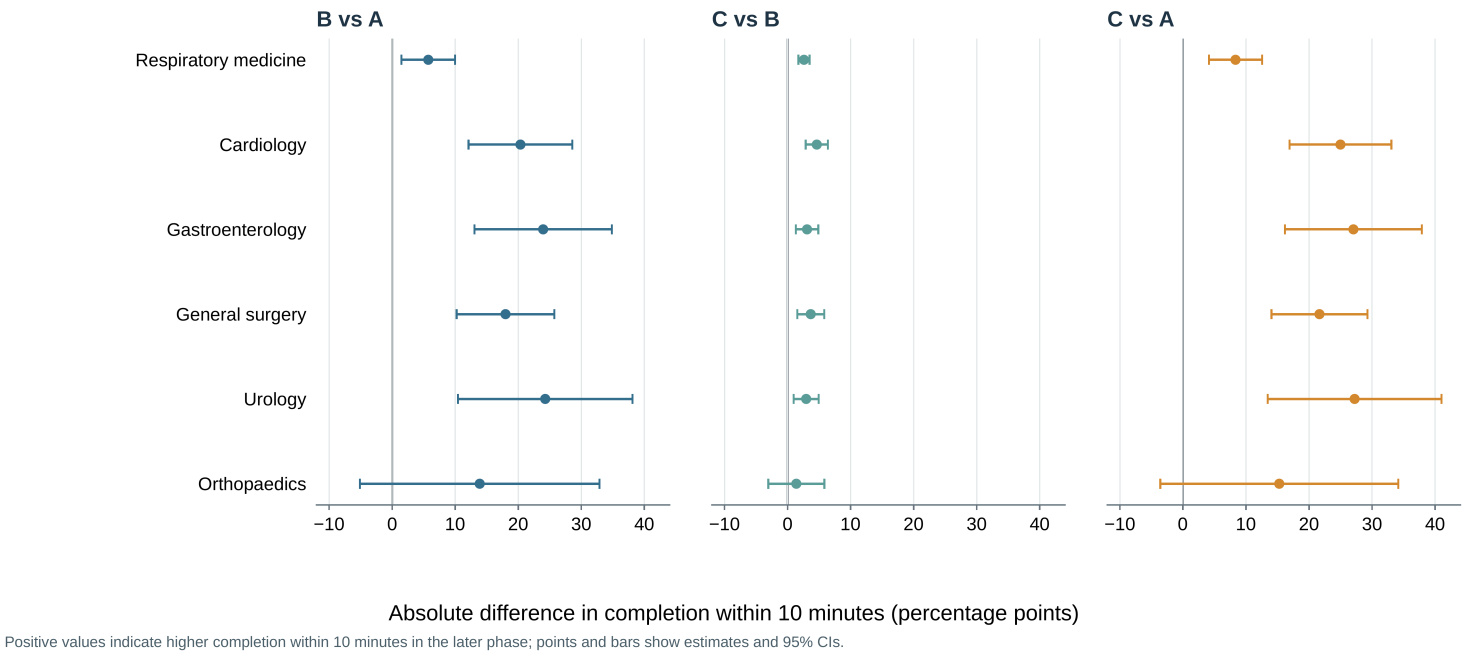


Figure 2

Phase differences in completion within 10 minutes by department. Points show absolute differences (later minus earlier phase, percentage points); bars show 95% monthly heteroskedasticity- and autocorrelation-consistent confidence intervals, not adjusted for multiplicity.

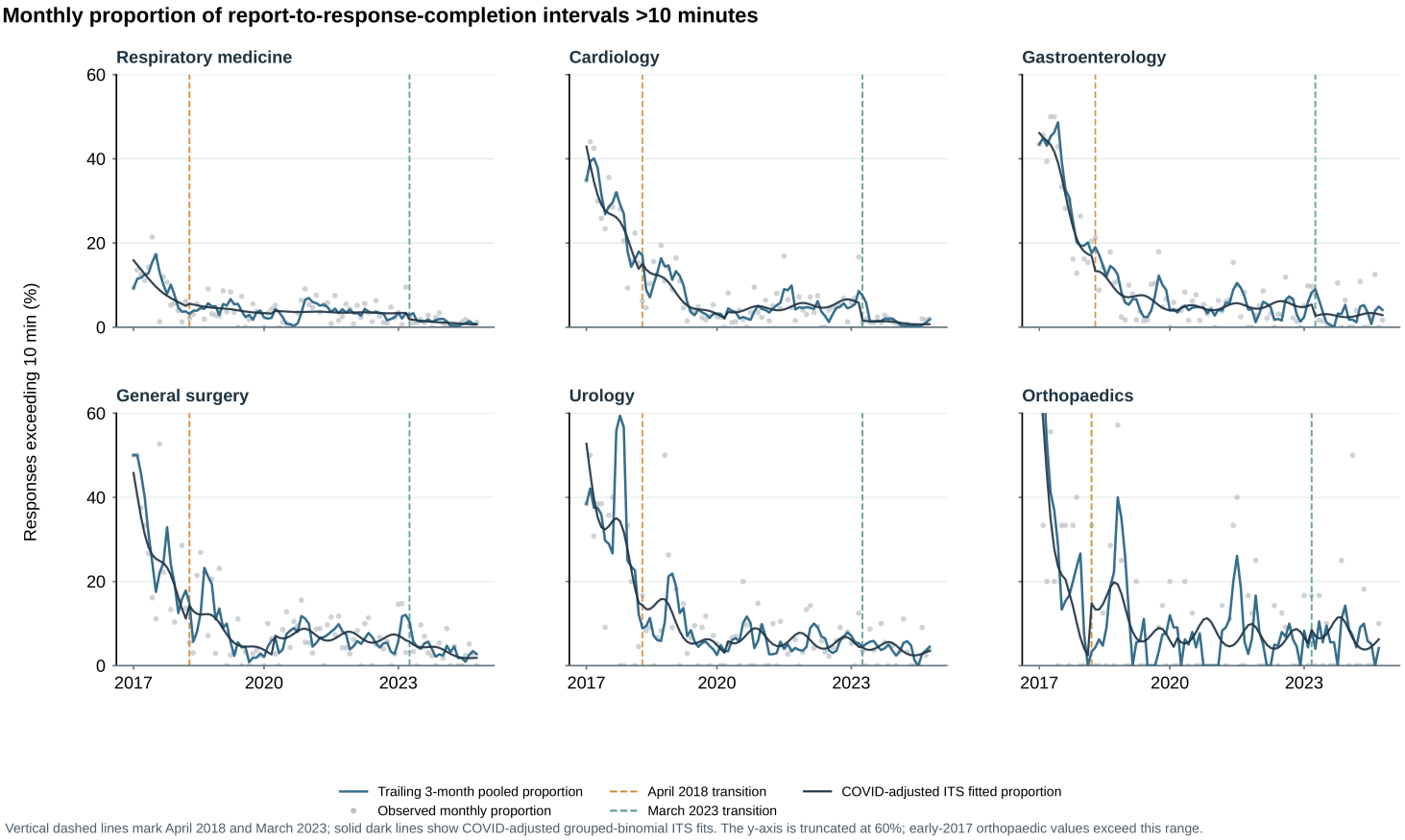


Figure 3

Monthly proportion of report-to-response-completion intervals exceeding 10 minutes by department. Grey points show observed monthly rates, the blue line the trailing three-month pooled rate and the dark line the COVID-adjusted grouped-binomial interrupted time-series fit. Dashed lines mark April 2018 and March 2023. The y-axis is truncated at 60%; early-2017 orthopaedic values exceed this range.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1.docx