¹ University of Dundee Medical School, Dundee, UK

² NHS Tayside, Dundee

³ Patient Safety Team, NHS Tayside

Correspondence to vicki.tully@nhs.scot

Cite this as: *BMJ* 2022;376:e055084

<http://dx.doi.org/10.1136/bmj-2020-055084>

Published: 24 February 2022

ESSENTIALS

How to embed quality improvement into medical training

Peter Davey,¹ Shobhan Thakore,² Vicki Tully^{1,3}

What you need to know

- From the start, medical training should involve identifying problems, analysing why they happen, and testing change
- Enable interprofessional learning by focusing on problems identified by multiprofessional clinical teams
- Support requires clinical and educational leadership, and individual support such as coaching

Training was recognised as a “bridge to quality” 20 years ago¹ and quality improvement is now integrated into appraisal for doctors in training² and outcomes for undergraduate medical education.³ In the UK, expectations for training of doctors in their first two years after graduation are set by the UK Foundation Year curriculum, which states that FY2 doctors are required to contribute significantly to at least one quality improvement project and report their work in their e-portfolio.⁴

Two systematic reviews^{5,6} found that teaching quality improvement and patient safety to trainees frequently resulted in changes in clinical processes. Subsequently, a realist review⁷ and a systematic review⁸ have focused specifically on the characteristics of quality improvement training that are associated with a positive, sustained impact on patient care outcomes and system performance improvement.

However, previous articles in this series have raised concerns that trainees in the UK are on short rotations, have limited time or support, and may perceive that they lack authority to persuade colleagues that problems need tackling.^{9,10} This article describes an approach which applies evidence about successful quality improvement training (table 1) to a curriculum on healthcare improvement for doctors in their first two years of training, drawing on the authors' experiences. The article recommends principles to help integrate quality improvement into medical training.

Table 1 | Evidence about the impact of training in quality improvement for healthcare professionals on patient care outcomes or system performance improvements*

Factor	Realist review ⁷ (39 studies of physician education in quality improvement)	Systematic review ⁸ (99 studies of quality improvement education for health professionals)
Project	Identifying educational and clinically relevant project topics is challenging. Consider having trainees choose their own project. Choose topics of clinical importance. Use near misses as a way to identify system errors	Quality improvement project in the curriculum OR 13.60 CI 2.92 to 63.29
Learners	Trainees are frontline providers and have deep insights into the clinical processes and the knowledge for improvement within the system. Quality improvement projects create opportunities for interprofessional engagement and education	Interprofessional learning OR 6.55 CI 2.71 to 15.52
Support	Successful quality improvement teaching in the clinical setting requires support from both educational and care delivery leaders and the work of the trainees. Programmes can be successful either by engaging all faculty around quality improvement or by having dedicated quality improvement faculty for teaching the subject within the clinical setting	Coaching OR 4.38 CI 1.79 to 10.94
Learning outcomes	Lack of clarity around whether educational and clinical outcomes are of equal importance. Sustainability is important for the clinical setting and the trainee	Most studies only assessed knowledge. A minority of studies reported impact on attitudes (13%) and behaviour change (3%)

CI=confidence interval

* The systematic review included a quantitative analysis of three pre-specified factors. The odds ratios (OR) in the systematic review are for association between three pre-specified curricular features and changes in clinical care processes or outcomes

This article was based on a literature search for systematic reviews about medical training in quality improvement and on the personal experiences of the authors in developing integrated curriculums for workplace based education.

Integrate quality improvement projects with clinical audit and service evaluation

Quality improvement education is more likely to report impact on clinical processes or patient outcomes when a quality improvement project is an explicit part of the curriculum.⁷ However, identifying meaningful projects that can be completed within a short time is challenging. Near misses in practice are an important source of information about system errors.⁷ Encouraging trainees to report weaknesses in the system and involving them in analysis of

individual cases enables them to evaluate delivery of care and to critique themselves and their peers within clinical teams.⁷

Quality improvement has great potential to be used with other approaches to change, such as audit and service evaluation.¹¹ These may identify areas of non-compliance with best practice or shortfalls in services that would benefit from a quality improvement approach. Quality improvement can also assess a service's readiness for change or identify risks associated with change.

In NHS Tayside, the FY2 quality improvement project is preceded by training in problem finding and analysis and is part of a connected curriculum of workplace based learning in quality improvement for medical students and foundation year doctors (fig 1). From 2022 this training will be completed by all 235 medical school graduates and all 92 FY2 doctors.

Fig 1 | Workplace based learning programmes on healthcare improvement in the undergraduate and foundation year (FY) curriculum. Foundation years are the first two years of postgraduate training

Build capacity for quality improvement projects

Studies of quality improvement education are more likely to report impact on clinical processes or patient outcomes when there is

evidence of interprofessional involvement.⁸ Interprofessional teams may include administrative, finance, and management, as well as clinical staff.⁷

Successful approaches to quality improvement include learners participating in a clinical quality improvement team that incorporates more than one learner or individual projects. Challenges include ensuring a clearly allocated time to complete the work, competing priorities, and short periods in which the work must be completed.⁷

The FY2 year is a rotation through three posts. The UK Foundation Programme requires that FY2s have three hours a week of non-clinical professional self-development time. The intended use of this time will include preparing for specialty application and developing skills in quality improvement, teaching, and leadership.¹²

In the early years of our programme we focused on acute care (acute medicine, anaesthetics, and emergency medicine) because the high throughput of patients facilitated quality improvement projects in the limited time available, and these were priority areas in the Scottish Patient Safety programme which built capacity for engagement of frontline staff with improvement methods. Over eight years we have built capacity for quality improvement projects across the range of services where FY2 doctors work.

In the first three years of the programme, most FY2 quality improvement projects focused on problems identified by the foundation year doctors. Some of these projects resulted in structural changes that have been sustained since.^{13 14} However, it was often difficult to sustain change that was perceived as increasing workload for other team members.¹⁵ We learnt from quality improvement projects with students that involving them in problems identified by the clinical teams enables them to design and test solutions,¹⁶ which can then be sustained and spread by the clinical teams. We still support projects focused on burning issues identified by foundation year doctors, but most projects now focus on problems identified by clinical teams.¹⁷ This facilitates interprofessional learning from the start (box 1).

Box 1: Example of sustained improvement enabled by an interprofessional learning team¹⁸

Problem

Unreliable implementation of the COUGH¹⁹ bundle in a surgical high dependency unit

Problem identification

Surgical high dependency unit team

Project leaders

FY2 trainee doctors

Interventions

Four interventions were implemented sequentially. Improvement occurred only after the fourth intervention

- Education through staff emails
- Two posters about risk scoring and detailed steps for junior doctors to take
- Moving observation charts from filing cabinets to a wall space that was dedicated to quality improvement projects
- Sticker placed in the admission notes by ward clerks

Lessons learnt

Lessons learnt from this project included the importance of encouraging and motivating all members of the team. The most successful intervention was the sticker, and this involved team work from the ward clerk, junior doctors, anaesthetists, physiotherapists, and nursing staff. New junior doctors rotate throughout the unit on a 4 monthly basis; therefore, it is vital that permanent members of the team are engaged so that the project can be sustainable

Support quality improvement training

Quality improvement education is more likely to affect clinical processes or patient outcomes when learners are supported by coaching.⁸ This requires commitment from academic, administrative, and clinical leadership.⁷ Ideally, learners should be embedded in clinical environments where continuous improvement cannot be disentangled from daily work.²⁰ It is essential that they join a department that is primed, ready, and welcoming given the short duration of their attachment. At an organisational level it is therefore important to know where this expertise exists and commit to growing this resource.²⁰ Within each clinical specialty, our foundation year doctors have access to a named quality improvement coach who is an improvement adviser. In addition to improvement methods, the coaches help the foundation year doctors with forming a multidisciplinary team, which could include a finance representative and a sponsor with links to executive level for leadership support.

The Scottish Quality and Safety fellowship programme²¹ has increased capacity for improvement methods in clinical services. It has been important to have a clinician appointed to a lead management role with responsibility for quality improvement in the organisation. Alignment of senior clinical leadership with the undergraduate and foundation year programmes enables trainee and student improvement to be targeted to areas of greatest need rather than towards vanity projects. Coordination allows the targeted use of trainees and students as an additional resource that can help stretched clinical teams.²² This allows the organisation to connect with ideas being generated by frontline teams and with ideas from service users in a way that would not otherwise be possible. The knowledge gained from individuals closest to the point of delivery is vital when looking to improve a complex system.^{23 24}

Key learning outcomes are behavioural

Evidence about quality improvement education shows a lack of clarity around the relative importance of educational and clinical outcomes and a focus on assessment of knowledge, with only 3% of studies in one systematic review assessing impact on learner behaviour.⁸ A recent evaluation of a quality improvement training programme reported that 62% of participants had implemented quality improvement projects at six months and 48% reported leading other quality improvement projects at 18 months after the programme.²⁵ Developing strategies to capture downstream quality improvement behaviour change is important because knowing something or even being skilled at doing something does not of itself lead to improvement.²⁶ In addition to leading quality improvement projects, learners should recognise how an isolated problem could be an opportunity for broader quality improvement, and take steps towards leading change.²⁰

In the UK, assessment of successful progression through quality improvement training is part of the Annual Review of Competency Progression process and relies on objective measurable information from several sources, including workplace based assessment of e-portfolio and supervisors' assessments.² In addition, individual royal colleges are introducing exit assessment from training through national postgraduate examinations.²⁷ Existing assessment tools enable trainees to build evidence of progression in quality improvement, with the input of educational and clinical supervisors. This can be supported using tools such as a structured guide to good practice in reporting the quality improvement project (box 2). Encourage trainees to present their work to their peers, trainers, and clinical colleagues or to submit it for publication.^{13 15 18 29 31}

Box 2: Guidance on writing up a quality improvement project for foundation year doctors and their assessors, based on the assessment approach that we have developed and evaluated with medical students²⁸

Suggested structure:

- Project aim
- Planned changes tested
- Predictions
- Measures—outcome, process, and balancing
- Summary of results, including run charts
- Analysis of data
- Project significance for local system and generalisable findings
- Reflections, including factors that promoted success, barriers to success, learning from project, and reflections on the role of the team

Education into practice

To enable doctors to make quality improvement in their first years of training, consider asking:

- How will you explain the concept of quality improvement in an engaging manner that encourages trainees to reflect critically on the service being provided in their area?
- How will you connect trainees with quality improvement experts, so they have support when designing their project, interpreting data, and presenting results?
- How will you ensure that the efforts of the trainee and their team are recognised to encourage future involvement and spread good practice?

How patients were involved in the creation of this article

The authors have drawn on their experience in partnering with patients in the design and delivery of multiple healthcare improvement activities. Patients were not directly involved in writing this article.

Recommended resources/further reading

- Realistic Medicine. Shared decision making, a personalised approach to care, reduce harm and waste, reduce unwarranted variation, managing risk better, becoming improvers and innovators. <https://www.realisticmedicine.scot>
- Institute of Healthcare Improvement. Patient safety, leadership and person centred care—free access for students and trainees (trainees need to register as a resident to get free access). <http://www.ihl.org/education/ihopenschool/courses/Pages/SubscriptionInformation.aspx>
- Quality improvement zone. Improvement Journey, project charter, model for improvement and quality improvement tools. <https://learn.nes.nhs.scot/1262/quality-improvement-zone/qi-tools>

Contributors: We thank Evridiki Fioratou and Sharon Hilton Christie for comments on this article.

Competing interests: We have read and understood the BMJ policy on declaration of interests and declare the following interests: none.

Provenance and peer review: This article is part of a series commissioned by *The BMJ* based on ideas generated by a joint editorial group with members from the Health Foundation and *The BMJ*, including a patient/carer. *The BMJ* retained full editorial control over external peer review, editing, and publication. Open access fees and *The BMJ*'s quality improvement editor post are funded by the Health Foundation.

- 1 Institute of Medicine (US) Committee on the Health Professions Education Summit. Health professions education: a bridge to quality 2003. <https://www.ncbi.nlm.nih.gov/books/NBK221528/>
- 2 Academy of Medical Royal Colleges. Quality improvement—training for better outcomes. 2016. <https://www.aomrc.org.uk/reports-guidance/quality-improvement-training-better-outcomes/>
- 3 General Medical Council. Outcomes for graduates 2019. <https://www.gmc-uk.org/education/standards-guidance-and-curricula/standards-and-outcomes/outcomes-for-graduates>

- 4 UK Foundation Programme. Curriculum. <https://foundationprogramme.nhs.uk/curriculum/>
- 5 Boonyasai RT, Windish DM, Chakraborti C, Feldman LS, Rubin HR, Bass EB. Effectiveness of teaching quality improvement to clinicians: a systematic review. *JAMA* 2007;298:1023-37. doi: 10.1001/jama.298.9.1023 pmid: 17785647
- 6 Wong BM, Etchells EE, Kuper A, Levinson W, Shojania KG. Teaching quality improvement and patient safety to trainees: a systematic review. *Acad Med* 2010;85:1425-39. doi: 10.1097/ACM.0b013e3181e2d0c6 pmid: 20543652
- 7 Jones AC, Shipman SA, Ogrinc G. Key characteristics of successful quality improvement curricula in physician education: a realist review. *BMJ Qual Saf* 2015;24:77-88. doi: 10.1136/bmjqs-2014-002846 pmid: 25271329
- 8 Starr SR, Kautz JM, Sorita A, et al. Quality improvement education for health professionals: a systematic review. *Am J Med Qual* 2016;31:209-16. doi: 10.1177/1062860614566445 pmid: 25583877
- 9 Allwood D, Fisher R, Warburton W, Dixon J. Creating space for quality improvement. *BMJ* 2018;361:k1924. doi: 10.1136/bmj.k1924 pmid: 29773587
- 10 Jones B, Vaux E, Olsson-Brown A. How to get started in quality improvement. *BMJ* 2019;364:k5408. doi: 10.1136/bmj.k5437 pmid: 30655245
- 11 Backhouse A, Ogunlayi F. Quality improvement into practice. *BMJ* 2020;368:m865. doi: 10.1136/bmj.m865 pmid: 32234777
- 12 England NHE. Foundation Programme review recommendation 14 intended uses of 'self-development time.' <https://www.hee.nhs.uk/sites/default/files/documents/SDT%20-%20Intended%20Uses%20of%20SDT.pdf>
- 13 Cathcart J, Cowan N, Tully V. Referral finder: saving time and improving the quality of in-hospital referrals. *BMJ Qual Improv Rep* 2016;5:w3951. doi: 10.1136/bmjquality.u209356.w3951 pmid: 27158494
- 14 Ross D, Petrie C, Tully V. Introduction of a junior doctors' handbook: an essential guide for new doctors. *BMJ Qual Improv Rep* 2016;5:w3822. doi: 10.1136/bmjquality.u209167.w3822 pmid: 26893891
- 15 Puvaneswaralingam S, Ross D. Improving the communication between teams managing boarded patients on a surgical specialty ward. *BMJ Qual Improv Rep* 2016;5:w3750. doi: 10.1136/bmjquality.u209186.w3750 pmid: 27493751
- 16 Tully V, Al-Salti S, Arnold A, et al. Interprofessional, student-led intervention to improve insulin prescribing to patients in an Acute Surgical Receiving Unit. *BMJ Open Qual* 2018;7:e000305. doi: 10.1136/bmjopen-2017-000305 pmid: 30019012
- 17 Botros S, Dunn J. Implementation and spread of a simple and effective way to improve the accuracy of medicines reconciliation on discharge: a hospital-based quality improvement project and success story. *BMJ Open Qual* 2019;8:e000363. doi: 10.1136/bmjopen-2018-000363 pmid: 31428702
- 18 Livie V, Livie J, Hilton-Christie S. Improving the use of the 'COUGH' bundle in surgical high dependency unit, Ninewells Hospital, Dundee. *BMJ Open Qual* 2020;9:e000851. doi: 10.1136/bmjopen-2019-000851 pmid: 32423972
- 19 Cassidy MR, Rosenkranz P, McCabe K, et al. COUGH. Reducing postoperative pulmonary complications with a multidisciplinary patient care program. *JAMA Surg* 2013;148:740-5.
- 20 Myers JS, Wong BM. Measuring outcomes in quality improvement education: success is in the eye of the beholder. *BMJ Qual Saf* 2019;28:345-8. doi: 10.1136/bmjqs-2018-008305 pmid: 30886120
- 21 NHS Education for Scotland. Scottish Quality and Safety (SQS) fellowship programme. <https://learn.nhs.uk/84/quality-improvement/learning-programmes/scottish-quality-and-safety-fellowship-programme>
- 22 Burnett E, Davey P, Gray N, Tully V, Breckenridge J. Medical students as agents of change: a qualitative exploratory study. *BMJ Open Qual* 2018;7:e000420. doi: 10.1136/bmjopen-2018-000420 pmid: 30234174
- 23 Juhl K, Grigsby RK. Engaging learners in health system quality improvement efforts. *Acad Med* 2017;92:593-7. doi: 10.1097/ACM.0000000000001577 pmid: 28121655
- 24 Wiseman L. Rookie Smarts: Why learning beats knowing in the new game of work. *Leader* 2015;76:54-9. doi: 10.1002/ltl.20179.
- 25 O'Leary KJ, Fant AL, Thurl J, et al. Immediate and long-term effects of a team-based quality improvement training programme. *BMJ Qual Saf* 2019;28:366-73. doi: 10.1136/bmjqs-2018-007894 pmid: 29789407
- 26 Lucas B, Nacer H. The habits of an improver: thinking about learning for improvement in health care London: Health Foundation. 2015. <http://www.health.org.uk/publications/the-habits-of-an-improver>.
- 27 Royal College of Emergency Medicine. Quality improvement project marking scheme 2021. https://rcem.ac.uk/wp-content/uploads/2021/10/RCQM_qualityimprovementP_Mark_Scheme_Adjusted_June_2020_for_COVID-19.pdf
- 28 Davey P, Fioratou E, Tully V, et al. Medical education for healthcare improvement. *Jpn J Med* 2018;2:304-15.
- 29 Barbour V, Thakore S. Improving door to CT scanner times for potential stroke thrombolysis candidates - The Emergency Department's role. *BMJ Qual Improv Rep* 2017;6:w4623. doi: 10.1136/bmjquality.u211470.w4623 pmid: 28824806
- 30 Ramsay N, Maresca G, Tully V, Campbell K. Does a multidisciplinary approach have a beneficial effect on the development of a structured patient handover process between acute surgical wards in one of Scotland's largest teaching hospitals? *BMJ Open Qual* 2018;7:e000154. doi: 10.1136/bmjopen-2017-000154 pmid: 30057950

- ³¹ Testrow S, McGovern R, Tully V. Secondary care interface: optimising communication between teams within secondary care to improve the rehabilitation journey for older people. *BMJ Open Qual* 2021;10:001274. doi: 10.1136/bmjog-2020-001274 PMID: 33579746