

What do we know about coaching in medical education? A literature review

Ben Lovell 

CONTEXT Coaching has been employed successfully in the competitive sports, professional music, and business and corporate worlds. It is now emerging as a training modality in medical education.

OBJECTIVES This paper reviews the current evidence on coaching strategies for doctors and medical students.

METHODS An applied literature search was conducted in PubMed, MEDLINE and Web of Science. Predetermined definitions of coaching interventions and their evaluations were used to narrow 993 papers down to 21, which were included in the final review. The 21 papers were critiqued with reference to validated scoring metrics.

RESULTS There are many papers discussing the merits of coaching in the world of medicine, but few evaluations of coaching interventions. Existing coaching

methodologies can be broadly summarised into three categories: coaching for doctor/student well-being and resilience; coaching for improved non-technical skills, and coaching for technical skills. Identification of suitable papers for inclusion is complicated by theoretical uncertainty regarding coaching: many papers use the term as a synonym for teaching or mentoring. The strongest evidence for coaching lies in the teaching of technical skills.

CONCLUSIONS There is weak- to medium-strength evidence to support coaching as a method of improving doctor well-being and enhancing non-technical skills, although the evidence base is limited as a whole. This review identifies strong evidence to support coaching as a method to improve technical skills. There is great scope for further studies investigating the power of coaching in medical students and doctors.

Medical Education 2018; 52: 376–390
doi: 10.1111/medu.13482



Department of Acute Medicine, University College London Hospitals National Health Service (NHS) Foundation Trust, London, UK

Correspondence: Ben Lovell, Department of Acute Medicine, University College London Hospitals NHS Foundation Trust, London NW1 2BU, UK. Tel: 00 44 20 3456 7890; E-mail: ben.lovell@nhs.net

 INTRODUCTION

Coaching is emerging as an increasingly appreciated resource in the medical teacher's toolbox.^{1–5} Professional coaching has long been utilised in sport and business to help individuals achieve their personal best. It differs from traditional tutelage in that it does not focus on knowledge transmission. It differs from mentorship in that it does not focus on advice and counselling. Coaching requires the provision of contemporaneous and individualised feedback on observed behaviour, and the use of stimulating and challenging observations to maximise the coachee's full potential. The coaching paradigm is thus: the coachee performs a task or activity, or applies his or her knowledge and training in a pre-constructed real or simulated scenario. The coach observes the coachee and uses a combination of provocation, questioning, challenging and encouragement to help the coachee achieve an improved performance. The coachee then performs the activity again, and the cycle is repeated. The purpose is to generate a measurably improved performance.^{2,6,7} The methods used by the coach to continually push the learner towards his or her personal best vary. In their typology of teaching roles in medical education, Stoddart and Borges assert: 'A coach strives to extract the highest level of performance possible from the learner. This can be accomplished by a wide variety of means that are as unique as the individual coaches and learners involved.'¹

The paucity of medical education research into coaching is puzzling, considering its long and efficacious usage within the domains of sport, music, lifestyle and leadership. If athletes, musicians and executives use coaching to strive for excellence, shouldn't physicians and surgeons also do so?^{8–10} In comparing doctors and musicians, Watling et al.¹¹ note that clinicians often speak of 'competency', which has connotations of adequacy, whereas musicians speak of the 'even better performance' and the constant need push towards their personal best. Although 'personal best' is not synonymous with 'excellence', there are evident advantages in encouraging doctors to constantly improve, rather than to attain a predetermined level of generic competency.¹²

Many tenets of sports coaching are transferable to health care, such as pre-session planning,

post-session debriefing and team training.¹³ In one example, these attributes are analogous with many of the principles of crisis resource management, a skill set that is taught in emergency medicine and anaesthesiology.¹⁴ Although the activities of athletes and doctors are vastly different, there are psychological, behavioural and socio-cultural attributes common to both arenas, such as endurance, dedication, sacrifice, teamworking and fast and slow thinking. Attempts to integrate the methodologies employed by sports coaches into our pedagogical framework may help inculcate these attributes, which may promote emotional resilience, technical dexterity and non-technical skills in our doctors.^{2,15}

Some studies have engaged coaching within the problem-based learning paradigm, facilitating student-centred knowledge construction.^{16,17} Others have trialled 'career coaching' for medical students,^{18,19} but do not delineate how these coaches differ from traditional educational supervisors. Herein lies a challenge in performing a comprehensive review of coaching techniques: the examination of many papers that purport to describe investigations into coaching pedagogy reveals a conceptual tension, as authors often use the term 'coaching' interchangeably with those of 'teaching' and 'mentoring'. The key characteristics of coaching, in comparison with teaching and mentoring, are detailed in Table 1. For the purposes of this review, coaching is defined in accordance with the following attributes.

- 1 The coach provides individualised real-time feedback.

Feedback has been criticised for often being vague or generic, rather than specific and trainee-focused.²⁰ Coaches give formative assessment and iterative feedback immediately after observing behaviours to help the coachee discover what does and doesn't work, and to inspire the learner to reach his or her maximum potential.²¹ The cycle of observation–feedback recurs until the learner attains his or her best possible performance.

- 2 The coach and coachee set individualised goals.

Coaches emphasise aims and outcomes rather than processes.³ Rather than micro-managing, the coach should use both challenges and support to help the coachee solve problems and think creatively to achieve his or her goals.

Table 1 Comparing teaching, mentorship and coaching

	Classroom teaching	Mentoring	Coaching
Focus	Focus on many individuals	Focus on one individual	Focus on one individual or a team
Goal	Acquisition/construction of knowledge	Advice and guidance	Addresses specific areas of for improvement
Timing	Usually over a certain time period	No time limitations	Usually over a certain time period
Assessment	Both formative and summative assessment	No observation of current abilities required	Observation of skills and behaviours; generates evolving feedback and formative assessment
Techniques	Uses pedagogical techniques to increase learners' knowledge	Advice and guidance	Encourages critical self-reflection, Socratic dialogue and exploration of method of self-betterment
Approach	Varied approaches based on heterogeneous education theories, including but not limited to didactic methods, problem-based learning, constructivist approaches, and simulation	Discussion-based	Collaborative
Outcomes	Predefined learning outcomes and objectives	May or may not set individualised, time-bound goals	Individualised goal setting
Purpose	Learners must achieve a predefined minimum knowledge base or skill set	Uses personal or lived experiences as a method of motivating and guiding learners	Constantly pushes for improved performance and increases in personal best

Adapted from Launer (2013).⁵⁹

3 The coach facilitates the development of new behaviours, insights and approaches to work.

Coaching is learner-centric: the responsibility for educational discovery, problem solving and personal growth lies with the learner.¹⁶ These activities are facilitated by the coach, who offers continuous feedback to develop a cycle of constant improvement.

4 The coach has expertise and experience within the relevant field.

The educational coach 'has an analytical understanding of the "game" and ability to motivate the learner toward excellence'.¹ Peer coaching is different in that a colleague at a similar level of accomplishment and experience takes on a coaching role by observing and giving feedback.²²

METHODS

This is a literature review into current coaching practices in medical education. The purpose of the literature review is to identify, summarise and critique the existing data, unlike the systematic review, which provides conceptual insights into data to generate new understanding.²³ Initial reading of the literature revealed that many coaching investigations are small in scale and exploratory, and hence are too limited to provide a rich substrate for a synthetic analysis or systematic review. Literature reviews have been criticised for their vulnerability to bias, yet are accepted as appropriate platforms from which to launch new evidence-generating enquiries when the reviewed literature is scanty.²⁴ The research question was deliberately kept broad and open: What do we

currently know about coaching interventions in the education of doctors and students? After the research question had been determined, the research protocol was devised; this included the search strategy, inclusion and exclusion criteria, and the methods of analysing papers and attributing a quality score.

In accordance with the research protocol, PubMed (1960–2017), MEDLINE (1960–2017) and EMBASE (1960–2017) were searched using the following search terms: coach OR coaching OR coached OR coaches AND medical student OR medic OR doctor OR undergraduate OR postgraduate OR clinician OR physician OR surgeon OR surgical AND education OR teaching OR skill OR learning.

In order to broaden the scope of the literature review and to uncover papers that may have been missed using database searches, hand-searches were performed in the high-yield journals *Medical Education*, *Medical Teacher*, *Teaching and Learning in Medicine*, *BMC Medical Education* and *Academic Medicine*. The searches were carried out with the assistance of an experienced medical librarian and a research database was gradually populated with suitable papers. Discrepancies of opinion regarding a study's eligibility were resolved by returning to the original paper for a collaborative review and discussion (Mark Lander from Whittington Hospital, London, UK). The initial search yielded 993 results. The removal of duplicates and non-English-language papers yielded 858 results. The

titles and abstracts of these papers were reviewed against the inclusion and exclusion criteria outlined in Table 2, after which 16 papers were retained. The final 16 papers were read and reread in depth, and a further five studies were identified from the referenced literature, which resulted in a final count of 21 papers (Fig. 1).

For each paper, the coaching intervention and outcomes were recorded. Papers reporting quantitative studies were scored using the Medical Education Research Study Quality Instrument (MERSQI) score in order to provide a standardised measurement of research quality.^{25,26} Qualitative papers were analysed with reference to the Critical Appraisal Skills Programme (CASP) qualitative checklist²⁷ and a quality score was assigned. The assignment of quality scores was carried out independently by the team members, who later met and agreed upon a mutually agreed score based on discussion and re-review of the original paper.

RESULTS

Table 3 provides a comprehensive overview of the 21 papers included for review. Coaching methodologies are summarised into three categories: (i) coaching for doctor well-being and resilience; (ii) coaching for improved non-technical skills, and (iii) coaching for technical skills. One study²⁸ employed multiple coaching modalities. Of the 21 papers, 12 were from the USA, two from

Table 2 Inclusion and exclusion criteria applied in this review

Inclusion criteria	Exclusion criteria
Studies in which coaching was the educational intervention	Non-English language
Studies explicitly mentioning 'coaching' or its cognates in the title or abstract	
Studies investigating coaching in medical students and doctors	Enquiries into the nature of coaching
Quantitative studies into coaching in educational interventions	Educational coaching strategies for nurses and other allied health care professionals
Qualitative papers focusing on the evaluation of coaching interventions, following a 'population–intervention–evaluation' format	Editorials, letters, opinion pieces
	Studies in which coaching is not defined, or is not discernible from standard instruction, or otherwise does not align with the attributes of coaching described in this paper
	Peer coaching studies

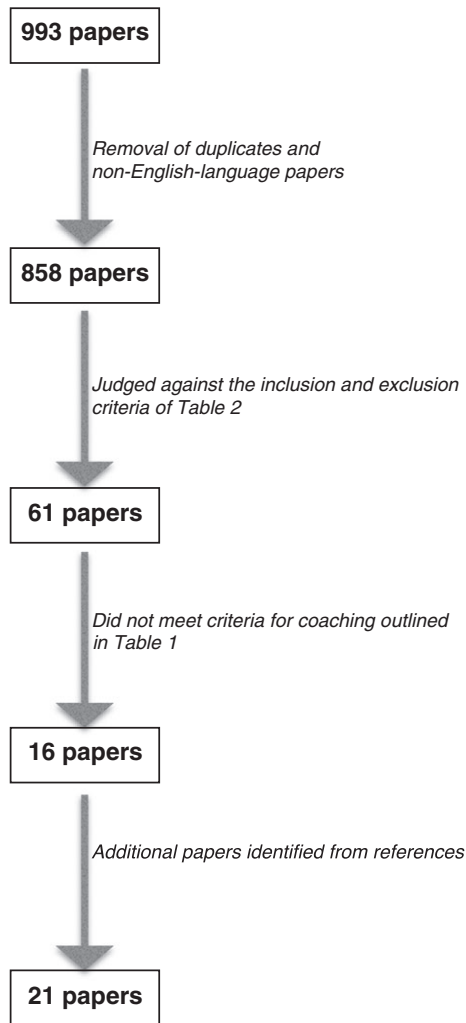


Figure 1 Results of the search and screening processes applied to identify papers for review

Australia, two from Denmark, and one each from the UK, Germany, the Netherlands, Canada and Taiwan. The search strategy revealed no articles with the primary search terms published prior to 2008. Among the quantitative papers, the general quality was low, with a mean average MERSQI score of 11.6. Among the qualitative papers, the CASP score was also low (mean score: 5.8), reflecting the largely descriptive nature of the studies.

Coaching for doctor well-being and resilience

There were seven studies within this category. Two studies focused on increasing emotional intelligence (EI) in residents and students. Guseh et al.²⁹ cited the correlations between EI and professionalism, academic success and interpersonal skills as a driver for their study. They found that medical students

exhibited improved adaptability and proactivity after 6 weeks of coaching. Webb et al.³⁰ attempted to increase EI through a 10-month coaching programme. This was essentially a negative study, showing that the residents did not engage with the course and none completed the programme.³⁰ The authors speculated that EI will need to achieve ‘buy-in’ from learners before it is effective.³⁰

Three studies used coaching to reduce stress. Kötter and Niebuhr³¹ used psychological coaching to reduce pre-examination stress in medical students in a medium-quality randomised controlled trial (RCT) (MERSQI score: 12). They found a significant reduction in examination-related stress in coached students, but no difference between individually coached and the group-coached students.³¹ Gardiner et al.³² developed a programme for rural doctors in Australia, comprising individual and group coaching. This longitudinal, quasi-experimental, 3-year study³² found significantly reduced stress scores in coached doctors and a 41% reduction in the desire to leave the profession, and was of medium quality (MERSQI score: 12). Schneider et al.³³ evaluated the perceived impact of individualised well-being coaching on physician stress and resiliency. This medium-quality study³³ (CASP score: 6) revealed that the programme increased resilience by improving boundary setting and prioritisation, self-compassion and self-care, and self-awareness.

Two studies used positive psychology to improve confidence, professional development and autonomy. Palamara et al.⁴ conducted a pilot observational study and reported that the coaching programme was enjoyed by the participants, who self-reported fewer feelings of burnout. Iyasere et al.³⁴ conducted a mixed-methods study and concluded that coaching results in changes in diagnostic and professional behaviour in practising doctors by promoting critical self-reflection; these findings relied on self-reported questionnaires completed by the participants. The quality of both papers was low, with MERSQI scores of 9 and 6.5, respectively.

Coaching for improved non-technical skills

Six studies evaluated coaching interventions to improve non-technical skills such as decision making, teamworking and reflective practice. Artenstein et al.³⁵ and de Lasson et al.³⁶ used coaching to facilitate professional identity formation in residents. Whereas the former study

Table 3 Summative tabulation of the papers included in the literature review

Study	Research question/aim	Coaching intervention	Outcomes of coaching intervention	Study design/ measurement of outcomes	MERSQI* or CASP [†] score	Category
Hu et al. ⁴² USA	To develop and evaluate a postoperative video-based coaching intervention for residents to improve technical and non-technical operative skills	Residents watched a video-recording of their operation with their coach, in a 1-hour one-to-one coaching session. Teaching points were identified in the operating room and the video-based coaching sessions	Video coaching session resulted in more teaching points, better resident-centred learning; promoted critical thinking	Mixed methods: comparison with control group and thematic analysis	*14	Surgical skills
Kötter & Niebuhr ³¹ Germany	<ul style="list-style-type: none"> Does resource-oriented coaching influence examination-related stress in medical students? Does resource-oriented coaching influence general and mental health in medical students preparing for examination? 	'Resource-oriented coaching': two 1-hour sessions of manual-based individual coaching by trained psychologists	'Our findings point to short-term resource-oriented coaching being effective in reducing medical school stress in candidates preparing for examination, whereas the stress level increased in control subjects'	RCT	*12	Psychological well-being
de Lasson et al. ³⁶ Denmark	How do junior doctors attending group-coaching describe the challenges they face regarding professional identity formation in the transition from student to doctor and do they consider coaching a helpful tool to develop a professional identity as a doctor?	Group coaching: three whole-day sessions and five 2-hour sessions during a period of 4 months	'Through group coaching participants found new ways of dealing with everyday challenges and learned to use peer discussions to disclose uncertainty and doubt without the fear of being regarded as less competent'	Qualitative: thematic analysis	†6	Professional identity formation
Bonrath et al. ⁴³ Canada	To assess the effectiveness of a coaching instructional approach to improve surgical skill and clinical safety	The modified PRACTICE coaching model: individualised feedback, debriefing, behaviour modelling, determining trainee needs, video review of operation, establishment of individualised training goals	The coached group scored significantly higher on procedural skills and made fewer technical errors	RCT	*15.5	Surgical skills

Table 3 (Continued)

Study	Research question/aim	Coaching intervention	Outcomes of coaching intervention	Study design/ measurement of outcomes	MERSQI* or CASP† score	Category
Guseh et al. ²⁹ USA	Does enriching students' WEI knowledge through resident coaches improve medical students' adaptability and proactivity on the OB/GYN clerkship?	Medical students assigned to a resident coach who was trained in WEI for a 6-week clerkship	Students with resident coaches trained in WEI had improved adaptability and proactivity after 6 weeks	Observational pilot study	*11	Psychological well-being
Palamara et al. ⁴ USA	Report on experiences in creating a professional development coaching programme for internal medicine interns based on the principles of positive psychology coaching	Quarterly meeting lasting around 40 minutes with coaches who had received 2 hours of training in positive psychology	Most of the interns (94%) rated the coaching programme as good or excellent, and 96% would recommend this programme to other residency programmes. The experience of burnout was lower in this cohort compared with a prior cohort	Observational study	*9	Psychological well-being
Yule et al. ⁴⁴ USA	Demonstrate the effect of non-technical skills coaching on intraoperative behaviours and clinical significant decisions during simulated operations for doctors	Individual coaching between simulated surgical cases lasting 10 minutes, giving structured feedback and identifying personal strategies for improvement	Non-technical skills improved, participants were faster to call for help when needed. No difference in operative time	RCT	*13.5	Surgical skills
Könings et al. ³⁷ Netherlands	To promote residents' reflection in the workplace by offering them a smartphone app and coaching sessions	Groups of seven to nine residents met three times at 2-week intervals over a period of 6 weeks, each session lasting 2 hours	Coaching sessions made medical residents more likely to recognise and record learning moments on a smartphone app	RCT	*11	Improve reflective practice
Artenstein et al. ³⁵ USA	To assess, in descriptive fashion, the feasibility and impact of incorporating an experienced physician into structured, interdisciplinary ward rounds to coach the elements of high value care	An experienced physician attended daily ward rounds to create teachable moments and coach newly appointed consultants	May improve value of care delivered and may enhance the professional development of newly appointed consultants. Average LoS decreased by 0.5 days	Observational descriptive pilot study	†3	Professional identity formation

Table 3 (Continued)

Study	Research question/aim	Coaching intervention	Outcomes of coaching intervention	Study design/ measurement of outcomes	MERSQI* or CASP [†] score	Category
Cole et al. ⁴⁵ UK	Compare the effects of structured coaching and autodidactic training in simulated laparoscopic surgery	Preoperatively, instructor and trainee identified and agreed on the learning aims for the upcoming training session. During the procedure, the instructor would follow an agreed-upon protocol to coach the trainees when facing difficulties. Postoperatively, structured feedback was provided and the learning aims for the next session defined	Mean operating time was significantly less in the control group for all operations. The control group caused significantly more errors per case than the intervention group	RCT	*13.5	Surgical skills
Liao et al. ⁴⁶ Taiwan	Confirm the impact of coached surgical simulator practice at the beginning of surgical training and investigate whether subsequent uncoached simulator practice provides additional benefit	Coached simulator sessions followed by untouched practice sessions/no further practice	Coached simulation improved novice trainees' success in biliary cannulation and overall performance. Additional uncoached practices did not appear to provide further benefit	RCT	*14	Surgical skills
George et al. ⁴⁰ USA	Describe the design, implementation and evaluation of a curricular intervention tailored to individual residents using a learning coach to develop EBM skills	The learning coach delivered the curriculum to residents through monthly 1-hour meetings, with half of each meeting devoted to EBM training	Quantitative and qualitative data showed significant changes in knowledge and skills regarding EBM	Mixed methods: self-report questionnaire, validated EBM knowledge test	*12.5	Improve EBM practice
Kim et al. ⁴⁷ USA	To compare the laboratory teaching of a basic technical skill by a non-physician skills coach and a faculty surgeon	Real-time suturing skills coaching by either surgeon or non-medical skills coach	Training by either a nonsurgeon skills coach or a faculty surgeon resulted in no difference in performance on a basic surgical skill. Nonphysician coaches may ease the teaching burden of surgical faculty members while providing similar quality of instruction for trainees.	RCT	*13	Surgical skills

Table 3 (Continued)

Study	Research question/aim	Coaching intervention	Outcomes of coaching intervention	Study design/ measurement of outcomes	MERSQI* or CASP [†] score	Category
Régo et al. ²⁸ Australia	Whether the coaching model is a reliable and defensible method of summative assessment in terms of: student performance; early identification of at-risk students; inter-rater reliability; the effectiveness of student self- and peer-assessment in the development of competence and confidence in clinical skills.	Clinical coaching groups of five students, regular formative assessment, regular self-, coach and peer rating of competence	The research students received higher OSCE scores than the control group. Coaches reported greater satisfaction and confidence through knowing what they were meant to teach. At-risk students were identified early and remediated. Potentially reduced teaching costs.	Mixed methods: formative test scores, self/peer/coach scores on competence and confidence, and qualitative analysis	*15.5	Mixed
Egener ³⁹ USA	Develop and implement a coaching approach to help organisations and physicians address issues related to impaired communication skills	Individual coaching sessions lasting 2 hours over 3–12 months	Physicians rated the intervention as highly satisfying	Observational descriptive pilot study	*6	Improve communication skills
Hu et al. ⁴¹ USA	Develop a methodology for continuing professional development in operative skill using video-based coaching	Rewatching of real operations with the operator and an experienced coach	Video coaching proved invaluable in identifying episodes of failure to progress and troubleshooting alternative approaches	Qualitative thematic analysis	†7	Surgical skills
Ammentorp et al. ³⁸ Denmark	To describe and analyse health professionals' experiences of coaching: what coaching meant to them and how it influenced different aspects of their lives	Depending on individual need, participation in two to four coaching sessions	Two dominant themes were identified: "progressive insight leading to actions" and "expressing needs for leadership aiming for self-realization." The results indicate that coaching can be effective in enhancing not only self-insight and core performance, but also increased positive feeling	Qualitative thematic analysis	†6	Improve reflective practice

Table 3 (Continued)

Study	Research question/aim	Coaching intervention	Outcomes of coaching intervention	Study design/ measurement of outcomes	MERSQI* or CASP [†] score	Category
Gardiner et al. ³² Australia	To provide preliminary evidence for the effectiveness of a cognitive coaching programme for rural doctor well-being, intention to leave and retention rates	Individual and group coaching along with 6 weeks of e-mail coaching. Eight coaching workshops over 3 years	Lower distress scores, 41% reduction in desire to leave,	Quasi-experimental study	*12	Psychological well-being
Schneider et al. ³³ USA	To evaluate the perceived impact of physician well-being coaching on physician stress and resiliency	Three and eight individual coaching sessions through the Physician Well-being Coaching pilot programme	Coaching helped participants increase resilience via skill and awareness development in three main areas: (i) boundary setting and prioritisation; (ii) self-compassion and self-care, and (iii) self-awareness	Qualitative content analysis	†6	Psychological well-being
Webb et al. ³⁰ USA	To increase EI in residents using coaching	10 months of coaching in EI	Only half of the class elected to participate in coaching. None completed the course. Only positive was an increase in 'achievement orientation' – striving to improve or meet the standards of excellence	Quasi-experimental study	*10.5	Psychological well-being
Iyasere et al. ³⁴ USA	Develop a coaching pilot programme to provide early-career hospitalists with feedback from a senior coaching advisor to minimise feelings of isolation among more hospitalists, and provide opportunity for feedback on clinical decision making in real time to enhance individual	12 coaches helped 28 early-career hospitalists in 23 2-week blocks	92% coachees rated intervention as useful/very useful. 80% reported a change in their diagnostic approach. 56% reported a change in specific patient diagnosis. 52% made less referrals to other specialties. 72% felt more comfortable as independent physicians	Mixed methods: surveys plus content analysis	*6.5	Psychological well-being

CASP = critical appraisal skills programme; EBM = evidence-based medicine; EI = emotional intelligence; LoS = length of stay; MERSQI = medical education research study quality instrument; OB/GYN = obstetrics and gynaecology; RCT = randomised controlled trial; WEI = workplace emotional intelligence.

integrated coaching into multidisciplinary ward rounds to promote high-quality patient care,³⁵ the latter used group coaching techniques over 4 months to help younger doctors find 'new ways of dealing with everyday challenges and ... use peer discussions to disclose uncertainty and doubt without the fear of being regarded as less competent'.³⁶ Both studies were observational and qualitative, and indicate that the programmes were well received by participants.

Könings et al.³⁷ and Ammentorp et al.³⁸ used coaching sessions and a smartphone app to promote reflective practice in their residents. In the first study, a medium-quality RCT, the authors found that coaching sessions made residents more likely to recognise and reflect upon everyday learning opportunities.³⁷ The second study investigated coachees' perceptions of a coaching programme that aimed to foster professional development and maturity.³⁸ The authors concluded that coaching enhanced 'progressive insight leading to actions' and improved '[the] expressing [of] needs for leadership aiming for self-realisation'.³⁸ They concluded that coaching 'can be effective in enhancing not only self-insight and core performance, but also increased positive feeling'.³⁸

Egener³⁹ evaluated a 12-month coaching programme designed to improve communication skills. The outcome of the study was purely observational: participating physicians reported the experience as 'highly satisfying'.³⁹ Consequently, the MERSQI score was extremely low at 6.

George et al.⁴⁰ implemented and evaluated a coaching intervention to improve residents' use of evidence-based medicine (EBM). This medium-quality study (MERSQI score: 12.5) employed a 'learning coach' to work with residents in a series of 1-hour sessions. Post-course self-reported questionnaires and validated EBM knowledge tests revealed a significant improvement in EBM knowledge and utilisation.⁴⁰

The studies included demonstrate a weak to medium evidence base for coaching interventions for non-technical skills. The exception is a study by Régo et al.,²⁸ which employed a comprehensive coaching intervention to improve Year 1 medical student knowledge and performance in undergraduate OSCEs. It used a group coaching method, in which students received regular formative assessments, and regular coach, self- and peer ratings of their competence throughout the

year. Coached students received higher OSCE scores than the control group, at-risk students were identified early and remediated, and repeated formative assessments correlated closely with end-of-year OSCE assessments.²⁸ The authors concluded that longitudinal coaching is effective, liked and may negate the need for expensive summative OSCEs, which represents an improved financial outcome for medical schools.²⁸

Coaching for technical skills

Seven papers analysed coaching for technical skills, namely, surgical skills. These papers were of much higher quality and used robust methodologies to detect significant changes in participants' abilities. In two papers, Hu et al.^{41,42} recorded operations to allow the immediate re-watching of the procedure by the operator and a coach, who identified areas for improvement, explored the coachee's reasons for selecting different approaches, and established strategies for improvement. These high-quality studies^{41,42} found that coaching significantly reduced rates of 'failure to progress' and increased ability to troubleshoot intraoperative problems. Bonrath et al.⁴³ also used video-recording with immediate postoperative coaching in a high-quality RCT to show that the coached group scored significantly higher on procedural skills and made fewer technical errors.

Three studies used real-time coaching in simulated surgery to improve surgical skills in high-quality RCTs. Yule et al.⁴⁴ delivered short individual coaching sessions between simulated surgical cases (lasting only 10 minutes), giving structured feedback and identifying strategies for improvement. Coached learners demonstrated significantly improved non-technical skills, and were faster to call for help.⁴⁴ Cole et al.⁴⁵ constructed a coaching intervention consisting of preoperative goal setting, intraoperative dialogue and postoperative feedback in a simulated laparoscopic procedure. Although the mean operating time was significantly shorter in the control group, the coached group caused significantly fewer surgical errors.⁴⁵ Liao et al.⁴⁶ described how one coached session in a simulated procedure resulted in outcomes equivalent to those achieved by multiple uncoached sessions, and concluded that coaching significantly reduced training time for surgeons.

Kim et al.⁴⁷ showed that non-surgical skills coaches were equally as effective in teaching suturing skills in a simulated setting as trained surgeons, concluding that: '...non-physician coaches may ease the teaching

burden of surgical faculty members while providing [a] similar quality of instruction for trainees.'

In summary, the papers included in this review provide a strong evidence base demonstrating that coaching facilitates improvements in surgical skills and technical ability, and is a financially viable model of education.

DISCUSSION

There is a lack of rigorous quantitative research into medical coaching programmes. Qualitative research is mostly limited to gauging coachees' perceptions and enjoyment of coaching interventions. However, this literature review has identified good-quality data demonstrating that coaching reduces surgical error, improves technical skill acquisition, improves examination scores, and identifies students who are struggling academically.

The present review did not identify studies that show how a coaching intervention results in improved outcomes for patients (Kirkpatrick level 4). Considering the newness of coaching within medical education, it is perhaps too early to register the change in patient outcomes; there are no evaluated coaching interventions preceding 2008. Medical educators must now turn their attention towards establishing high-quality longitudinal coaching programmes that follow outcomes up to the patient level, particularly within the realms of physician well-being and non-technical skills, in which the evidence is weakest. Niglio de Figueiredo et al.⁵ have instigated an RCT of an intervention designed to enhance communication skills in physicians working in cancer services, the outcomes of which will be evaluated by the coachee, and the coachee's peers and patients. This study⁵ promises to go some way towards capturing the patient-reported outcomes that are currently lacking from the evidence base.

Enquiries into coaching as a means of improving doctor well-being and emotional resilience are particularly timely. Resilience has been cited as a factor protective against mental distress and burnout in medical students and physicians.^{48,49} Strategies for teaching resilience skills within medical education are gaining prominence in the literature.⁵⁰⁻⁵² Currently, the pedagogical approach with the strongest evidence refers to the use of resilience workshops and cognitive behavioural

training,⁵³ which resonates with the use of coaching workshops to enhance well-being as described in this review. If we embrace resilience training as part of the medical curriculum, coached programmes may be important in its delivery. Although this paper has only discovered a weak evidence base for coaching as a means of improving doctor well-being and promoting resilience, this is largely attributable to the non-existence of robust interventions and evaluations. Large rigorous studies are needed to determine the power of coaching for resilience.

Coaching demands a committed, available and trained faculty staff, which may present a logistical and financial barrier to its delivery. However, many of the papers in this review referred to studies in which coaching programmes were developed with minimal time and financial outlay. Hu et al.⁴¹ improved surgical ability following a single 1-hour coaching session, and Cole et al.⁴⁵ improved non-technical skills in surgeons by incorporating 10-minute coaching sessions into the postoperative period. It is therefore likely that small coaching interventions can improve patient safety and patient care; this possibility alone makes the area worthy of further study.

The lack of exploration into coaching methodologies outside the operating room may reflect ingrained social obstacles. Mutabdzic et al.⁵⁴ identified cultural barriers to the coaching model that included questioning of the need for improvement, worry about appearing incompetent and loss of autonomy. None of the papers in this review examined this facet of the coaching method. Further exploration of coachees' perceptions of coaching may reveal a 'resistance' to coaching, whether as a result of scepticism, or fear of being perceived as incompetent or in need of correction. These learner-centric barriers have historically been encountered and addressed by educationalists during the introduction of reflective practice and learning portfolios,^{55,56} both of which are important tools used in appraisal and professional identity formation. If coaching gains prominence in medical education, teachers may need to overcome these obstacles.

In his work on signature pedagogies (teaching approaches specific to the culture of the profession in which they are enacted), Shulman describes how comparisons of the teaching paradigms of different professions can illuminate methods of improving education.⁵⁷ Drawing lessons from other

disciplines regarding the coaching paradigm may entail a cultural shift in how we perceive medical training. As discussed previously, the language of 'competence' in medical training does not align with the 'personal best' that coaching strives to achieve in other domains. In music and sports training, coaches are seen as central and indispensable to training,⁵⁸ whereas coaches do not yet figure among the core team of educators within the culture of medical education and, as yet, there is no compelling evidence that they should.

To further our understanding of medical coaching, educators must now develop and evaluate coaching interventions in areas of clinical practice that demand nothing less than 'transcendent performance'¹¹ every time. Although surgery is the obvious context, further reflection identifies other clinical 'performances' that may be responsive to coaching, such as the delivery of bad news, the management of medical emergencies, and simply coping with the pleasures and tribulations of a medical career.

Limitations and strengths

As the Methods section makes clear, the literature review serves to adduce and critique what is currently known about a topic in order to lay the foundations for further research. The results presented here are a critical summation of scholarly work regarding coaching in medical education, rather than a synthetic analysis of other papers. As such, the current review provides no further insights into what medical educational coaching is, how it works, or how it is best implemented or delivered.

The search strategy focused upon the term 'coaching' and its cognates. As described earlier in this review, this term is subject to a degree of interpretivism within the existing literature. Just as the search revealed many papers about coaching interventions that did not meet the definitions outlined in the inclusion criteria, there may exist studies that describe effective coaching education but do not refer to it by name, and have therefore eluded the search strategy of this review. Hence, this review is limited to the critique of papers that self-identify as referring to studies investigating coaching training. Future reviews will be broadened by including the skills and language of coaching (e.g. 'feedback', 'performance improvement' and 'personal best') within the search.

CONCLUSIONS

Coaching is a formative method of teaching that may hold great promise within the realm of personal and professional development in the medical world. Already, our surgical colleagues have begun to build a strong case for coaching for surgical excellence, and this trend is likely to continue. Examination of coaching methods in the public and corporate sectors tells us that coaching may prove a fruitful endeavour in terms of nurturing the essential non-technical skills required by today's doctors, such as resilience, resourcefulness, reflective practice and communication skills.

Acknowledgement: The author thanks Maurice Hepworth mh Coaching and Leadership Tyne and Wear, UK, for his thoughts on coaching, teaching and mentoring.

Funding: None.

Conflicts of interest: None.

Ethical approval: Not required.

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Received 24 July 2017; editorial comments to author 7 September 2017, accepted for publication 18 September 2017

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