BMJ Open Quality

Validation and application of a tool to assess self-confidence to do improvement

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To cite: Richardson A, Rees J. Validation and application of a tool to assess self-confidence to do improvement. *BMJ Open Quality* 2025;**14**:e003130. doi:10.1136/bmjoq-2024-003130

Received 19 September 2024
Accepted 4 March 2025

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ABSTRACT

Introduction Increasing improvement capability in the workforce is vital within healthcare. The type of quality improvement training to increase capability varies. One way to measure the impact of improvement training is self-confidence to do improvement.

Objectives Our objectives were to validate a tool to assess self-confidence to do improvement and to observe the degree of change before and after improvement training. We aimed to assess the degree of impact on self-confidence associated with varying exposure to quality improvement training.

Methods We used an online 10-item and 4-point scale to assess self-confidence before and after improvement training. Reliability analysis using Cronbach's alpha was performed. The nature of the underlying construct was investigated using exploratory factor analysis and a full set of pre and post measures were used, and to compare individual question changes, a series of paired Wilcoxon tests were performed with Bonferroni post hoc corrections for multiple comparisons. To assess the differing lengths of programmes, individual results from each programme were combined meta-analytically with course duration added as a moderator.

Results 252 completed questionnaires were analysed at baseline and a full set of pre and post measures were available for 128 participants. Cronbach's alpha for the tool was satisfactory at 0.93 (0.92–0.94) and measured a single underlying construct with an eigenvalue of 6.17. A significant increase in confidence to improve from before to after intervention was found ($t(127) = 14.36$, $p<0.001$, $d=1.27$ (95% CI 1.03–1.50)). Post-testing differences were significant ($F(6,125) = 2.89$, $p=0.02$) with shorter courses having significantly smaller increases in confidence.

Conclusions This manuscript provides a validated self-confidence tool to help assess improvement capability. Our tool offers a way to measure the impact of improvement capability on varying training durations and inform decisions about allocating staff time to this activity.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ While it is recommended that healthcare staff need to understand improvement methods and how to use them to increase capability for effective change and to transform services, the type of quality improvement training available varies widely in duration.

WHAT THIS STUDY ADDS

⇒ We validated a 10-item and 4-point scale to measure self-confidence to do improvement to help measure the impact of quality improvement capability training and inform decisions about allocating staff time to this activity.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Improvement trainers can use this tool to assess the impact of self-confidence to do improvement on courses of varying duration delivered to healthcare multidisciplinary teams.

INTRODUCTION

Healthcare in the UK, like many other countries worldwide, is facing extraordinary performance, financial and workforce pressures identifying the need for continuous improvement as critical to its future success.[1 2] This need for improvement relies on the local health system having the capability to implement change effectively and transform services throughout the whole system.[3]

National frameworks for action, including 'NHS Impact' and 'The NHS Patient Safety Strategy',[4 5] call for individuals and teams to understand proven improvement methods and how to use them to implement change to make improvements. This improvement capability is important as improvements rarely occur by chance; instead, they require intentional actions of staff equipped with skills needed to bring about changes.[6] The emphasis on actions to increase improvement capability is on the entire workforce and this context has resulted in healthcare organisations taking a strong focus on the delivery of quality improvement training to increase capability for effective change and to transform services. The type of quality improvement training available varies widely in duration from a small number of minutes to programmes lasting 12 months; and allocating the protected time to attend training is often a challenge due to clinical and workforce pressures. Given this situation,

it is crucial for healthcare organisations to measure the impact of quality improvement capability training to inform decisions about allocating precious staff time to this activity.

At a local level, we offer and support staff to attend a range of multidisciplinary quality improvement training opportunities to build improvement capability and one of the measures to evaluate the programmes is self-assessment of confidence to do quality improvement. Confidence to do improvement is identified as one of the three key parts of improvement capability building alongside knowledge and skill development.[7 8]

Previously, improvement programmes to increase improvement capability have evaluated self-confidence.[7–10] Two improvement programmes targeting doctors-in-training used unvalidated instruments pre and post programme to self-assess confidence, one involved 1 question and a 3-point scale[7] and the other contained 10 questions and a 4-point scale.[8] Another group evaluated a multidisciplinary quality improvement programme with an unvalidated tool comprising two questions and a 5-point scale.[9] A 10-question 4-point tool was developed and pilot-tested on 12 multidisciplinary team members to self-assess confidence to do improvement and was found to have good internal reliability as measured by a single underlying construct.[10] The only other validated tool attempting to assess confidence is an 18-item, 7-point tool developed for nurses and nursing students with three questions focusing on confidence with skills, knowledge and attitude to do quality improvement.[11]

We wanted to use a validated tool on the multidisciplinary team to assess a range of quality improvement concepts closely linked to the course content we delivered. Therefore, we aimed to extend the validation process on the self-assessment of confidence tool previously undertaken on 12 multidisciplinary team members[10] but on a much bigger sample size. We also aimed to use the 10-question 4-point scale[10] to evaluate self-confidence before and after a range of quality improvement programmes with varying exposure to our quality improvement courses. This evaluation was set up to observe the degree of change associated with self-confidence to do quality improvement work. Understanding the degree of impact on self-confidence associated with varying exposure to QI training is important to judge and guide the future allocation of time to courses.

METHODS

Setting

The tool was tested in one large teaching Trust in the Northeast of England. The Trust has two acute hospitals and provides primary, secondary and tertiary care.

Extension of the preliminary validation process

To confirm the validation process and evaluate whether simple addition of the individual question results to give a total score for each participant was justified, a reliability analysis using Cronbach's alpha was performed on the baseline questionnaire results. The nature of the underlying construct was investigated using exploratory factor analysis (parallel analysis with maximum likelihood estimation). Two sensitivity analyses were performed to confirm results in the presence of missing data—a second exploratory factor analysis was conducted only on the baseline data of the subset of participants with complete pre and post measures and response bias excluded by reanalysis of pre-post differences with random removement of a further 20% of participants.

Applying the confidence tool to a range of quality improvement programmes

All participants on several quality improvement programmes were invited to undertake an online self-assessment of their confidence using the 10-item self-assessment tool before (pre) and after the end of their improvement programme (post). The pre self-assessment was issued 2 to 3 weeks before starting the course and the post self-assessment was issued 2–3 weeks after completing the course. To evaluate self-confidence, a full set of pre and post measures were used, and to compare individual question changes, a series of Wilcoxon tests were performed with Bonferroni post hoc corrections for multiple comparisons. To assess whether the differing lengths of programme offered influenced the change in confidence experienced, individual results from each programme were combined meta-analytically (fixed effects methods chosen as the interventions were fundamentally identical) with course duration added as a moderator. All statistical analysis was carried out using IBM SPSS V.29.0.1

Table 1 outlines an overview of the quality improvement course content, format of the learning, frequency and duration of each session, number of learning hours, sample size and the mean change to the confidence scores. The participants on all courses were from the multidisciplinary team; this included doctors, nurses, physiotherapists, managers, speech therapists and healthcare assistants.

The self-assessment confidence tool

The 10-item 4-point Likert scale to gauge each participant's self-assessment of confidence consisted of a scale: 1—not at all confident, 2—not so confident, 3—somewhat confident, 4—very confident.[10] The 10 items were as follows:

How confident are you:

1. with the identification of a quality problem?
2. to develop an improvement aim?
3. to identify outcome and process measures appropriate for a clinical problem?
4. with identifying changes in practice to improve processes?
5. to use several cycles of change in practice to improve care delivery?

Table 1 Quality improvement course details

Group	Year	Content overview	Format of learning and duration of each session	Total learning hours delivered	Pre and post confidence sample size	Mean (95% CI) change	d (SE d)
Initial Sample Leadership roles	2019	Model for Improvement* Measurement Testing using PDSA Sustainability and spread	6 days of 7 hours classroom learning	42	12	8.75 (6.89–10.61)	2.99 (0.55)
Four clinical teams	2020	Model for Improvement* Measurement Testing using PDSA	1.5 hours of prelearning 4 hours of classroom learning 2 virtual coaching sessions of 1 hour	7.5	29	4.38 (2.31–6.45)	0.81 (0.17)
Day Surgery Team	2022	Model for Improvement* Measurement Testing using PDSA	1 hour of pre-learning 5 virtual learning sessions of 1.5 hours	8.5	4	4.25 (0.07–8.44)	1.62 (0.33)
Leading For Improvement (LFI) programme	2021	Model for Improvement* Measurement Learning systems Quality management Psychology of change Coaching and sponsorship High impact leadership	1 hour pre-learning 4 days of 7 hours classroom learning 1 day of 3 hours classroom learning	32	10	7.30 (3.91–10.69)	1.54 (0.25)
Improvement programme for Teams (IPT) 1	2021	Model for Improvement* Measurement Testing using PDSA implementation, spread, and scale-up	1 hour pre-learning 7 virtual learning of 3.5 hours 7 sessions of 1 hour coaching 1 hour celebration event	33.5	38	9.18 (7.43–10.94)	1.72 (0.27)
Improvement Programme for Teams (IPT) 2	2022	Model for Improvement* Measurement Testing using PDSA implementation, spread and scale-up	1 hour pre learning 3 virtual learning sessions of 3.5 hours 2 days of 7 hours classroom learning 7 sessions of 1 hour coaching 1 hour celebration event	35.5	9	9.89 (5.38–14.40)	1.69 (0.79)
Improvement Programme for Teams (IPT) 3	2023	Model for Improvement* Measurement Testing using PDSA implementation, spread and scale-up	1 hour pre-learning 3 days of 7 hours of classroom learning 5 days of 1.5 hours virtual coaching 1.5 hour celebration event	31	26	9.35 (5.93–12.76)	1.11 (0.28)

*Model for Improvement included topics were: identifying a quality problem, aim setting, identifying change ideas, creating an improvement team, using cycles of change and sustaining change

Table 2 Individual item reliability statistics

Item	If item dropped Cronbach's α	Item-rest correlation	Mean	SD
Q1	0.93	0.65	2.71	0.71
Q2	0.92	0.78	2.63	0.73
Q3	0.92	0.76	2.29	0.78
Q4	0.93	0.64	2.78	0.72
Q5	0.92	0.73	2.46	0.81
Q6	0.92	0.74	2.11	0.89
Q7	0.92	0.76	2.44	0.88
Q8	0.92	0.73	2.46	0.77
Q9	0.92	0.73	2.13	0.83
Q10	0.92	0.76	1.96	0.79

6. with data analysis and using run/control charts to display results of changes?
7. to create an interdisciplinary improvement team and assign roles necessary for improvement success?
8. to ensure change tested is implemented into practice and sustained?
9. to train others to do quality improvement?
10. to use quality improvement language to share a vision and target messages about the change and quality improvement?

Ethics

We used secondary analysis of data already collected as part of our routine monitoring of quality improvement courses so ethical approval was not required.

RESULTS

Replication of the validation process

A sample of 252 completed questionnaires were taken at baseline. A reliability analysis was performed on the baseline questionnaire results. Cronbach's alpha for the 10-item scale was satisfactory at 0.93 (0.92–0.94) with acceptable item to total correlations and no item deletion leading to an increase in Cronbach's alpha (table 2).

Exploratory factor analysis was performed using parallel analysis using maximum likelihood estimation. The KMO test overall revealed MSA=0.94 indicating sampling was adequate and Bartlett's test was significant ($\chi^2(45)=1649.32$, p<0.001) indicating the sample was suitable for principal component analysis. Analysis showed that the self-assessment tool measured a single underlying construct with an eigenvalue of 6.17 which explained 62% of the variability with all 10 items loading onto this factor with loadings between 0.78 and 0.80. Given that a substantial proportion did not complete the follow-up analysis, a sensitivity analysis was performed to confirm this factor structure using only those 128 participants with complete data sets. In this reduced data set, single underlying construct with an eigenvalue of 6.15 which explained 57% of the variability was found with all 10 items loading onto this factor with loadings between 0.65 and 0.80 in essentially the same pattern.

Applying the confidence tool

A full set of pre and post measures were available for 128 participants and given all questions loaded onto a single factor, for these, the total scores were calculated simply as the sum of individual items (table 1). There was a significant increase in confidence to improve from before to after intervention with a large effect size (t(127) = 14.36, p<0.001, d=1.27 (95% C.I. 1.03 – 1.50)) from a baseline mean score of 24.12 (95% CI 22.94 to 25.30) to a follow-up mean of 31.95 (95% CI 31.17 to 32.73).

To compare individual question changes, a series of paired Wilcoxon tests were performed with Bonferroni post hoc corrections for multiple comparisons. The 128 participants with complete pre/post measures were compared. There was a significant increase in score on each question from before to after intervention (all p<0.001 after correction) as shown in figure 1.

Mixed analysis of variance (ANOVA) (group x baseline v follow-up) reveals a significant difference in increase in confidence between the groups (F(5,118) = 2.91, p=0.02). Follow-up simple effects analysis reveals there was no significant difference between groups at the pre-testing stage (F(6,125) = 1.90, p=0.09), but post-testing group differences were significant (F(6,125) = 2.89, p=0.02) suggesting differing groups may have improved by different amounts which was confirmed by a significant difference in change scores by group (F(6,128) = 3.89, p=0.001). Post hoc testing revealed that the day surgery and four clinical teams groups which had shorter courses had significantly smaller increases in confidence than the other groups.

Given the relatively large number of participants who did not complete follow-up questionnaires, confidence in the results was assessed by performing a sensitivity analysis. A further random 20% of each group were removed and the pre-post analyses repeated. In the reduced data set, the pattern of results was unchanged with calculated

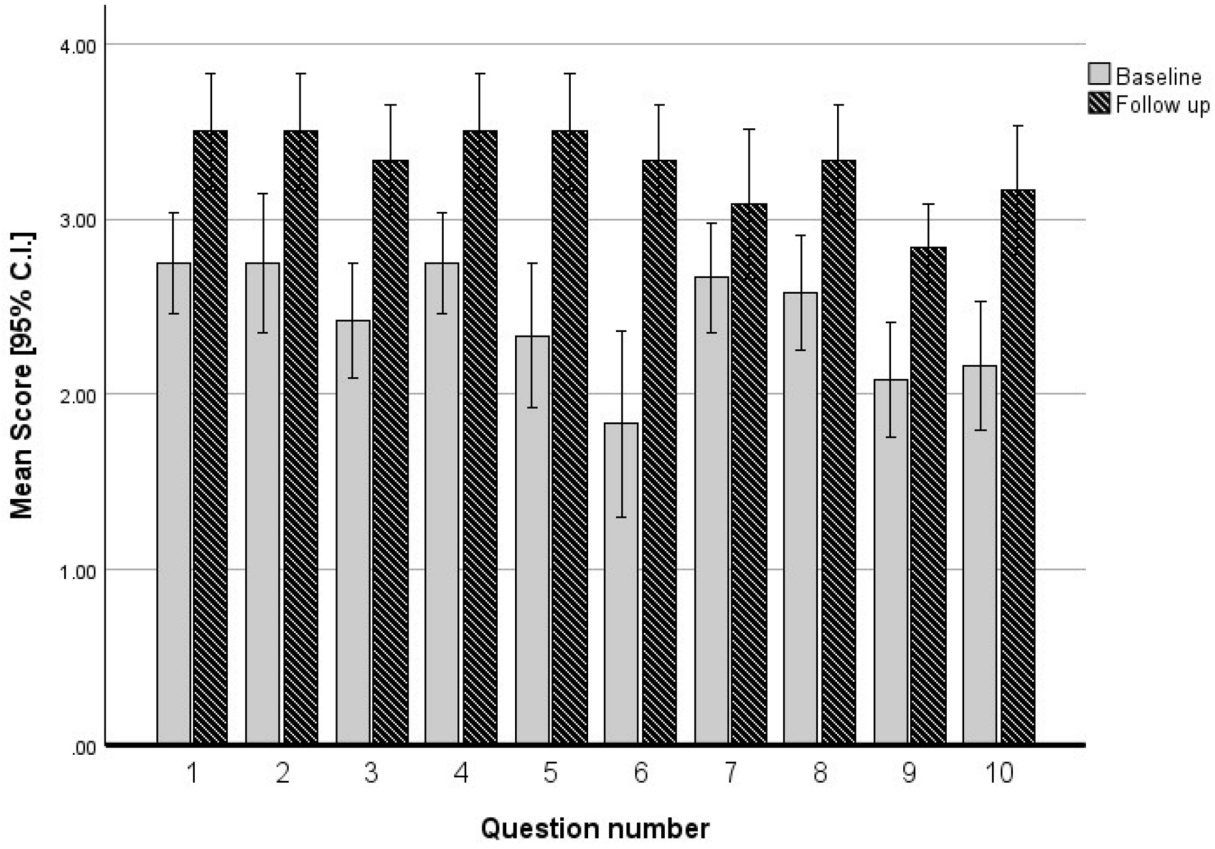

Figure 1 Mean baseline and follow-up score (95% CI) for each item in the scale.

effect sizes of the intervention remaining of similar magnitude suggesting that the observed effects are not an artefact of the reduction in participant numbers from pre to post testing.

Meta-analytic combination of the studies (fixed effects model as effectively drawing from one single population) was performed to confirm this and reveals an overall effect size of d=1.30 (1.09–1.51) as shown in figure 2A. Entering the number of guided learning hours into a meta-regression reveals that course length is a significant mediator of the improvement effect size outcome (estimated coefficient 0.02, z=2.95, p=0.003) as shown in figure 2B. Given that the initial leadership roles group appear an outlier in the metagression, a sensitivity analysis was performed by repeating the meta-analysis excluding this group. Results were essentially unchanged with a pooled effect size of d=1.24 (1.03–1.45) across the remaining studies with course length remaining as a significant mediator of outcome (estimated coefficient 0.02, z=2.95, p=0.013).

DISCUSSION

Replicating the 10-item and 4-point scale to measure self-confidence to do quality improvement[10] on a much larger sample has shown to have high internal consistency as measured by Cronbach's alpha and measured a single underlying construct. This suggests it is an appropriate tool to use to help assess the impact of quality improvement courses.

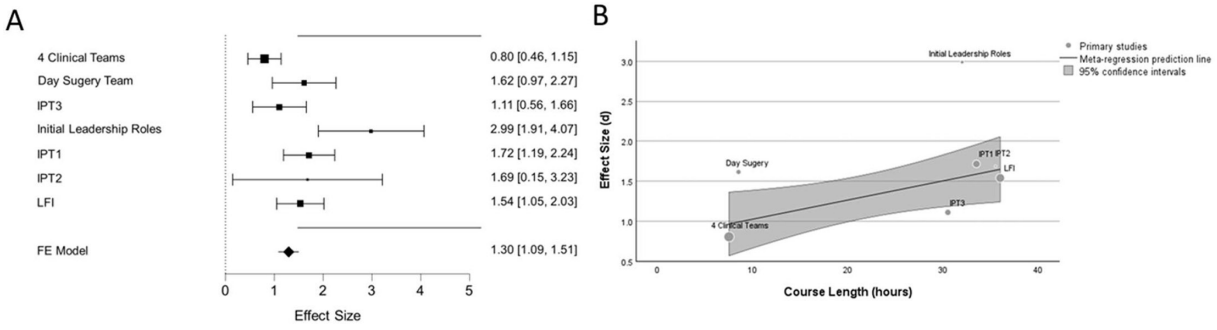

Figure 2 (A) Forest plot summarising fixed effects meta-analysis of individual interventions. (B) Bubble plot showing the meta-regression with duration of course in hours as a significant moderator of the change in confidence achieved.

The number of participants completing the baseline assessment was 252 and this was reduced to 128 completing the post assessment. The reason for this reduction is unknown; however, it is likely to be associated with the reported problems such as survey fatigue and restricted time.[12]

With all our courses, we found significant increases in confidence to improve from before the courses started to after our quality improvement courses completed. To gain an insight into the degree of impact on confidence to do quality improvement work, we found that varying exposure to QI training produced varying changes to confidence. The course content make up on quality improvement was similar, but there were varying quantities of exposure to the improvement content as this ranged from 7.5 hours to 42 hours. The two shorter courses were 7.5 and 8.5 hours (approximately 1 day) and resulted in a significantly smaller increase in confidence than the longer duration courses which ranged from 31 to 42 hours (approximately 4–6 days). This is important information to help judge and guide the future allocation of precious time to quality improvement training. If the aim is for staff to have a high level of confidence to do improvement, a longer duration course of 4–6 days is likely to better equip staff by improved confidence. This longer time needs to be carefully considered as clinical practice is already busy and the demand for staff time is high. Therefore, strategies to consider could be building quality improvement training into existing protected time away from clinical practice such as part of the continuous professional development allocation. Also, we did not provide courses within a mid-zone duration of 2–3 days so further evaluation of this shorter duration is suggested in the future, as this could mean less time away from clinical practice.

The initial sample group had a much greater increase in confidence. This group was the first group receiving the training with a strong desire to not only increase their confidence to do improvement but also develop their capability to train others on quality improvement. Therefore, it is likely that this group had a higher motivational factor leading to increased confidence.

We had several limitations. All participants were from one healthcare provider in one location in the north-east of England. However, as we provide care to primary care, secondary care and tertiary care and the participants were from the multidisciplinary team, the sample represents healthcare staff. Other studies assessing self-confidence to do improvement have used unvalidated tools[7–9] or have not targeted the multidisciplinary team.[11] Therefore, our validated tool offers an informative way to contribute to the assessment of the impact of improvement training courses.

Even though we found significant increases in confidence to improve, other confounders were not captured such as prior experience with QI training, gender, team organisational structure and support, as well as knowledge and skill obtained prior to training. Therefore, it is unknown if these other confounders are related to the confidence changes. Future work should capture these other confounders to assess if they impact on confidence.

None of the participants on our courses were patients or carers so including them in future evaluations would be important to check if the use of this tool could be extended beyond the healthcare professional population. Given the increasing focus on coproduction of healthcare research and the involvement of patients in improving their own care, this could be valuable. It would also be useful to determine whether the tool demonstrates convergent validity with the existing validated tool in this area[11] or other independent measures of confidence to improve.

The training content was not entirely identical for each course, some of the course participants had leadership roles so additional content was added such as learning systems and quality management. Confidence was not measured for these additional aspects of training as unique to a small number of participants.

Our post assessment of confidence was limited to 2–3 weeks after each course finished. Longer-term evaluation of the participants at 6 and 12 months after the courses completed would be informative to assess if the increases in confidence are sustained.

CONCLUSIONS

Our testing of a 10-item and 4-point scale to measure self-confidence tool has shown to be a valid tool, which therefore can contribute to the assessment of the impact of quality improvement training courses. Our findings indicate that varying exposure to QI training produced varying changes to confidence and longer course duration of 4–6 days produced a higher level of confidence to do improvement.

Contributors This work has been the work of and written by the two listed authors, AR and JR. AR has acted as the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

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