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ORIGINAL RESEARCH REPORTS

Publishing Audit and Service Evaluations: Comparing Student Work and the Published Literature

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Abstract

Purpose: **Master's students complete a major project as a mandatory component of their programme and many conduct Quality Improvement (QI) projects. Publishing student work enables knowledge sharing and may be helpful for career progression, however there is limited literature on the publication potential of Master's students' work. This study aimed to investigate whether there is a difference in the study size, approach and quality of the reporting in student produced and equivalent published QI activities.**

Method: **Ten student and ten published articles were identified for analysis. Each paper was quality appraised and data pertaining to the size and scope of the projects were extracted, including approach to data collection, number of quality cycles performed, number of sites studied, and study outcome. Descriptive and inferential statistical analysis was conducted to explore the comparative performance of the two bodies of work.**

Results: **Compared to student work, published work was characterised by larger sample size (n = 744 vs 171.6), longer duration of data collection (12.75 vs 4.83 months), more prospective designs and more studies that involved introducing a new intervention than student work. No differences were identified between quality appraisal scores between the two bodies of work ($p = .24$), apart from in studies that included a new intervention, in which published work performed better than student work (81.80% vs 65.50% for achievement of quality appraisal domains). All published studies demonstrated positive findings, compared to just half of student work.**

Conclusion: **Published and student QI work appear to differ in terms of scale and quality, however there are many encouraging factors for consideration for students wishing to disseminate their QI projects. Supporting the process of preparation for publication is an important learning experience. Practical approaches to improve the scope and quality of student projects are identified.**

Keywords: Continuing education, Intervention, Master's education, Publication, Quality improvement

1. Introduction

Engagement in continuing education is a key requirement for health care professionals. Adapting a definition for continuing medical education [1] from a medical to a broader health care context provides a useful way to describe this activity: 'any activity that is intended to maintain, develop, or increase the knowledge, skills and professional performance and relationships that a health care professional uses to provide services for patients, the public, or the profession'. For many health care professionals, continuing education entails completing Master's level study, conducted on a part time basis alongside working in health care settings. In the United Kingdom (UK), Master's level study involves completion of a dissertation or final project, which comprises a substantial piece of

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independent enquiry. The Master's dissertation often results in the production of an extended monograph, although this may not be best suited to students on professionally oriented programmes who do not intend to go on to doctoral study [2]. Master's level enquiry should demonstrate dimensions of originality and there is a potential opportunity for student projects to contribute to disciplinary knowledge and to practice [2]. Although not a requirement at this level, achieving publication of Master's student projects in academic journals enables the dual benefit of dissemination of knowledge and/or practice, and personal and career development for the student beyond the achievement of their degree award.

The limited literature on publishing student projects in medicine and allied health is largely focussed in undergraduate medicine and indicates that a relatively small number of students go on to publish their student projects. This ranges from 14% to 17% in the UK [3,4], up to 32.7% in New Zealand [5], and in Germany, where research is a mandatory requirement of a medicine degree, a proportionally larger figure of 66% of students achieved publication. Students were among the authors of 28% of all papers published from a medical faculty in a German university [6]. Barriers to achieving publication reported in these findings included that students felt they did not know how to write an article, reported that they were not encouraged to submit articles and cited lack of time as a barrier [3]. To the best of our knowledge, there is no equivalent body of literature that has considered publishing among students involved in continuing health professions education.

Master's students enrolled at Warwick Medical School are required to complete a Professional Project or Dissertation as part of their education. The majority of these students are professionally employed in medicine and allied health, and are completing continuing education as part of their medical specialty training, to achieve advanced practitioner status, and/or to develop in their area of clinical interest and enhance their practice. Students submit their work written in the format of a journal article for a named publication that they have selected to be relevant to their area of enquiry and field of professional practice. This assessment approach has been designed with the intention of encouraging onward dissemination of project findings. Many of these students complete a form of quality improvement (QI) activity for their Professional Project, for example, clinical audit [a project "designed and conducted to produce information to inform delivery of best care" [7]] or service evaluation [a project "designed and conducted solely to define or judge current care" [7], with service evaluation projects either evaluating an existing service (service evaluation, no intervention) or a newly developed service (service evaluation including intervention)]. Drivers for the choice to conduct a QI focussed project include the difficulties and time-consuming efforts for obtaining ethical approval to conduct original research, and that many students have QI questions pertinent to their workplace that they wish to answer to bring about local change or improvement. QI projects are an integral aspect of local improvement in a healthcare environment and are instrumental in promoting quality in healthcare. There is limited previous analysis of student-generated QI work in the published literature. Roush & Tesoro [8] investigated the quality of final projects completed by Doctor of Nursing Practice (DNP) students in America. Using a purpose designed critical appraisal tool, they systematically analysed the rigour of 65 DNP projects, identifying a wide variability in quality and rigour of the work produced. This ranged from high-level practice-scholarship in some projects that could lead to improvements in health care delivery and outcomes, to projects with multiple flaws in design, implementation or evaluation that limited their value.

QI scholarship is known to be difficult to report in journal articles owing to multiple factors that include the mismatch between the norms of biomedical publication and the expectations of QI authors and difficulties in reporting context, which is critical to QI work [9]. Other challenges include having time to write up work for publication alongside delivering clinical care. Nevertheless, dissemination of QI studies is important to provide an opportunity for others to learn from what can work and how it might be portable to other contexts, and to learn what doesn't work to 'reduce wasteful duplication across healthcare sites' [9,p5]. The potential for students to publish their QI work is unknown; there is a scarcity in the literature regarding the relative quality of student generated QI work and published QI studies. It is possible that differences exist between the type, quality and scale of the work typically conducted by students and that which is published.

To begin to address this gap, we conducted a study that investigated whether there is a difference in the study size, approach and quality of the reporting in student produced and equivalent published QI activities. For the purpose of this study, a QI study was considered to be a clinical audit or service evaluation (service evaluation, no intervention [SE-NI] or service evaluation including intervention [SE-I]) activity that was designed and

conducted for the purpose of local improvement and change. Evaluating this issue will help to guide future direction in the education of Master's level continuing health care education students, to feed into improvements in healthcare delivery and patient outcomes.

2. Method

The approach of the study was to critically appraise and compare the approach, scale and quality of student and published QI projects. The study was reviewed and approved by University of Warwick Biomedical and Scientific Research Ethics Committee to access student work for the purposes of research (BSREC 86/18–19).

2.1. Student articles

Ten anonymised QI projects conducted by Warwick Medical School postgraduate students for the purposes of their Professional Project module meeting the inclusion criteria were selected from database of 110 articles of student work from 2016 to 2019. Students completing QI-focussed Professional Projects were registered on Masters degrees in Advanced Clinical Practice, Advanced Critical Care Practice, Diabetes and Paediatric Diabetes. Article order within the database was randomised using Microsoft Excel. Beginning at the first project, articles were reviewed against the inclusion criteria, until the quota of 10 articles had been achieved. The remaining student articles were not reviewed.

Student articles meeting the following criteria were included in the study:

- Project conducted in a UK setting
- Project that explicitly reports a data-driven quality improvement study
- Project that provides empirical accounts of local quality improvements programmes, with assessment of impact and main goal being local change [10].
- Project submitted towards the Professional Project module as part of Master's programme of study
- Project that has been marked and deemed satisfactory and the student has finished their programme

2.2. Published articles

Ten published articles were identified from a search on Medline. Given the breadth of quality improvement activity that is published and indexed, it was important to bound the scope of the literature search to enable identification of an equivalent group of published articles to the Professional Project cohort. The search strategy was designed to identify work from similar areas of clinical practice and arising from the same health care system. The following search terms were used: 'service evaluation', 'quality improvement', 'clinical audit', 'diabetes', 'emergency care', 'critical care', 'advanced practice' and were combined with 'England', 'Scotland', 'Wales' and 'Northern Ireland'. Year limits of 2016–2019 were included.

The search results were exported to Microsoft Excel, where their order of presentation was randomised. Beginning at the first record, the full text of the published article was obtained, and the article was reviewed against the inclusion criteria, until the quota of 10 articles had been achieved. The remaining published articles were not reviewed.

Published articles meeting the following criteria were included in the study:

- Project conducted in a UK setting
- Project that explicitly reports a data-driven quality improvement study
- Project that provides empirical accounts of local quality improvements programmes, with assessment of impact and main goal being local change [10].
- Article must have been published in the last 3 years
- Article must be published in a peer-reviewed journal
- Article must be available in full text

2.3. Data extraction

To compare the scale of published and student projects, a purpose designed data extraction table was used. Two reviewers independently conducted the data extraction (authors CE and LH), with any disagreements resolved by consensus. Studies were classified as either A (audit), SE-NI or SE-I, according to aforementioned definitions. To evaluate relative sizes of study, information about the number of sites involved in the study, number of improvement cycles and number of patients/cases, whether data were collected prospectively or retrospectively and the period of data collection, were extracted. In order to explore whether publication bias was a factor, studies were classified as 'positive' or 'non-positive', replicating the approach of Song et al. [11], who classified positive results as those

that were considered to be 'positive', 'favourable', 'significant', 'important', 'striking', 'showed effect' and 'confirmatory'; and classified non-positive results as those that were considered to be 'negative', 'nonsignificant', 'less or not important', 'invalidating', 'inconclusive', 'questionable', 'null' and 'neutral'.

2.4. Quality appraisal

A modified version of the Quality Improvement Minimum Quality Criteria Set (QI-MQCS) [12] was used to conduct critical appraisal of the two bodies of work. The QI-MQCS is a 16-domain, validated, reliable critical appraisal tool that assesses expert-endorsed QI domains for studies that include a QI intervention. It has been shown to be able to discriminate between studies [12]. QI-MQCS was adapted to be suitable for the body of studies being reviewed in this article, to include studies with no intervention, i.e. clinical audits and service evaluations with no intervention. This involved accepting a wider definition of several domains to include existing service or standard as well as intervention. This approach was taken in the absence of a suitable tool for critical appraisal of non-intervention studies and to support the need to be able to conduct analyses on a mixed set of evidence. A summary of the adaptations made to QI-MQCS for the purpose of this study can be found in Table 1. Each paper identified for the study was scrutinised using the modified QI-MQCS by two independent reviewers (authors CE and LH), with any disagreements resolved by consensus. Papers were scored based on whether each domain highlighted in the modified QI-MQCS was present within the paper, using the minimum criteria for each domain as described in Table 1. Three domains (Implementation, Adherence/Fidelity, and Spread) were deemed not applicable to studies with no intervention, so A and SE-NI studies were evaluated out of 13; SE-I studies were evaluated against the full 16 criteria.

The Standards for Quality Improvement Reporting Excellence (SQUIRE) statement [13] was considered for use, however it is a set of standards for reporting QI rather than a quality appraisal tool. However, given the value of standards for reporting and the widespread use of SQUIRE, it was recorded for each article (both published and student work) whether a project had cited SQUIRE as a framework used in the reporting of work.

2.5. Data analysis

Descriptive statistical analysis was conducted on the performance of the two bodies of work. To summarise the approach and scale of the work, mean (with standard deviation) and median (with

Table 1. Modified QI-MQCS (modified wording shown in italics).

Domain		Minimum criteria to be met
1	ORGANIZATIONAL MOTIVATION	Names or describes at least one reason or motivation for the organization's participation in the intervention or *evaluation of current practice*
2	INTERVENTION, *EXISTING SERVICE OR STANDARD* RATIONALE	Names or describes a rationale linking at least one central intervention, *existing service or standard* component to intended effects
3	INTERVENTION, *EXISTING SERVICE OR STANDARD* DESCRIPTION	Describes at least one specific change in detail including the personnel executing the intervention *or the current service or standard*
4	ORGANIZATIONAL CHARACTERISTICS	Reports at least two organizational characteristics
5	IMPLEMENTATION	Names at least one approach used to introduce the intervention
6	STUDY DESIGN	Names the study design
7	COMPARATOR	Describes at least one key care process *or the audit standard*
8	DATA SOURCE	Describes the data source and defines the outcome of interest
9	TIMING	Describes the timing of the intervention and/*or* evaluation to determine the presence of baseline data and the follow-up period after all intervention components were fully implemented
10	ADHERENCE/FIDELITY	Reports fidelity information for at least one intervention component, or describes evidence of adherence or a mechanism ensuring compliance to the intervention
11	HEALTH OUTCOMES	Reports data on at least one health-related outcome
12	ORGANIZATIONAL READINESS	Reports at least one organizational-level barrier or facilitator
13	PENETRATION/REACH	Provides information on the proportion of all eligible units who actually participated
14	SUSTAINABILITY	Describes the sustainability or the potential for sustainability *of the intervention, or of reaching the standard or an improvement to the existing service*
15	SPREAD	Describes the potential for spread, existing tools for spread, or spread attempts/large-scale rollout
16	LIMITATIONS	Reports at least one limitation of the design/evaluation

range) values for continuous variables were calculated and frequencies for categorical variables. To examine the potential differences in the performance of meeting the quality standard, percentage of papers in each group meeting domain criteria were calculated. Total modified QI-MQCS scores were normalised to a percentage achievement to ensure that quality scores between A and SE-NI (out of 13) and SE-I studies (out of 16) were comparable. Mann Witney U test was used to compare quality scores of student and published work, with significance accepted at $p < .05$. Given the small sample size and hence the lack of statistical power, all the comparisons made were exploratory and were intended to complement our detailed appraisal of the two bodies of work and to provide some indications of areas that might warrant further investigation.

3. Results

Ten student articles were identified for analysis (Fig. 1), with five exclusions made and 95 potential articles not reviewed. The student projects identified all involved quality improvement activities conducted in a hospital setting except one which focussed on out of hospital cardiac arrest. Clinical settings including the emergency department, critical care unit, maternity unit and outpatient departments were represented within the sample, with half of the studies involving adult patients and half involving paediatric patients (with some including their families).

Ten published papers were identified for analysis [14–23], with 20 exclusions made (Fig. 2) and eight articles not reviewed. The published articles identified involved QI activities conducted in hospital settings, primary care and in the community. Clinical settings including paediatric intensive care, out of hours primary care and general practice were represented within the sample, with clinical issues including polytrauma and patient education included.

3.1. Study characteristics

Notable differences in the types of studies were observed between the two groups, with the majority of published work (7 studies) presenting SE-I projects, compared to only two SE-I student papers. Half of student projects were clinical audits, compared to only one published audit. Student projects demonstrated shorter data collection

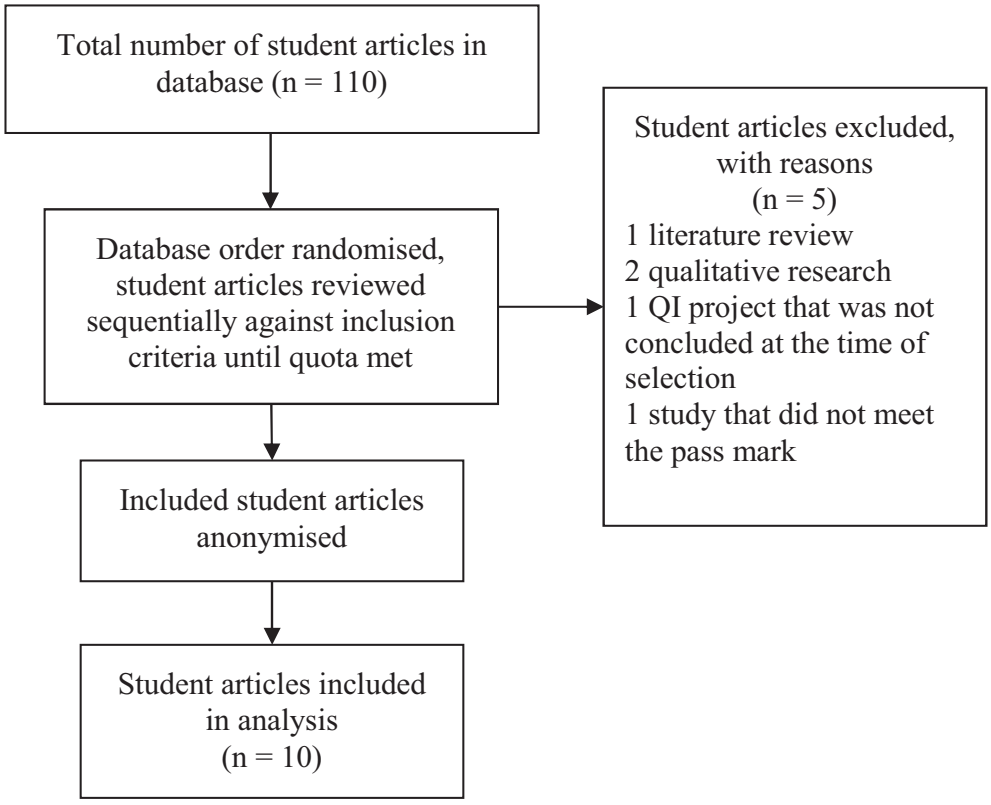

Fig. 1. Identification of student articles.

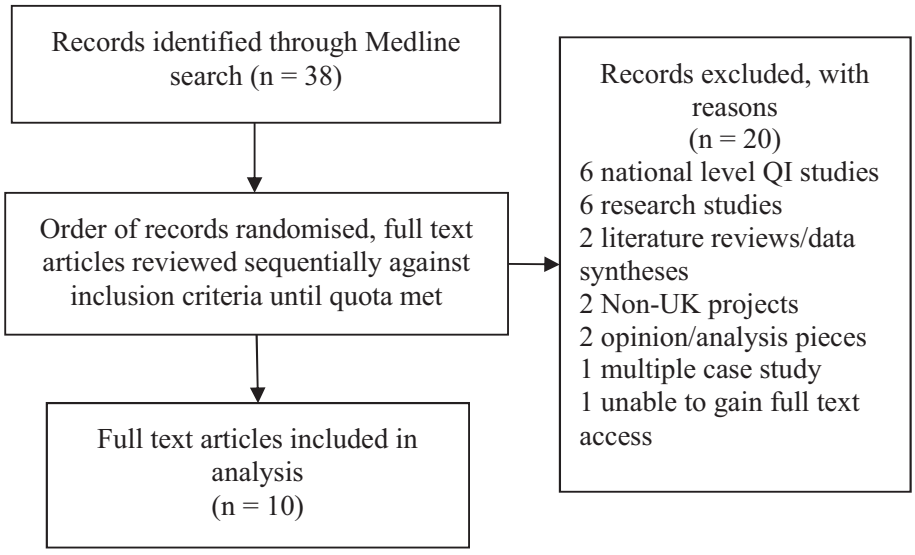

Fig. 2. Identification of published articles.

periods than published articles, where data collection periods ranged from 1 month to 12 months (mean: 4.83 ± 3.9 months; median: 3 months) compared to published work that ranged from 2 months to three years (mean: 12.75 ± 10.4 months; median: 10.5 months). Similarly, published work had higher patient numbers (mean: 744.0 patients; median: 326 patients) compared with students articles (mean: 171.60 patients; median: 110 patients), with both bodies of work including papers with fewer than 20 cases. Student projects tended to adopt a retrospective design (n = 8) with more prospective designs identified in the published articles (n = 6). All student work was carried out on one site and undertaking one cycle, whereas six out of 10 published articles performed one cycle on one site. Interestingly, an equal mix of positive and non-positive outcomes of the student work was identified, whereas 9 out of 10 published articles reported a positive outcome. Of all 20 articles reviewed, just one student paper cited use of the SQUIRE statement. Detailed analyses of student articles and published articles are shown in Tables 2 and 3 respectively, and summary statistics in Table 4.

3.2. Quality appraisal

Collectively, published articles performed similarly to student articles when using the modified QI-MQCS criteria (mean published article score: 83% vs mean student article score: 78.50%) (Table 4). The difference was not statistically significant ($U = 34.5$, $p = .24$). However differences in performance were observed for SE-I studies where published work outperformed student work (mean published SE-I modified QI-MQCS score: 81.80% vs mean student SE-I modified QI-MQCS score: 65.50%). Published articles performed better than student articles in 7/16 modified QI-MQCS domains and performed equally in 6/16 domains (Table 5). Student work performed better in 3/16 domains. Student articles tended not to discuss adherence/fidelity (domain 10) or spread (domain 15), whereas this was more widely considered in published work. Low performing domains found within the student work also included Penetration/Reach (domain 13) and Organisational Characteristics (domain 4), which were also the lowest performing domains for published work with just 57% and 40% of published papers reporting these items respectively.

4. Discussion

The aim of this study was to investigate whether differences are apparent in the approach, scale and quality of reporting of QI projects conducted by Master's students and in published articles. QI is an umbrella term under which many different approaches sit, of which one is clinical audit [24]. Published work in our sample was characterised by a greater number of intervention studies whereas student work at our institution demonstrated a greater number of clinical audit or service evaluation (no intervention) studies, which indicates that student work tended to be located towards the quality assurance end of the improvement spectrum. The limited published non-intervention studies may be indicative of the preference for journals to publish studies that are considered

Table 2. Analysis of student papers: study design and critical appraisal.

Study	QI study type	Patients/ cases (n)	Data collection method	Data collection period	Study outcome	QI-MQCS domain															QI-MQCS Score	SQUIRE used
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	SE-NI	45	Retrospective	3 months	Non- positive	✓	✓	✓	x	–	✓	✓	✓	✓	–	✓	✓	x	✓	–	✓	11/13 (85%)	x
2	A	126	Retrospective	12 months	Both (multiple outcomes assessed)	✓	✓	x	x	–	✓	✓	✓	✓	–	✓	✓	✓	✓	–	x	10/13 (77%)	x
3	A	224	Retrospective	6 weeks	Non- positive	✓	✓	✓	✓	–	✓	✓	✓	✓	–	x	x	x	✓	–	✓	10/13 (77%)	✓
4	SE-I	620	Retrospective	1 month	Positive	✓	✓	✓	✓	x	✓	✓	✓	✓	x	✓	✓	✓	x	x	✓	12/16 (75%)	x
5	SE-NI	100	Retrospective	4 months	Non- positive	✓	✓	✓	x	–	✓	✓	✓	✓	–	✓	✓	x	x	–	✓	10/13 (77%)	x
6	SE-NI	392	Retrospective	12 months	Positive	✓	✓	✓	✓	–	✓	✓	✓	✓	–	✓	✓	x	✓	–	✓	12/13 (92%)	x
7	A	120	Retrospective	3 months	Non-positive	✓	✓	✓	x	–	✓	✓	✓	✓	–	✓	✓	x	✓	–	✓	11/13 (85%)	x
8	A	17	Prospective	3 months	Positive	✓	✓	✓	✓	–	✓	✓	✓	✓	–	✓	✓	x	✓	–	✓	12/13 (92%)	x
9	A	11	Retrospective	Unknown	Non- positive	✓	✓	✓	x	–	✓	✓	✓	x	–	✓	✓	x	✓	–	x	9/13 (69%)	x
10	SE-I	61	Prospective	4 months	Positive	✓	✓	✓	x	✓	✓	✓	✓	✓	x	x	x	x	x	x	✓	9/16 (56%)	x

Table 3. Analysis of published papers: study design and critical appraisal.

Study	QI study type	Patients/ cases (n)	Data collection method	Data collection period	Study outcome	QI-MQCS domain															QI-MQCS Score	SQUIRE used
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Rice et al. [14]	SE-I	68	Prospective	9 months	Positive	✓	✓	✓	x	✓	✓	x	✓	✓	✓	✓	x	✓	x	x	✓	11/16 (69%)	x
Nazar et al. [15]	SE-I	1468	Prospective	5 months	Positive	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	14/16 (86%)	x
McCall et al. [16]	SE-I	28	Prospective	2 months	Positive	✓	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	x	✓	✓	x	✓	13/16 (81%)	x
Collins [17]	SE-NI	1539	Retrospective	12 months	Positive	✓	✓	✓	✓	–	✓	✓	✓	✓	–	✓	✓	x	✓	–	✓	12/13 (92%)	x
Moore et al. [18]	SE-I	801	Prospective	3 years	Positive	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	15/16 (94%)	x
McGovem et al. [19]	Audit	256	Retrospective	Unknown	Non-positive	✓	✓	✓	x	–	✓	✓	✓	x	–	✓	✓	✓	✓	–	✓	11/13 (85%)	x
Wynell-Mayow [20]	SE-I	15	Retrospective	12 months	Positive	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	x	✓	x	x	13/16 (81%)	x
Eveleigh et al. [21]	SE-NI	396	Prospective	Unknown	Positive	✓	x	✓	x	–	✓	✓	✓	x	–	✓	✓	✓	✓	–	✓	10/13 (80%)	x
Navarro et al. [22]	SE-I	2830	Retrospective	5 months	Positive	✓	✓	✓	x	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	x	13/16 (81%)	x
McPeake et al. [23]	SE-I	40	Prospective	21 months	Positive	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	x	x	✓	✓	13/16 (81%)	x

Table 4. Summary article characteristics by study type.

	n	Student articles						n	Published articles					
		Number of patients		Length of data collection period (months)		Normalised QI-MQCS score			Number of patients		Length of data collection period (months)		Normalised QI-MQCS score	
		Median	*Range*	*Median*	*Range*	*Mean*	*SD*		*Median*	*Range*	*Median*	*Range*	*Mean*	*SD*
All study types	10	110	609	3	11	78.50%	10.9	10	326	2815	10.5	34	83.0%	7.0
A	5	120	213	3	10.5	80.0%	23	1	256	n/a	n/a	n/a	85.0%	n/a
SE-NI	3	100	347	4	9	84.67%	7.5	2	967.5	1143	12	n/a	86.0%	8.4
SE-I	2	340.5	559	2.5	3	65.05%	13.4	7	68	2815	9	34	81.86%	7.4

Table 5. Modified QI-MQCS domain achievement by group.

Domain	% met by student work	% met by published work
1. Organisational motivation	100	100
2. Intervention, existing service or standard rationale	100	90
3. Intervention, existing service or standard description	90	100
4. Organisational characteristics	40	40
5. Implementation	50	86
6. Study design	100	100
7. Comparator	100	80
8. Data source	100	100
9. Timing	90	80
10. Adherence/fidelity	0	86
11. Health outcomes	80	90
12. Organisational readiness	80	80
13. Penetration/reach	20	70
14. Sustainability	70	80
15. Spread	0	57
16. Limitations	80	80

innovative and/or studies with 'newsworthy' findings. An interesting observation is that ninety percent of published work appraised for this study reported a 'positive' outcome, compared with 50% positive and 50% non-positive outcomes for student work. While this is not a systematic evaluation of a body of literature and our sample is too small to allow quantitative comparison, these findings raise the question as to whether publication bias could be an issue for QI projects. Publication bias is under-researched area in health services and delivery research, and may be particularly an issue for quality improvement studies [25]. For example, a systematic review showed that out of six quality improvement studies to increase vaccine uptake, only the study reporting a positive result was published [26]. Our findings may indicate that students whose studies do not present an innovative intervention, or whose results produce an outcome that is non-positive or negative, may have greater difficulty in having their projects accepted for publication that those with a positive outcome. However, students should not be discouraged from submitting negative or non-positive results for publication or trying to publish these, as publishing negative or neutral findings is important.

In terms of quality appraisal, published and student work both performed well in reporting the motivation of their organisation to conduct the study, the intervention rationale, description of the intervention and study design and the data source, demonstrating the ability of both groups to effectively discuss the importance and significance of the problem identified in their work and how they approached evaluating this problem. Notably, organisational characteristics were not well described in with either group, and was the poorest performing domain within published articles. To meet the criteria of this domain, two specific descriptors of the organisation were required, for example, the environment within which the project is occurring, size of organisation, patient mix. Adequate description of this domain is important for the audience to assess the 'generalisability to their organisation' by ensuring transparency around the demographics of the organisation [12]. It was noted that many papers in both groups gave either just one descriptor of their organisation, or they were deemed too vague to achieve the attainment of the domain. The issue of poor reporting of contextual factors has been described elsewhere in the reporting of QI studies [27]. Other domains that were poorly described in student work included penetration/reach, adherence/fidelity and spread respectively, whereas published work scored much better in these areas. These domains address the practicality of reproduction of the project, that is, whether a project could feasibly be expanded across other sites. In part, this finding will be contributed to by the lack of intervention studies in the student cohort; further contributing factors could include students focussing on their own context for their write up rather than considering the potential

interest of a wider audience and/or misunderstandings about concepts of spread (in improvement science) versus generalisability (in research).

In explaining the differences between student and published work, it is necessary to acknowledge the context within which the bodies of work are produced. Students who enrol in a Master's programme are required to complete a Professional Project as part of their education. As this project is one part of a curriculum, there are both time and resource constraints placed upon the student that differ to authors who are in a clinical environment in a professional capacity. Students must complete their projects within a fixed timeframe to be eligible for their award, which limits the number of cycles that can be performed and might limit the number of patients or period of data collection selected for a student study. Roush & Tesoro [8] also noted this issue, where some work submitted for DNP was incomplete due to the required timescale for completion. Published authors may have more scope to dictate a longer data collection period for example; indeed, median patient numbers and median data collection periods were at least three-times greater within the published group than the student group. However, time to write up QI work can be a barrier to dissemination among clinical staff [9], whereas students are required to report their findings for the purpose of their award. It is worth noting that 6 of the 10 published articles were carried out on one site and only one cycle of the project was performed, and published examples with small sample size (<20) and retrospective data collection only were located. This is encouraging for students as it suggests that small scale studies can inform clinical practice and that carrying out a project of limited scope is not necessarily a barrier to publication.

A further consideration in the differences between the two bodies of work is the peer-review process that published articles have undergone in order to achieve publication status. It would be reasonable to expect a higher quality of reporting in this group which has had the input of journal editors and expert reviewers, and where several authors have contributed to the final written representation of the project. While the project supervisor would have critically commented on student draft work, the student work appraised has not undergone such a rigorous, iterative process involving feedback from multiple sources. Therefore this body of assignments represents work at the end of an assessment process but the beginning of the publication process, where the role of others changes, for example, the supervisor becomes a co-author. The potential for some student work to not be suitable for publication should also be borne in mind, since student work can be subject to 'fatal flaws' [8] that would not pass through the peer review process.

4.1. Methodological considerations

The main limitation to this study was the small sample size of work sampled, which included student work from only one institution. A larger sample of both bodies of work could potentially produce more reliable and representative results. In order to produce a comparative sample of student and published work, a deliberately narrow field of QI studies were searched (advanced practice, emergency care, diabetes and critical care), and these studies do not represent reporting of QI in all fields of health care. The limits of the search in this study could be broadened in order to overcome this issue and yield a more generalisable sample of results.

This study used a modified version of the QI-MQCS tool to appraise the bodies of work. This is a validated tool that has been widely used for quality evaluation in systematic reviews of QI studies (for examples, see [28,29]), however was not designed for use with studies with no intervention. The use of a critical appraisal tool to ensure inclusion of reporting certain QI items does not necessarily mean that a given student paper would be acceptable to a journal editor. To fully understand the barriers or likelihood of student work being published, it would be beneficial to follow a cohort of students through the publication journey.

4.2. Implications for students and medical educators

Notwithstanding the time constraints in which students have to complete their work, including a longer data collection period (which could be achieved if using a retrospective design) and/or a greater number of patients in the evaluation would address some differences in the comparative scale of student and published work. Furthermore, students could explore QI projects that build upon work that has already been conducted in order to increase the scope of the work included in a final publication, for example, combining an intervention that they introduce for their project on the basis of a previously conducted (but not published) audit, enabling a multiple cycle or larger overall project for publication.

Medical educators should emphasise the need for complete description of context and reproducibility of QI work when designing learning materials to

support writing up of projects, recognising the difference in this approach to the norms for biomedical publication. Specifically, sufficient description of the organisational characteristics, penetration and spread of the QI activity should be emphasised. Perceived barriers to publication such as lack of supervisory support could be partly offset by the provision of more in depth guidance that could be helpful to both supervisors and students. Encouraging the use of the QI-MQCS [12] and the SQUIRE statement [13] for self- or peer-assessment of work, during both the assessment write up and subsequent manuscript preparation stage, could assist in increasing the potential for higher quality reporting of work.

4.3. Conclusion

To conclude, published and student QI work appear to differ in terms of scale and quality, however there are many encouraging factors for consideration for students wishing to disseminate their QI projects. Some omissions in student work could be remedied simply, particularly if using the QI-MQCS tool as a template to guide their writing. Also encouraging is the finding that 6 out of the 10 published works took place on one site and with one cycle, which suggests that the relatively small scope of some student projects does not necessarily mean that it in itself is a barrier to publishing work. Publication, therefore, may be achievable for students. Students with non-positive or negative findings should not be discouraged from attempting to publish their work. Encouraging and supporting the process of preparation for publication is an important aspect of medical education and the professional development of students, through reflecting on their QI experience and findings beyond their own institution and for the sharing of knowledge within their disciplines, and deserves consideration for future exploration and investigation.

Conflicts of interest

The authors have no conflicts of interest to declare.

Ethical approval

The study was reviewed and approved by University of Warwick Biomedical and Scientific Research Ethics Committee (BSREC 86/18–19).

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None.

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