

Review Article

Dr H M Yip takes responsibility for the integrity of the content of the paper

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Abstract

Objective. Recent studies have indicated a lack of ENT training at the undergraduate and post-graduate levels. This study aimed to review the impact of recent educational innovations in improving ENT training for medical students and junior doctors in the UK.

Methods. Three independent investigators conducted a literature search of published articles on ENT education. Included studies were analysed using qualitative synthesis methods.

Results. An initial search yielded 2008 articles; 44 underwent full-text evaluation and 5 were included for final analysis. Most included studies demonstrated benefits for students when compared to existing teaching standards in terms of objective assessment (knowledge and skills gained) or subjective assessment (confidence and preference) following implemented educational innovations.

Conclusion. This study identified educational innovations developed in the past 15 years to enhance the teaching of core ENT competencies. More research is needed to establish their impact on the state of ENT medical education in the UK.

Introduction

ENT is one of the most common surgical specialties encountered across various medical disciplines. ENT conditions represent up to 25 per cent of adult and 50 per cent of paediatric primary care consultations.¹ In the hospital setting, ENT is the third largest specialty behind orthopaedics and general surgery.² Furthermore, ENT emergencies are commonplace in accident and emergency departments.³ Despite its common occurrence within clinical practice, both junior doctors and medical students report minimal exposure and training in the specialty.^{4–6}

The lack of ENT teaching in medical school has been well-reported for decades. Ishman *et al.*,⁷ in 2015, identified the need for increased exposure to the specialty. Meanwhile, Ferguson *et al.*,⁸ in 2016, described an overwhelming lack of confidence in the practice of ENT amongst final year medical students and junior doctors. In their survey of undergraduate ENT teaching in 27 UK medical schools, Mace and Narula⁹ found that the average time spent by medical students in an ENT clinical attachment was only 1.5 weeks. Furthermore, 22 per cent of these schools did not offer an ENT attachment.⁹ Morris *et al.*¹⁰ found, in their pre-course questionnaires, that 74 per cent of the students felt their undergraduate anatomy teaching to be insufficient; specifically, 71 per cent believed there had been insufficient coverage of head and neck anatomy at medical school. This highlights the limited time and priority given to ENT topics by medical schools. Given the underrepresentation of ENT in the medical school curriculum, it is especially important that ENT teaching be delivered using the most effective methods available. The majority of existing secondary literature consistently identifies the inadequate coverage of ENT conditions within the undergraduate medical curricula and junior doctor training.

A systematic review of otolaryngology in undergraduate medical education showed that the most commonly used teaching methods were out-patient clinics and operating theatre attendance.⁷ Despite this, a survey of newly qualified doctors in the UK draws into question the effectiveness of these teaching methods.⁵ It is clear there is a need for change in ENT education in the undergraduate curriculum. However, the factor that limits change is the available time within the undergraduate medical curriculum. Any additional teaching for one specialty would likely lead to a reduction for another. Therefore, it is especially important to identify novel teaching solutions to better optimise the time allocated for ENT education. This systematic review aimed to evaluate current innovations that can provide possible solutions to this issue.

Research question

Our systematic review aimed to bridge the existing knowledge gap by reviewing all high-quality primary research of ENT educational innovations developed in the past 15 years to

Table 1. Summary of core ENT competencies

| Authors (year) | Country | Method | Conclusion |
|--|---------|--|--|
| Constable <i>et al.</i> ¹² (2017) | UK | Interview & questionnaire: – 8 interviewees, incl. ENT SpRs, foundation year doctors, GPs – 44 questionnaire respondents, incl. GPs, ENT & non-ENT consultants, doctors & medical students | ENT topics that ranked most important: (1) ENT clinical exam; (2) when to refer to ENT; (3) all forms of otitis; (4) common ENT emergencies; (5) tonsillitis; (6) quinsy; (7) indications for tonsillectomy; (8) management of ENT problems by non-ENT doctors; & (9) stridor & stertor |
| Lloyd <i>et al.</i> ¹³ (2014) | UK | 2-round Delphi questionnaire: – 159 respondents, incl. ENT consultants & SpRs, A&E consultants & SpRs, GPs & paediatricians | Learning objectives that scored most highly were: (1) history taking & exam; (2) red flag symptoms; (3) common ENT conditions, incl. all otitis types; (4) acute & chronic rhinosinusitis; (5) thyroid disease; (6) pharyngeal infection; & (7) airway compromise |
| Doshi & McDonald ¹⁴ (2012) | UK | 2-round Delphi questionnaire: – 61 respondents, incl. 12 medical students, 4 ST1 & ST2 doctors, 10 GPs, 10 ENT consultants & 25 ENT registrars | ENT emergencies junior doctors should know: (1) foreign body in ear; (2) foreign body in nose; (3) epistaxis; (4) tonsillitis; (5) quinsy; & (6) otitis externa |
| Elloy & Sama ¹¹ (2010) | UK | Summary of clinical & technical skills for management of ENT emergencies described in Intercollegiate Surgical Curriculum Programme ST1 curriculum | Clinical skills: (1) perform a comprehensive ENT & neck clinical exam; & (2) ability to manage common ENT emergencies, incl. simple epistaxis, ear, nose & oropharyngeal foreign bodies, acute oropharyngeal infections, & facial skeleton simple fractures Technical skills: (1) endoscopic or microscopic exam in clinic; (2) nasal cautery; (3) foreign body removal from ear canal, nose & oropharynx; (4) microsuction of ears; (5) drainage of quinsy; & (6) reduction of simple nasal fracture |
| Wong & Fung ¹⁵ (2009) | Canada | Survey of: – Directors of otolaryngology, family medicine & emergency medicine – Community otolaryngologists from medical schools | Top 5 topics identified were: (1) otitis media; (2) rhinitis; (3) sinusitis; (4) sore throat; (5) peritonsillar abscess; & (6) tonsillar disease |
| Lee <i>et al.</i> ¹⁶ (2005) | UK | Questionnaire: – 152 medical students responded | Recommended learning objectives include: (1) common ENT operative procedure; (2) clinical head & neck anatomy; (3) management of common ENT diseases; (4) indications & contraindications of various surgical treatments; & (5) risks & complications that may arise from operative procedures |
| Carr <i>et al.</i> ¹⁷ (1999) | Canada | Questionnaire: – 123 participants, incl. family doctors & community otolaryngologists | Key topics are: (1) acute & chronic otitis media; (2) otitis externa; (3) epistaxis; (4) sinusitis; (5) allergic rhinitis; & (6) sore throat |

Summary of core ENT competencies: (1) knowledge of common ENT conditions – all forms of otitis, rhinosinusitis, tonsillar diseases, sore throat & thyroid diseases; (2) recognition & management of common ENT emergencies – foreign body in ear or nose, epistaxis, quinsy, surgical complications & airway compromise; (3) ENT history & examination; (4) recognition of red flag symptoms & when to refer for ENT specialist input; (5) knowledge of clinical head & neck anatomy; and (6) knowledge of common ENT procedures – nasolaryngoscopy, nasal cautery, foreign body removal, microsuction of ears, quinsy drainage & reduction of simple nasal fractures. Incl. = including; SpR = specialist registrar; GP = general practitioner; A&E = accident and emergency; ST = specialist trainee (year)

improve the teaching of core ENT competencies described above (Table 1).^{11–17} We aimed to review comparisons of all ENT educational innovations developed for both medical students and junior doctors to defined current educational standards. The specific outcomes investigated included the objective assessment of knowledge and skills, and the subjective assessment of confidence and preference, following implemented innovations.

Core ENT competencies

There is currently large variation in otolaryngology content in the undergraduate medical curriculum. The Royal College of Surgeons of England published a National Undergraduate Curriculum in Surgery in 2015 to help address some of the issues surrounding the variability in undergraduate teaching.¹⁸

This curriculum included six key surgical conditions relating to ENT. However, the learning outcomes listed for each surgical condition are often vague, with room for personal interpretation.

Therefore, we performed a preliminary literature review to collate studies defining core ENT competencies for junior doctors within the medical curricula (Table 1). These can be broadly classified into six main groups: knowledge of common ENT conditions, recognition and management of common ENT emergencies (e.g. foreign body in the ear or nose, epistaxis, quinsy, surgical complications, airway compromise), ENT history and examination, recognition of red flag symptoms and when to refer patients for ENT specialist input, knowledge of clinical head and neck anatomy, and knowledge of common ENT operative procedures (e.g. tonsillectomy, nasolaryngoscopy). We based our inclusion and exclusion

Table 2. Key words and MeSH terms used in search strategy

| Concepts | Key words | MeSH terms |
|----------|---|---|
| 1 | ENT or otorhino* or otolaryngo* or “ear, nose and throat” | Otolaryngology or otorhinolaryngologic surgical procedures or otorhinolaryngologic diseases |
| 2 | Medical student* or medical school* or undergraduate* | Undergraduate medical education or medical students |
| 3 | Doctor* or clinician* or physician* or trainee* or surgeon* | Graduate medical education or physicians |
| 4 | Educat* or e-learning or simulat* or learn* or competen* or teach* or skill* or train* or course* or curricul* or tech* or knowledge or innovate* | |
| 5 | United Kingdom or UK or Great Britain | United Kingdom |
| 6 | 1 and (2 or 3) and 4 and 5 | |

MeSH = medical subject headings

criteria on these competencies, defined within the literature as crucial objectives of ENT medical education.

Materials and methods

This study was conducted based on methods established in a protocol written *a priori* (Appendix 1, available online). Three investigators independently performed a literature review of all published articles relating to otolaryngology in medical education. We searched for articles across five databases: Medline, Embase, Education Resources Information Center (‘ERIC’), Cochrane and Web of Science. The literature search was conducted from 6 July 2019 to 13 September 2019. Table 2 shows the key words and medical subject headings used in our search strategy.

Our inclusion and exclusion criteria are summarised in Table 3. Non-randomised studies of interventions and randomised, controlled trials (RCTs) were included in our study following comprehensive risk of bias assessments. Both study types were included given the paucity of RCTs in educational research. Only studies that evaluated changes in our desired outcome measures after the implementation of an educational innovation were included.

An initial literature search was performed independently by all three investigators; disagreements between the investigators regarding study inclusion were resolved through discussion. Subsequent results are presented in a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (‘PRISMA’) diagram (Figure 1).

Included studies were critically appraised using a tailored data extraction form (Appendix 2, available online), developed based on recommendations by the UK National Health Service Centre for Reviews and Dissemination.¹⁹ Data extraction was performed independently by all three investigators and consensus was achieved prospectively. Extracted data from these studies were then analysed using qualitative synthesis methods.

Results

A total of 2008 studies were identified by searching Medline, Embase, Education Resources Information Center, Cochrane

Table 3. Inclusion and exclusion criteria

| Parameter | Inclusion criteria | Exclusion criteria |
|----------------|--|--|
| Location | UK studies | Non-UK studies |
| Timescale | Articles published from 2004 onwards (within past 15 years) | Articles published before 2004 |
| Training level | Medical students & junior doctors | ENT specialist trainees |
| Article type | Actual implementation with evaluation of intervention & comparison to current standard | Needs-assessment only, opinion piece only, no baseline measurement & abstract-only publication |
| Topic | Medical education | Not related to medical education |
| Specialty | ENT-related | Not focused on ENT |
| Teaching focus | Defined core ENT competencies (Table 1) | Non-core ENT competencies |

and Web of Science databases. All identified studies were entered into Endnote and 610 duplicates were removed. The remaining 1401 studies underwent a thorough review of titles and abstracts, of which 1357 studies did not meet our inclusion criteria. Forty-four studies underwent full-text analysis (Table 4).^{6–8,10–14,20–55} Of these studies, 38 were excluded for failing to meet our inclusion criteria. Six studies were then rigorously assessed for their risk of bias levels, after which one study was excluded because of a critical risk of bias. Five studies were included for final qualitative synthesis and their baseline data are presented in Table 5.^{10,20–23} Figure 1 shows an overview of our literature search process.

Study quality assessment

Six studies were assessed for risk of bias, using the Risk of Bias in Non-Randomised Studies of Interventions I tool⁵⁶ and the Revised Cochrane Risk-of-Bias tool for Randomised Trials.⁵⁷ Two randomised, controlled trials (RCTs), conducted by Alnabelsi *et al.*²⁰ and Smith *et al.*,²¹ were found to have a low risk of bias. The RCT performed by Edmond *et al.*²² was found to be at a moderate risk of bias because of concerns regarding: missing outcome data, outcome measurements and possible selection bias of its reported results. The single arm cohort study performed by Smith *et al.*²³ had a moderate risk of bias because of concerns regarding apparent confounding and outcome measurement biases. The study conducted by Morris *et al.*¹⁰ had a serious risk of bias as a result of an inherent selection bias of its outcome measures. Lastly, the study conducted by Elloy and Sama¹¹ was found to have a critical risk of bias, as per the Risk of Bias in Non-Randomised Studies of Interventions I assessment tool. This is because there was significant missing outcome data and unadjusted confounders. As such, an *a posteriori* decision was made amongst the three investigators to exclude this study from the final qualitative synthesis.

Objective assessment

Alnabelsi *et al.*²⁰ compared synchronous e-learning in otolaryngology emergencies teaching to traditional face-to-face teaching. Twenty-five students (16 fourth-year and 9 fifth-year medical students) were randomised to the face-to-face

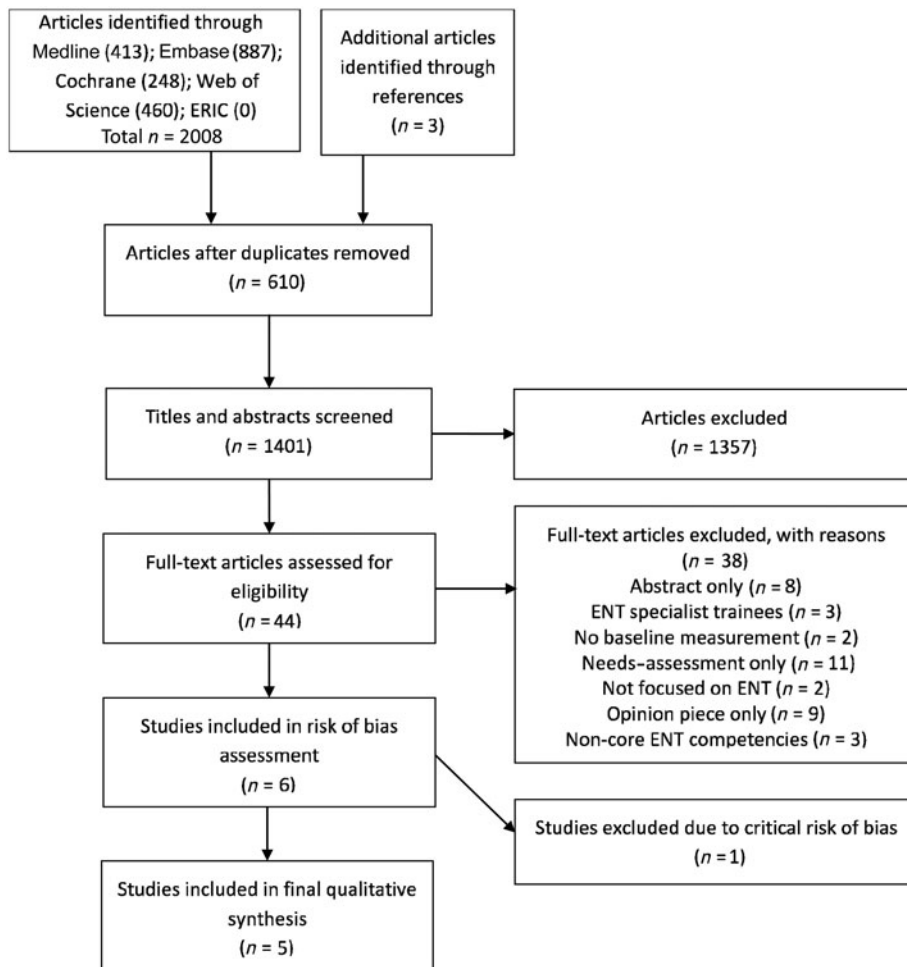


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses ('PRISMA') flow diagram for our literature search process. ERIC = Education Resources Information Center

teaching group and 25 students (15 fourth-year and 10 fifth-year medical students) were randomised to the synchronous e-learning group. Objective assessment revealed no significant difference in the magnitude of improvement in lecture test scores between the two groups ($p = 0.17$).

Edmond *et al.*²² compared video podcasts to written handouts in the teaching of three common ENT conditions: epistaxis, otitis media and tonsillitis. Objective assessment revealed no significant difference ($p = 0.07$) between the two methods, with the handout group scoring fractionally higher with a larger average improvement (mean post-exposure score of podcasts and handouts = 37.8 and 38.3, respectively).

Smith *et al.*²³ developed a practical and simulation-based intensive ENT 'boot camp' to prepare junior doctors entering ENT jobs, using emergency simulation methods. Objective assessment using pre- and post-course multiple-choice questions at the level required of a foundation doctor or core training grade doctor revealed that the post-course test scores (average of 76 per cent, range of 64–92 per cent) were significantly higher than the pre-course test scores (average of 48 per cent, range of 20–92 per cent) ($p < 0.01$).

Smith *et al.*²¹ assessed whether training on a realistic human mannequin with structured video feedback improved flexible nasolaryngoscopy performance, in comparison to a lecture and video presentation only. Objective assessment revealed that mannequin training together with video feedback produced significant performance improvements in terms of the time taken to reach the vocal folds ($p = 0.02$) and global ability ($p < 0.01$).

Subjective assessment

Subjective assessment by Alnabelsi *et al.*²⁰ revealed no difference between the synchronous e-learning and the face-to-face teaching groups in terms of the lecture's usefulness ($p = 0.48$), interactivity ($p = 0.83$) and its ability to meet educational needs ($p = 0.97$); the face-to-face teaching group, however, was more satisfied overall ($p = 0.03$).

Subjective assessment by Edmond *et al.*,²² using a five-point Likert scale questionnaire, demonstrated that medical students enjoyed using video podcasts more than written handouts.

Subjective assessment by Smith *et al.*,²³ using a validated Dundee Ready Education Environment Measure scoring system, revealed that 84 per cent of candidates would strongly recommend the ENT boot camp, and 100 per cent reported they were more confident performing ENT examinations and dealing with emergencies.

Morris *et al.*¹⁰ described focused near-peer teaching on three areas of head and neck anatomy. Subjective assessment showed that all students ($n = 30$) had increased confidence in their knowledge after the course.

Discussion

To our knowledge, this study represents the first attempt to systemically review all existing levels of evidence of educational innovations developed to improve ENT teaching for medical students and junior doctors in the UK. We limited our time-scale of the literature search to the past 15 years, since 2004, in

Table 4. Outcomes of 44 articles that underwent full-text analysis

| Authors (year) | Title | Outcome | Exclusion reason |
|--|---|----------|---------------------------|
| Kanegaonkar <i>et al.</i> ²⁴ (2005) | The Brighton ENT introductory course | Excluded | Abstract-only publication |
| O'Neill <i>et al.</i> ²⁵ (2005) | Deaf awareness and sign language: an innovative special study module | Excluded | Non-core ENT competencies |
| Thio ²⁶ (2006) | 6th Basic Science for Otolaryngology Course | Excluded | Abstract-only publication |
| Makura <i>et al.</i> ²⁷ (2007) | Foundation year two in ENT: a brave new (training) world | Excluded | Opinion piece only |
| Murphy <i>et al.</i> ²⁸ (2007) | Quinsy trainer | Excluded | No baseline measurement |
| Newbegin <i>et al.</i> ²⁹ (2007) | Student-selected components: bringing more ENT into the undergraduate curriculum | Excluded | Opinion piece only |
| Vasani ³⁰ (2007) | MMC. A trainees experiences | Excluded | Opinion piece only |
| Chawdhary <i>et al.</i> ⁶ (2009) | Undergraduate ENT education: what students want | Excluded | Needs-assessment only |
| Sharma <i>et al.</i> ³¹ (2010) | Re: Is that the ENT SHO? Concerns over training and cross cover | Excluded | Opinion piece only |
| Elloy & Sama ¹¹ (2010)* | Does an ENT introductory course improve junior doctors' confidence in managing ENT emergencies? | Included | |
| Fraser <i>et al.</i> ³² (2011) | Current use of and attitudes to e-learning in otolaryngology: questionnaire survey of UK otolaryngology trainees | Excluded | Needs-assessment only |
| Holland <i>et al.</i> ³³ (2011) | Cadaveric hands-on training for surgical specialties: is this back to the future for surgical skills development? | Excluded | Not focused on ENT |
| Amin & Hone ³⁴ (2012) | Surgical induction courses: a junior trainee's perspective | Excluded | Opinion piece only |
| Bannister ³⁵ (2012) | Improving the GP VTS training experience in ENT | Excluded | Needs-assessment only |
| Bannister ³⁶ (2012) | Current UK undergraduate training in otolaryngology: a 10 year national review | Excluded | Needs-assessment only |
| Doshi & McDonald ¹⁴ (2012) | Determining the content of an educational ENT website using the Delphi technique | Excluded | Opinion piece only |
| Hettige <i>et al.</i> ³⁷ (2012) | ENT cross-cover survey: factors that influence trainees' confidence levels in managing common ENT on-call emergencies | Excluded | Needs-assessment only |
| Lightbody & Wilkie ³⁸ (2012) | Current ENT training within the UK | Excluded | Needs-assessment only |
| Pal & Zarod ³⁹ (2012) | Evaluating the use of simulation in facilitating training in airway assessment | Excluded | Abstract-only publication |
| Tan <i>et al.</i> ⁴⁰ (2012) | Student-led otology teaching | Excluded | Abstract-only publication |
| McGlade <i>et al.</i> ⁴¹ (2013) | Deaf awareness training in medical schools | Excluded | Opinion piece only |
| Lloyd <i>et al.</i> ¹³ (2014) | Development of an ENT undergraduate curriculum using a Delphi survey | Excluded | Opinion piece only |
| Reznitsky <i>et al.</i> ⁴² (2014) | Does an introductory ENT course immediately improve clinical decision making? | Excluded | Abstract-only publication |
| Stobbs & Kumar ⁴³ (2014) | The role of simulation in surgical training | Excluded | Not focused on ENT |
| Smith <i>et al.</i> ²¹ (2014)* | A randomized controlled trial of nasolaryngoscopy training techniques | Included | |
| Alnabelsi <i>et al.</i> ²⁰ (2015)* | Comparison of traditional face-to-face teaching with synchronous e-learning in otolaryngology emergencies teaching to medical undergraduates: a randomised controlled trial | Included | |
| Ishman <i>et al.</i> ⁷ (2015) | Qualitative synthesis and systematic review of otolaryngology in undergraduate medical education | Excluded | Opinion piece only |
| Jain <i>et al.</i> ⁴⁴ (2015) | Undergraduate otolaryngology training in the United Kingdom, any change? | Excluded | Needs-assessment only |
| Piromchai <i>et al.</i> ⁴⁵ (2015) | Virtual reality training for improving the skills needed for performing surgery of the ear, nose or throat | Excluded | ENT specialist trainees |
| Whitcroft <i>et al.</i> ⁴⁶ (2015) | ENT junior on calls: the role of education in cross covering | Excluded | Abstract-only publication |
| Wong & Singh ⁴⁷ (2015) | Simulation can cultivate medical students' interest in ENT surgery | Excluded | Abstract-only publication |
| Al-Hussaini & Tomkinson ⁴⁸ (2016) | Exploring medical undergraduates' perceptions of the educational value of a novel ENT iBook: a qualitative study | Excluded | No baseline measurement |

(Continued)

Table 4. (Continued.)

| Authors (year) | Title | Outcome | Exclusion reason |
|--|---|----------|---------------------------|
| Easto & Reddy ⁴⁹ (2016) | A survey of ENT experience in South West Peninsula general practitioner trainees: how can post-graduate ENT training be improved? | Excluded | Needs-assessment only |
| Ferguson <i>et al.</i> ⁸ (2016) | Does current provision of undergraduate education prepare UK medical students in ENT? A systematic literature review | Excluded | Needs-assessment only |
| Hunter <i>et al.</i> ⁵⁰ (2016) | Retention of laryngoscopy skills in medical students: a randomised, cross-over study of the Macintosh, A.P. Advance ^(TM) , C-MAC ^(®) and Airtraq ^(®) laryngoscopes | Excluded | ENT specialist trainees |
| Smith <i>et al.</i> ²³ (2016)* | The ENT boot camp: an effective training method for ENT induction | Included | |
| Steven <i>et al.</i> ⁵¹ (2016) | Otological aspects of undergraduate otolaryngology education in the United Kingdom | Excluded | Abstract-only publication |
| Edmond <i>et al.</i> ²² (2016)* | A comparison of teaching three common ear, nose, and throat conditions to medical students through video podcasts and written handouts: a pilot study | Included | |
| Constable <i>et al.</i> ¹² (2017) | Prioritising topics for the undergraduate ENT curriculum | Excluded | Needs-assessment only |
| Musbahi <i>et al.</i> ⁵² (2017) | Current status of simulation in otolaryngology: a systematic review | Excluded | ENT specialist trainees |
| Steven <i>et al.</i> ⁵³ (2017) | An undergraduate otolaryngology curriculum comparison in the United Kingdom using a curriculum evaluation framework | Excluded | Needs-assessment only |
| Morris <i>et al.</i> ¹⁰ (2018)* | Head and neck anatomy: effect of focussed near-peer teaching on anatomical confidence in undergraduate medical students | Included | |
| Jia & Al-Omari ⁵⁴ (2019) | A versatile grommet trainer | Excluded | Non-core ENT competencies |
| Spiers <i>et al.</i> ⁵⁵ (2019) | Augmenting ENT surgery outside the medical school curriculum: the role of a 1-day otolaryngology course | Excluded | Non-core ENT competencies |

*Indicates that study fulfilled inclusion criteria

order to identify the most recent developments in the field of ENT medical education. The most prominent finding highlighted by this systematic review is the paucity of evidence exploring ENT educational innovations and their impact. This limited the number of studies included in our final analysis (Table 5).

Two innovations – ENT boot camp and nasolaryngoscopy training on a realistic human mannequin – demonstrated significant improvements in participants' knowledge and skills through objective assessments. Consistent improvements in students' confidence and personal preference across most of the studied innovations were also noted. This indicates that there would be benefits and positive responses to the implementation of these educational innovations within the existing medical curriculum.

Innovations in ENT teaching can be classified according to different modalities, such as information technology (IT) developments, extra-curricular ENT courses and simulation-based training. In the following paragraphs, we decided to evaluate the benefits of the different innovations in our included studies according to these three main themes.

Over the past years, IT resources have had increasing roles in medical education, but this development has outpaced the research to demonstrate its efficacy. Critical assessment of these IT resources is essential to determine their benefits. The IT educational innovations included in this review have been found to be as good as traditional methods in teaching ENT topics.^{20,22} Alnabelsi *et al.*²⁰ highlighted the potential of e-learning modalities in overcoming the restrictions of time and space that traditional face-to-face teaching require. Students felt that video podcasts were more enjoyable than traditional handouts and expressed desire for their incorporation into the main curriculum.²² Given the benefits, we felt that synchronous e-learning and video podcasts have great

potential for further application in effective teaching of core ENT topics. This mirrors the findings of Fung,⁵⁸ who reported that e-learning is well received by medical students for ENT teaching and should be incorporated into the undergraduate medical curriculum following empirical assessment.

Morris *et al.*¹⁰ showed that a relevant extra-curricular ENT course can improve students' confidence in their knowledge of the ENT topics being taught. They also demonstrated that near-peer teaching of anatomy is preferred by students over traditional anatomy teaching methods, and it improved their retention of knowledge.¹⁰ This has been attributed to the more effective communication that takes place between near-peer tutors and tutees.⁵⁹ This suggests it might be useful to incorporate near-peer teaching into the undergraduate ENT curriculum.

Also in this theme, Smith *et al.*²³ demonstrated that junior doctors feel more prepared to provide emergency ENT cover after an ENT boot camp. This is especially important given the cross-cover system currently in place, which implies that most ENT departments' out-of-hours emergency work may be provided by a junior doctor with limited ENT experience and expertise.⁶⁰ Their boot camp differs from traditional ENT introductory courses, as it places a greater emphasis on the simulation of scenarios and skills to train participants in the management of ENT emergencies.²³ Their findings suggest that acquisition of the skills crucial for junior doctors during out-of-hours ENT emergency work is better achieved by an intensive, practical, skills-focused approach, rather than via traditional training.²³ This highlights how the correct teaching method can yield more knowledge in less time.

There is evidence that simulation-based training has seen growing importance in the field of surgical education.^{61,62} Simulation of evolving ENT emergencies in an ENT boot camp, such as airway obstruction and epistaxis, was shown

Table 5. Baseline data of final five included studies

| Authors (year) | Design | Sample size | Educational innovation | Defined standard | Evaluation method | Subjective assessment | Objective assessment | Risk of bias assessment |
|--|------------------------|--|---|--|---|---|---|---|
| Alnabelsi <i>et al.</i> ²⁰ (2015) | RCT | 50 4th & 5th year medical students | Synchronous e-learning in otolaryngology emergencies teaching | Traditional face-to-face teaching | – Improvement between pre- & post-lecture test scores – Students' ratings of lecture on Likert-type scale | No difference in student ratings between 2 groups for: usefulness of lecture ($p = 0.48$), interactivity ($p = 0.83$) & meeting educational needs ($p = 0.97$). Face-to-face teaching group, however, was more satisfied overall ($p = 0.03$) | Students in both groups had improved test scores following lecture ($p < 0.01$). No difference in magnitude of test score improvement between groups ($p = 0.17$) | Overall low risk of bias & minimal confounding |
| Smith <i>et al.</i> ²¹ (2014) | RCT | 13 junior doctors & 23 final year medical students | Training on a realistic human mannequin with structured video feedback | Lecture & video presentation | – Volunteer discomfort – Assessors marked video based on endoscope control & anatomical awareness | None | Mannequin training with video feedback produced significant performance improvements in: time to reach vocal folds ($p = 0.02$) & global ability ($p < 0.01$) | Overall low risk of bias |
| Edmond <i>et al.</i> ²² (2016) | Randomised pilot study | 41 2nd year students | Video podcasts for 3 common ENT conditions: epistaxis, otitis media & tonsillitis | Written handouts | 60-item true or false statement test written by senior author (20 questions per subject) | 5-point Likert scale questionnaire demonstrated that medical students enjoy using reusable learning objects such as podcasts, & feel they should be used more in their curriculum | Both podcasts & handouts demonstrated a statistically significant increase in student scores. However, no significant difference ($p = 0.07$) between methods | Overall moderate to serious risk of bias due to concerns regarding: missing outcome data, outcome measurement & selection of reported results |
| Smith <i>et al.</i> ²³ (2016) | Quantitative study | 18 junior doctors | ENT boot camp | None | 2 different MCQ tests were developed to assess common & emergency ENT knowledge at level required of foundation or core training grade doctor. Tests were completed by candidates before & after course | Validated Dundee Ready Education Environment Measure scoring system showed 84% of candidates would strongly recommend course, & 100% reported being more confident performing ENT exams & dealing with emergencies | Test scores were significantly higher post-course than pre-course (means of 76% (range 64–92%) & 48% (range 20–92%), respectively; $p < 0.01$) | Overall moderate to serious risk of bias |
| Morris <i>et al.</i> ¹⁰ (2018) | Quantitative study | 15 pre-clinical (years 1–2) & 15 clinical (years 3–5) medical students | Focused near-peer teaching on head & neck anatomy | Student's opinion on teaching of head & neck anatomy in undergraduate curriculum at their medical school | Participants completed questionnaire before & after attending anatomy course | All students ($n = 30$) expressed benefit from course. Pre-clinical students showed significant improvement in confidence to name anatomical structures & in application ($p < 0.05$) | None | Overall serious risk of bias due to selection of reported results & confounding |

RCT = randomised, controlled trial; MCQ = multiple-choice question

to improve candidates' knowledge and confidence.²³ The importance of simulation-based training in ENT was further highlighted by Smith *et al.*,²¹ who established the benefit of using a mannequin with video feedback for improving trainees' flexible nasolaryngoscopy technique, with no significant difference in outcomes between the students and junior doctors. This suggests that the training benefits a diverse range of trainees at different career grades. Given these benefits, there is potential for similar simulation-based training to be incorporated into the undergraduate and post-graduate curriculum to teach other ENT practical skills covered in the Intercollegiate Surgical Curriculum Programme.¹¹

Despite the significant benefits that these innovations bring, we strongly believe that time and resource constraints are the limiting factors of educational change. Although traditional teaching methods fare lower in subjective assessments by students, they could be more financially feasible compared to some of the innovations assessed in this review. For example, Smith *et al.*²³ and Edmond *et al.*²² noted up-front financial costs in implementing the ENT boot camp and video podcasts. Therefore, time and resource demands should be variables included in future studies.

The relative scarcity of literature on ENT medical education was the main limitation of our systematic review, which led to only five studies being included in our final qualitative synthesis. There could be educational innovations adopted by other centres in the UK that have not been evaluated and published. We recommend further research evaluating the advantages and disadvantages of recent ENT educational innovations so that they can be considered for incorporation into current teaching practices.

Conclusion

Our review demonstrates that there have been educational innovations developed in the past 15 years, in the form of IT, extra-curricular courses and simulation-based training, to enhance the teaching of core ENT competencies. More research is needed, focusing on the impact that these educational advances have on the state of ENT medical education in the UK. We hope that this review will provide suggestions for institutions to improve their ENT training, serve as a springboard for further research in this area, and ultimately help prepare medical students and junior doctors to manage ENT conditions in their practice.

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