COVID-19 impact on junior doctor education and training: a scoping review

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ABSTRACT
COVID-19 has had a significant impact on healthcare resources and the medical workforce. Clinically-based medical education is the principal source of learning, and this has been profoundly impacted by restrictions due to COVID-19. It follows that junior medical staff and their education would be significantly impacted due to the altered volume and breadth of their clinical exposure. Some literature has been published regarding the impact to medical training during COVID-19. This study sought to review junior medical staff perceptions and their reported impact of the COVID-19 pandemic on their education and training.

Nine databases (three Ovid MEDLINE databases, Embase, Web of Science, Scopus, Cumulative Index to Nursing and Allied Health Literature, Educational Resources Information Centre and PsychINFO) were searched for studies published in 1 January 2020 through 24 August 2020. Via a scoping review protocol, an iterative process was used to perform the identification, review and charting analysis of the reported outcomes and themes. Descriptive analysis was performed using quantitative and qualitative methods.

Of the 25 343 sources identified, 32 were included in the review. There were studies published from nearly all continents, predominantly in surgical journals, with a wide spread of specialties. Themes identified included the current impact of the pandemic in relation to continuation of and modifications to training programmes, as well as the future impact due to training requirements and career progression.

Junior medical staff report that the COVID-19 pandemic has had a significant impact on their education and training. Whether the changes imposed by the pandemic on education are temporary measures or permanent fixtures, and whether standards of competence may be impacted, is not yet known. This scoping review forms a basis for further investigation in the field.

INTRODUCTION
COVID-19 has had a significant impact on the medical workforce. Late in 2019, a COVID-19 outbreak moved from epidemic to pandemic, affecting population centres globally. The devastation wrought by COVID-19 in Asia and Europe placed enormous pressure on healthcare resources, both in terms of hospital and intensive care unit (ICU) capacity, as well as personal protective equipment (PPE) supplies for healthcare workers in high-risk environments. To this end, measures including increasing ICU capacity, restricting volumes of elective surgery, rationalising PPE stores, limiting in-person clinical contact and considerations regarding redeployment of medical staff to 'front-line' emergency department and ICU areas were instituted.

Formalised education programmes, with training undertaken in a clinical environment, were introduced by Osler in the late 19th century.[1] The progressive shift of responsibility of medical education from an academic setting to that of the healthcare system[2] has reached a point where the principal source of education is clinically based. As part of an ever-expanding field of study, the awareness that medical education is multifaceted and is a primary outcome, rather than a by-product of clinical experience, is becoming more prevalent. While there has been much investigation into optimal trainee working hours, it is clear that commitments to education, training, service provision, research, individual study and preparation for assessments must be, and often are not, finely balanced.[3] However, the significance of the impact of learning environments on learner outcomes must not be underestimated,[4] and that of the clinical environment on trainee education is inextricably linked.[5] There has been a rapid increase in publications linked with the COVID-19 pandemic, but there is yet to be a comprehensive review that reports the impact on medical education for junior medical staff.

Given the impact of COVID-19 on the volume and breadth of clinical exposure junior staff would have in their clinical roles, we sought to determine junior medical staff perceptions regarding the impact of the COVID-19 pandemic on their education and training. We performed a scoping review to assess existing literature in the field and to form a foundation for future study.

METHOD
The methodological framework articulated by Arksey and O'Malley was used as the basis for this scoping review, adhering to five phases: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data and (5) collating, summarising and reporting the results.[6]

Identifying the research question
The question posed in our inquiry was: what is known about the perceptions of junior medical staff regarding the impact of the COVID-19 pandemic on their education and training? Given the volume of research relating to COVID-19 being rapidly published, we thought this question to be sufficiently broad to capture relevant data.

Table 1 Search strategy defined along PCC guidelines,[7] including complete strategy incorporating Boolean operators and MeSH terminology

Population terminology	Junior doctor, resident, registrar
Concept terminology	Education, training
Context terminology	COVID, coronavirus, epidemic, pandemic
Search strategy	("education" OR "training") AND ("COVID" OR "coronavirus" OR "epidemic" OR "pandemic") AND ("junior doctor" OR "resident" OR "registrar") AND NOT ("student")
MeSH terms	Internship and residency, medical staff

MeSH, medical subject heading; PCC, population, context, concept.

Identifying relevant studies

A search strategy was developed with the intention of capturing maximal results initially, which could then be further refined. In accordance with the population, context, concept (PCC) framework,[7] a protocol investigating the impact on education and training in the context of the COVID-19 pandemic in the junior medical staff population was developed. For the purposes of this study, we defined junior medical staff as any person with a medical degree who was not yet an attending/consultant. This includes interns, residents, registrars, trainees and fellows. The search strategy included medical subject headings related to the search terms in order to increase the literature captured, in addition to the use of Boolean operators to combine multiple search terms (table 1). Varied evidence resources were used to identify relevant literature, including electronic databases, bibliographic lists of identified journal sources and hand-searching of key journals where relevant.

The first author (MAS) conducted the search on 24 August 2020, initially identifying sources in three Ovid MEDLINE databases (MEDLINE, In-Process & Other Non-Indexed Citations and Epub Ahead of Print), followed by Embase, Web of Science, Scopus, Cumulative Index to Nursing and Allied Health Literature, Educational Resources Information Centre and PsychINFO. English language was used as a filter at the conclusion of each search. There were no qualifications on date or publication type employed. A search of the grey literature was not conducted given the volume of sources identified from existing databases.

Endnote V.X9 (Clarivate Analytics, Philadelphia, Pennsylvania, USA) was used to export sources to individual reference libraries reflecting the origin of sources. The reference libraries were subsequently combined, and duplicate references removed.

Table 2 Exclusion criteria determined via an iterative process undertaken during collation of studies identified using the aforementioned search strategy

Exclusion criteria	Foreign language
	Sources published in 2018 or earlier
	Sources discussing incorporation of public health into the medical curriculum
	Sources discussing incorporation of telemedicine into the medical curriculum
	Sources regarding residency programme changes (in contrast to measuring perceptions of junior staff of the impact of COVID-19 on medical education)
	Sources regarding perceptions of programme directors (in contrast to junior medical staff)
	Sources regarding medical students (in contrast to junior medical staff)
	Sources regarding changes in clinical practice alone

As a result of the time-sensitive nature of the subject matter as well as the constraints on available resources, exclusion criteria were determined. The iterative nature of this process ensured that these criteria were modified in the development of a sound strategy. A requirement of only English language literature circumvented the need for translation of material which would otherwise have proved both time and resource consuming. Further, with the COVID-19 pandemic having originated, to our knowledge, in 2019, any material published prior to this date would fall outside the context of this study. Additional exclusion criteria were imposed throughout the process of undertaking the search (table 2).

Study selection

A screen of study titles was undertaken independently by two authors (MAS and SKF), followed by a consultative process where any source agreed on by both authors as satisfying the review progressed to abstract review, whereas any source agreed on by both authors as requiring exclusion, failed to progress. Where there was disagreement between the authors, the source proceeded to abstract review.

A similar process was undertaken in the abstract review phase. Additionally, any source without an abstract automatically progressed to the full-text review phase. For full-text review, the consultative process was repeated. Disagreements were referred to a third author (DN) for a final independent opinion.

At this stage, a bibliographic search of references in selected sources was undertaken and the screening process above was implemented in examining these results, after which they were included in the final yield of sources for scoping review.

Charting the data

The data charting phase involved the synthesis and interpretation of data by sorting of the material thematically.[6] Variables aligned with the PCC components of the research question were defined and inserted into a data charting form using Microsoft Excel (Microsoft Excel for Mac, 2020, Microsoft Corporation, Redmond, Washington, USA). Demographics of the publications were included in the charting form. Further variables were added to the spreadsheet during the charting phase in response to the iterative nature of charting. Two authors (MAS, SKF) extracted the data, and a consultative process was undertaken to ensure accuracy of the results charted. Any disagreements were resolved by either consensus, or failing that, referral to a third author (DN).

An assessment of the quality of the studies was undertaken using the Medical Education Research Study Quality Instrument (MERSQI).[8] This 10-item scale is comprised of six domains (study design, sampling, type of data, validity of evaluation instrument, data analysis and outcomes), each scored according to particular criteria. The summative score ranges between 5 and 18, with a higher score indicating a higher quality of research. Of note, given that the MERSQI is only applicable to observational, experimental and quasi-experimental studies,[9] editorials in our scoping review were not evaluated with this tool.

Collating, summarising and reporting the results

The final stage of the scoping review framework relates to the presentation and analysis of the results as outlined below.

RESULTS

The initial OVID Medline search identified 82 studies, and collation of all references yielded 25 296 sources. Following a

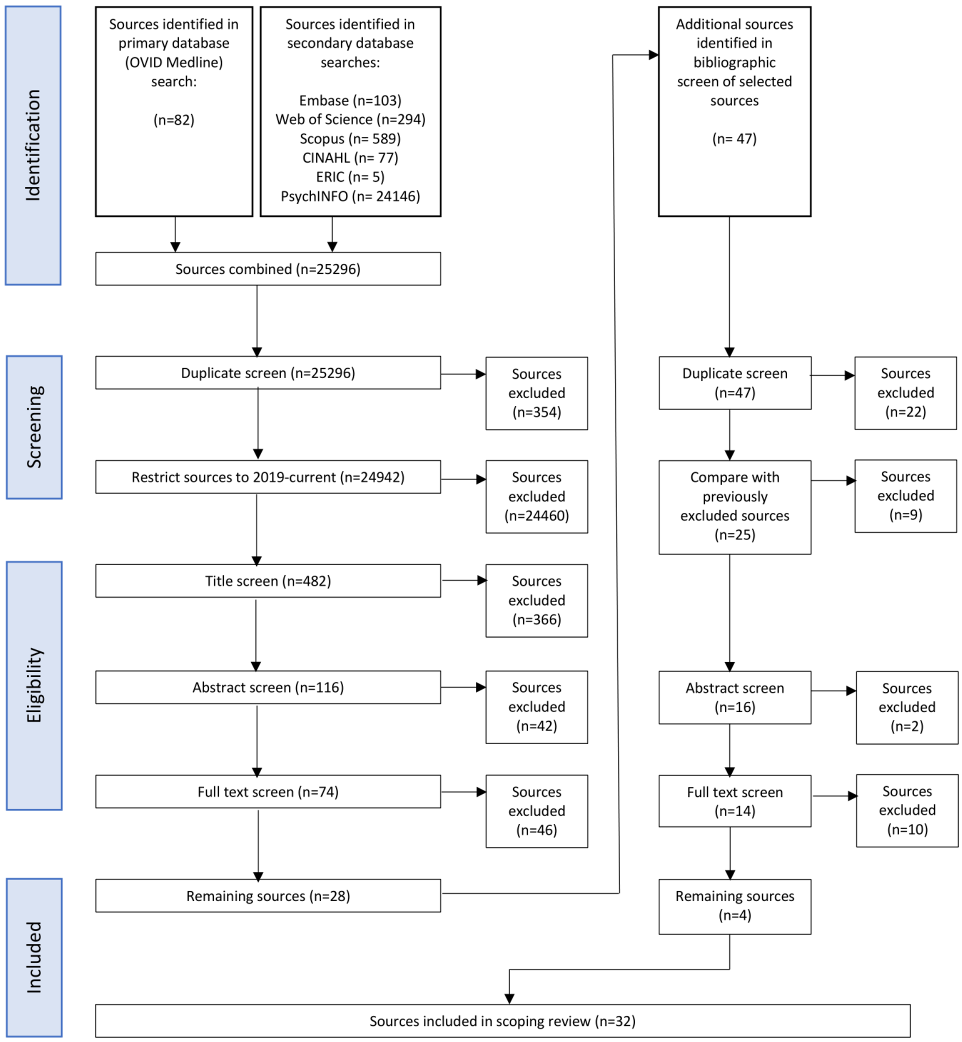

Figure 1 PRISMA flow diagram (adapted from Moher *et al*[39]) of the literature search (conducted 24 August 2020) and study selection process for this scoping review on the perceived impact of the COVID-19 pandemic on junior medical staff education and training. CINAHL, Cumulative Index to Nursing and Allied Health Literature; ERIC, Educational Resources Information Centre; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

duplicate screen (in which 354 studies were excluded) and exclusion of studies on the basis of date of publication (24 460), 482 (1.9%) titles were deemed eligible for title screen. Following the study protocol, 366 and 42 sources were excluded from the title screen and abstract screen phases, respectively. Studies were removed if they (1) examined perceptions of staff or students other than junior doctors, (2) related to changes in clinical practice rather than education and training, (3) addressed programmatic changes to residency programmes or curriculum (such as the introduction of public health modules) rather than perception of junior medical staff on their education and training (table 2). Full-text review of the remaining 74 sources resulted in exclusion of 42 sources based on the above criteria.

At this stage, a bibliographic search of references in selected sources was undertaken, yielding 47 results. Using the screening process described above, a further four were included in the study. Thus 32 sources were included in the scoping review (figure 1) (online supplemental appendix A).

Study characteristics

The characteristics of sources identified in this scoping review are presented in table 3. Reflecting the rapidly evolving nature of the literature investigating COVID-19, a significant number of publications remained in press at the time of the scoping review, with a similar number having been released in the 2 months preceding the search date, and fewer studies in the earlier months. Despite OVID Medline having been nominated as the primary database for the search and yielding six sources, more sources were identified in both Web of Science (12) and Scopus (9) databases. Due to the large number of countries (17) from which authors published their studies, sources were categorised by continent of origin. The majority of these were from North America (13, 40.6%) and Europe (12, 37.5%), with the remainder from Asia (3, 9.4%), South America (2, 6.3%) and the Middle East (2, 6.3%).

Interestingly, the vast majority (26, 81.3%) of sources were found in surgical journals, with only one (3.1%) identified in an education journal and five other journals. Studies were published in 28 journals. The most common manuscript categories were original/research article (23, 71.9%) and letters to the editor/editorials (6, 18.8%), with the remaining three sources listed as 'education', 'special topic' and 'short communication'. The majority (28, 87.5%) of sources related to cross-sectional studies, with the remaining four (12.5%) being editorials.

Table 3 Publication demographics of sources included in the scoping review on the perceived impact of the COVID-19 pandemic on junior medical staff education and training

Month	May (n=1)	June (n=4)	July (n=7)	August (n=6)	In press (n=14)
	28	10 11 23 24	12–14 29 34 36 38	15 16 25 37 40 41	17–22 26 27 30–33 35 42
Database identified	OVID Medline (n=6)	Embase (n=1)	Web of Science (n=12)	Scopus (n=9)	References (n=4)
	14 23 38 40–42	30	10–12 15 18 20 24 26 32–34 37	13 16 17 19 21 27 28 31 35	22 25 29 36
Number of authors	1–5 (n=13)	6–10 (n=15)	11–15 (n=3)	15–20 (n=0)	20+ (n=1)
	12–14 19 26–28 30 31 34 38 41 42	11 16–18 20–23 25 29 32 33 35 37 40	15 24 36		10
Continent of origin	North America (n=13)	Europe (n=12)	Asia (n=3)	South America (n=2)	Middle East (n=2)
	16 19–21 26–28 30 35–37 40 42	10 14 15 17 22 24 25 29 31–33 41	18 23 34	11 38	12 13
Type of journal	Surgical (n=26)	Education (n=1)	Other (n=5)		
	10–12 14–16 18–20 23–26 28–34 36–38 40–42	35	13 17 21 22 27		
Open access journal	Yes (n=7)	No (n=25)			
	11 13 14 23 28 34 38	10 12 15–22 24–27 29–33 35–37 40–42			
Publication type	Original/research article (n=23)	Letter to editor/editorial (n=6)	Education (n=1)	Special topic (n=1)	Short communication (n=1)
	10–13 16–18 20–24 26 27 31–33 35–38 40 42	25 28–30 34 41	19	14	15
Type of study	Cross-sectional (n=28)	Editorial/perspective (n=4)			
	10–27 31–33 35–38 40–42	28–30 34			

Following exclusion of the four editorials, the mean MERSQI Scores calculated for the references in this scoping review was 8.2 out of a potential total of 18 (online supplemental appendix B). All studies received a score of 0 for validity of the evaluation instrument, as they used new and as yet unvalidated instruments. Sources scoring higher than the mean (13, 46.4%) tended to have a higher response rate, increased complexity of data analysis or higher-level educational outcomes.[10–22]

Study context

In keeping with the PCC structure of a scoping review, the study context was investigated (table 4). The issue of the impact of COVID-19 on education and training was found to be central to most studies (25, 78.1%) and peripheral to the remaining seven (21.9%). During the iterative charting process, we examined whether the surveys were distributed via the programme director (6, 18.8%), a specialty organisation (4, 12.5%), a trainee organisation (4, 12.5%), an accrediting body (3, 9.4%) or otherwise a research or special interest group (2, 6.3%). The response rates, where reported (16, 50.0%), were also collated, and demonstrated a median response rate of 60.9% (IQR 54.5%–85.0%). The greatest proportion of sources reporting response rates to have had no official distribution method (6, 37.5%), followed by a programme direction (3, 18.8%), a trainee organisation (3, 18.8%), a specialty organisation (2, 12.5%) and an accrediting body (2, 12.5%). Further, the direct impact of COVID-19, as defined as participants having had direct contact with COVID-19 positive patients or working in a unit treating COVID-19 positive patients, was examined. Despite these studies investigating the impact of COVID-19, no mention was made of direct contact with COVID-19 in 15 (46.9%), and a relatively even distribution of participants having had contact with COVID-19 patients in other studies. In the eight studies (25.0%) investigating secondment to another specialty, a mean of 26.6% of respondents had been redeployed.[14 16 19 23–27]

Population characteristics

The study population demographics identified in studies were examined (table 5). With participants having been surveyed across more than 20 countries, participant origin was categorised by continent. The largest proportion of participants was from North America (13, 40.6%), with 10 from Europe (31.3%), one from South America (3.1%) and one from the Middle East (3.1%). Interestingly, four (12.5%) studies obtained responses from participants across multiple continents, reflecting the increasingly collaborative nature of research studies. There was a wide spread of specialties reported in this scoping review, predominantly orthopaedic surgery (7, 21.9%), followed by urology (5, 15.6%), neurosurgery (4, 12.5%), otorhinolaryngology (3, 9.4%), general surgery (2, 6.3%) and other surgical specialties (4, 12.5%). Other non-surgical specialties accounted for five (15.6%) studies.

The sources investigated doctors who varied in their level of training. Of the 32 studies identified, the majority were completed by junior medical staff only, residents or trainees (19, 59.4%), the chief or representative resident (3, 9.4%) or combination of fellows and residents (2, 6.3%). The remaining eight (25%) studies contained a heterogeneous population of senior and junior staff, with three (9.4%) obtaining responses from both programme directors and participants (fellows/trainees). Therefore, in addressing the junior medical staff responses specifically, we extracted the number of junior medical staff participants from each study, and identified a distribution of nine (28.1%)

Table 4 Contextual details of studies included in this scoping review on the perceived impact of the COVID-19 pandemic on junior medical staff education and training

COVID-19 impact on education and training	Key concept (n=25)	Peripheral concept (n=7)				
	11 14–20 23–36 38 41 42	10 12 13 21 22 37 40				
% dealt directly with COVID-19 patients	0%–25% (n=4)	26%–50% (n=5)	51%–75% (n=6)	76%–100% (n=2)	No mention (n=15)	
	15 23 24 38	12 13 16 18 33	14 17 22 25 35 40	10 19	11 20 21 26–32 34 36 37 41 42	
Distribution method	Programme director (n=6)	Trainee organisation (n=4)	Specialty organisation (n=4)	Accrediting body (university/board) (n=3)	Research/special interest group (n=2)	No mention/ N/A (n=13)
	16 19 20 31 35 42	10 14 17 24	22 26 27 36	13 21 32	18 41	11 12 15 23 25 28–30 33 34 37 38 40
Response rates	0%–25% (n=2)	26%–50% (n=0)	51%–75% (n=7)	76%–100% (n=5)	N/A (n=4)	No mention (n=12)
	16 27		10 13 15 17 22 33 37	11 12 20 32 40	28–30 34	18 21 23–26 31 35 36 38 41 42

studies with up to 100 junior medical staff respondents, 13 (40.6%) with 101–250 participants, three (9.4%) with 251–500 subjects and three (9.4%) with greater than 500 responses. Four sources, being the four editorials in the scoping review, were not included in this categorisation.

Participant demographics were reported predominantly in reference to age and gender. Of the six (18.8%) studies which reported a mean age of respondents, the median of these means was 29.5 (IQR 29.2–30.4) years. Of the three (9.4%) studies reporting age ranges, an arbitrary distinction of less than 30 years, or greater than (or equal to) 30 years was chosen, and combined, 71.7% of respondents were younger than 30 years of age. One study reported all participants to be in the 25–34 year age range.[11] There was no mention of age in 18 studies. Thirteen (40.6%) studies reported gender, with the median reporting 33.3% female representation (IQR 30.0%–61.6%).

Impact on current training

The primary question of whether the COVID-19 pandemic was perceived to have had an impact on education and training was addressed in 21 (65.6%) of sources (figure 2). Eight of these studies reported a negative impact, whereas the remaining 13 reported the presence or magnitude of impact without specifically defining it in a positive or negative light. Only four studies (12.5%), representing the orthopaedic, urological, neurosurgical and otorhinolaryngological specialties, assessed the importance of education to the participants or authors.[20 28–30]

In determining the overall extent of disruption to training, 24 (75.0%) of sources investigated whether the training programme had been continued through the pandemic. Almost all of these sources (23, 95.8%) reported an increase or continuation of the training programme, with only one reporting a reduction of 33% of respondents.[31] Similarly, 24 (75.0%) examined whether an online platform had been employed for educational purposes. In a significant proportion (21, 87.5%) of references, the training programme continued in a purely online format, whereas two (8.3%) conducted education both online and in-person[18 32] and one (4.2%) reported a change in method for 33% of participants without providing further details.[31] Of note, there were two sources which examined either disruption to training or utilisation of an online platform but not both. Only six (18.8%) addressed the adequacy of supervision during this time, of which four (66.7%) sources noted increased or adequate supervision or emotional support,[13 16 21 33] one (16.7%) noted unavailability of mentors.[22] One study (16.7%) reported approximately 20% of respondents feeling they had inadequate supervision, whereas up to 39% described their supervision as adequate.[14]

Beyond the overall impact of COVID-19, we assessed whether the impact on particular educational modalities, including assessment, had been investigated. In keeping with the larger surgical representation of sources, 28 (87.5%) assessed whether clinical activity had been affected (figure 3). Of these studies, 14 (50.0%) provided quantitative data, resulting in a median of 72.9% (IQR 59.1%–94.4%) of trainees reporting a negative impact on their training. Beyond clinical experience, 17 (53.1%) discussed the impact on didactic training modalities of lectures, tutorials and webinars, whereas 8 (25.0%) addressed journal club and seven (21.9%) investigated the effect on case conferences. With a reduction in time spent performing clinical duties, 14 (43.8%) sources examined the impact on self-directed study. Of these, four (28.6%) reported additional time available for study,[16 19 34 35] and two (14.3%) discussed the additional self-study resources and the ability to widen theoretical knowledge.[25 27]

Table 5 Demographic details of survey respondents in sources included in this scoping review

Continent of origin	North America (n=13)	Europe (n=10)	Asia (n=3)	South America (n=1)	Middle East (n=1)	Multiple continents (n=4)
	16 19–21 26–28 30 35–37 40 42	10 15 17 22 24 25 29 31–33	18 23 34	11	13	12 14 38 41
Specialty	Orthopaedic (n=7)	Urology (n=5)	Neurosurgery (n=4)	ENT (n=3)	General surgery (n=2)	Other surgical* (n=4)
	11 18 30 31 34 40 42	10 15 19 29 38	12 16 28 33	20 32 36	35 37	14 23 26 41
	Combined surgical †(n=2)	Medical (n=1)	All specialties‡ (n=1)	Other§ (n=3)		
	24 25	22	13	17 21 27		
Level of training	Resident/trainee (n=19)	Consultants and junior staff (n=5)	Chief resident/ representative resident (n=3)	Programme director and fellow/resident (n=3)	Fellow and resident (n=2)	
	11 12 14–18 20 23–25 27–29 32–35 38	22 30 31 41 42	21 37 40	19 26 36	10 13	
Number of junior medical staff participants	0–100 (n=9)	101–250 (n=13)	251–500 (n=3)	501–1000 (n=2)	>1000 (n=1)	N/A (n=4)
	11 12 14 27 31 32 36 37 41	13 16 18–22 25 26 33 38 40 42	10 15 17	23 24	35	28–30 34
Age¶	Median (IQR) age (n=6)	Mean %<30 years (n=3)	Mean %>30 years (n=3)	Other (n=1)	N/A (n=4)	No mention (n=18)
	29.5 (29.2–30.4)	71.7	28.3	11	28–30 34	15 16 19–21 24–27 31 33 35–38 40–42
Female (%)	Median (IQR) % (n=13)				N/A (n=4)	No mention (n=15)
	33.3 (30–61.6)				28–30 34	14 16 20 21 24 25 27 31 33 35 36 38 40–42

*Other surgical specialties include Plastic and Reconstructive Surgery; Ophthalmology, Oral and Maxillofacial Surgery and Vascular Surgery.
†Combined surgical specialties denote study populations inclusive of all surgical specialties.
‡All specialties denote study populations inclusive of all junior medical staff from any specialty.
§Other specialties include Obstetrics and Gynaecology, and Radiology.
¶The median age was calculated by obtaining the median of all reported mean ages (six sources). Where population age was reported by percentage of population falling within certain age ranges (three sources), an arbitrary cut-off of 30 years was chosen, and mean percentages of these ranges were obtained. One source (other) reported the entire study population as being between 25 and 34 years of age.

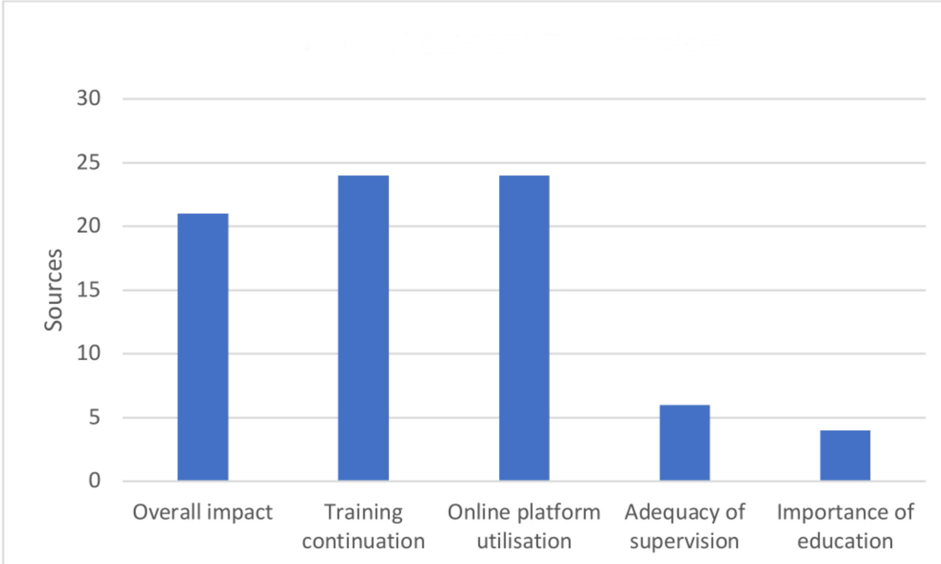

Figure 2 The impact on current training as determined by outcomes measured in studies included in this scoping review, represented graphically and with accompanying explanatory table.

Similarly, 12 (37.5%) references examined the impact of COVID-19 on research. Eight (75%) reported increased time available for research, whereas one study reported an equal proportion of respondents (25%) who thought there was increased or decreased research activity,[24] and one study demonstrated 69.8% of participants reporting moderate or higher disruption to their research activity.[27]

Given the importance of assessment in any curriculum, the impact of COVID-19 on examinations was investigated. Specifically, seven (21.9%) sources examined whether assessments had been impacted, with six of these (85.7%) reporting the cancellation or postponement of examinations and one (14.3%) investigating the utility of online examination.[11] In one of the sources, 74% of trainees thought that the rescheduling of a major examination would result in a worse educational experience.[21]

Impact on training requirements and career progression

The natural extension of the COVID-19 pandemic impacting current education is the implication for satisfying training requirements and career progression (figure 4). Of the 12 (37.5%) sources examining this issue, six (50.0%) reported a majority of survey respondents expressing concern that they would not meet logbook requirements or a satisfactory level of competence on training completion.[17 19 20 22 31 35] With the exception of two sources in which these concerns were in the minority,[16 26] the remaining source discussed but did not quantify the degree of concern.[30 34 36 37]

Addressing potential remedies for the impact on training requirements, eight (25.0%) sources asked whether prolonging training was a consideration. In four of these sources (50.0%),

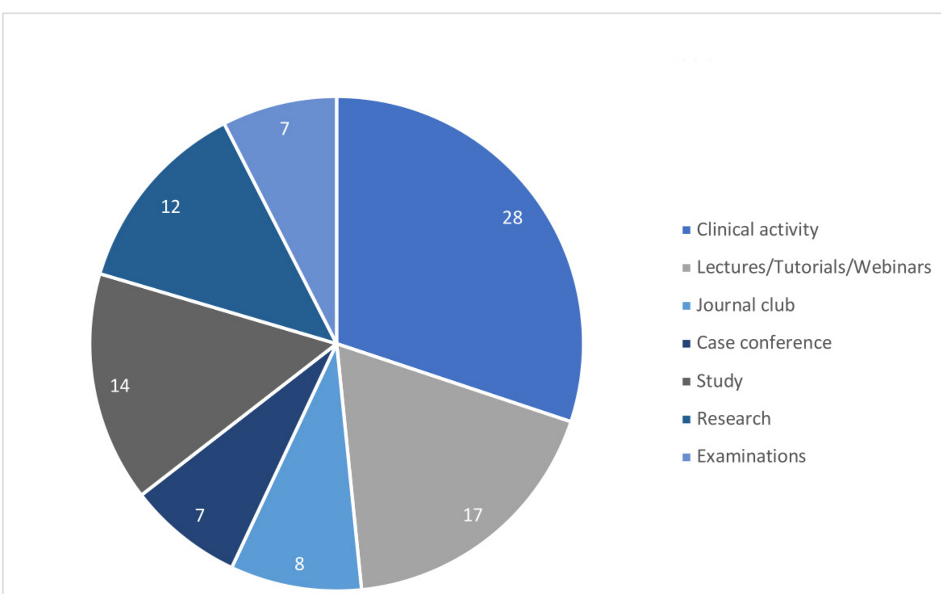

Figure 3 The impact on educational modalities, including assessment, measured in studies included in this scoping review, represented graphically and with accompanying explanatory table.

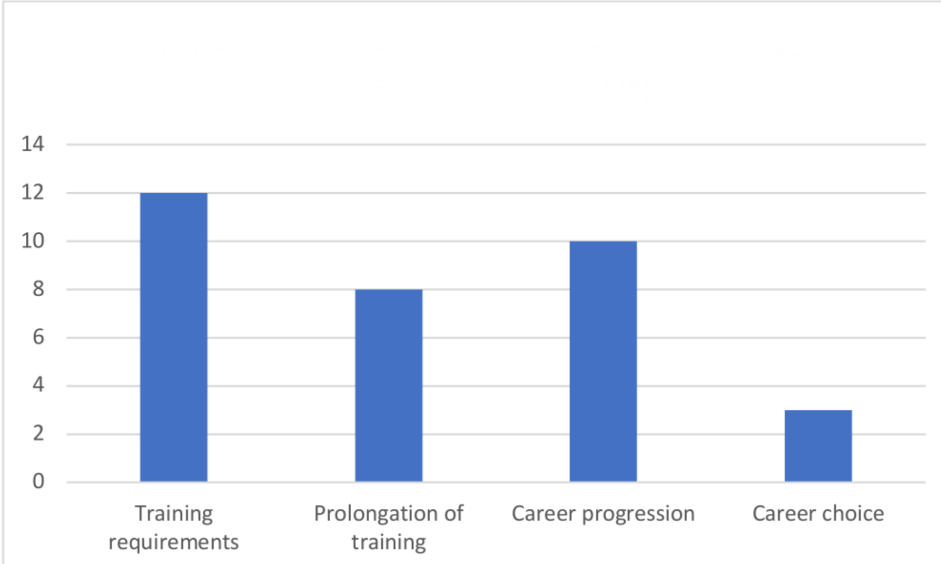

Figure 4 The perceived impact on satisfying training requirements and implications to training and career progression, represented graphically and with accompanying explanatory table.

greater than 40% of respondents were amenable to an extension of training,[22 25 36 38] whereas in two sources (25.0%) the majority of participants thought there should be no prolongation of training.[14 37] Two sources (25.0%) discussed but did not quantify responses to this issue.[20 35]

The COVID-19 pandemic might have introduced uncertainty to trainees regarding their career progression. Ten (31.3%) sources reported concerns from junior medical staff, relating to competence,[37] fellowship planning[16 27] and future career goals.[17 20 24] Three sources reported the postponement of employment discussions or uncertainty regarding anticipated employment.[26 30 36] One source reported participants anticipating an increased likelihood of fellowship, to combat the impacts on training received during the COVID-19 pandemic.[19]

Three (30.0%) of the 10 sources which examined perspectives on career progression also questioned whether the COVID-19 pandemic had impacted the trainees' career choices. These sources demonstrated a range of 12.3%–14.9% of participants who reported that there had been an impact on career choice, either viewing their intended career less favourably or altering their employment ambitions.[16 20 24]

DISCUSSION

It is indisputable that the COVID-19 pandemic has had a profound impact on the healthcare system, both in relation to resources and the provision of care. From a basis of 32 studies, we discuss current and future impacts on junior medical staff education, and identifying publication demographics, future directions for study and the strengths and limitations of this review.

Current impact—disruption

The magnitude of the effect of the COVID-19 pandemic on education should not be underestimated. Every publication in this review specifically addressing this question (n=21) found significant impact that was generally negative. With the demands on the healthcare system due to the COVID-19 response, trainees have been redeployed to other specialties or have experienced significant reductions in their clinical exposure, thus negatively impacting the quality of their education in their specific area of training. Availability of supervisors and mentors was of moderate concern. Online-based teaching has been employed but generally rated as inadequate. Assessment to allow for demonstration of competency has been severely impacted, with some substitute online methods used. No clear guidance or outcomes on the impact of postponed assessment have yet been reported, but the majority of junior doctors do not favour prolonged training. Finally, there has been significant impact on career progression and thus uncertainty, particularly around future anticipated employment, which is destabilising for junior staff. Junior doctors who have been preparing for conferences, meetings and examinations were unable to attend due to either postponement or cancellation.

Current impact—adaptation

Educational programmes have responded to the challenges posed by adapting in the COVID-19 world. Importantly, education has continued despite disruptions to their format, as seen in 95.8% of studies that had continuation or increase in training. This has largely been facilitated by a shift to education via online platforms, which have enabled continuation of teaching. Trainees have shown resilience and flexibility, by showing initiative in using their additional available time for study, research, examination preparation and widening of theoretical knowledge. Programme changes catering for disruption, including adjustments to formal assessments, clinical supervision and competency thresholds, may be required, particularly if the pandemic continues.

Future impact

The logical extension of any disruption to education is the potential impact on a trainee's future—specifically satisfying training requirements and career progression. There is understandable concern that trainees may not meet caseload requirements and therefore obtain adequate experience prior to completion of training. Accordingly, consideration as to the adjustment of requirements might need to be taken, and perhaps trainees be allowed to complete their training with a lesser degree of clinical experience. However, this raises issues of level of competence, which has been identified by trainees as a cause for concern.

Furthermore, given the responsibility of the medical education system to produce graduates who are able to satisfy the healthcare needs of their specific community in a safe manner, the potential to accredit practitioners with less experience may be questionable. To this end, several studies explored trainees' perceptions regarding prolongation of training, though the responses to this are mixed in that some trainees' favoured this while other felt it further disrupted their career progression.

The subsequent stage in many junior doctors' career progression is postgraduate fellowship training. The inability to attain adequate experience for current fellows in post-fellowship training may result in a disruption to trainee advancement as fellows fail to progress through their final stage of supervised education. This may potentially reduce the options available to junior doctors for their careers to progress. Similarly, given the increased clinical independence afforded to fellows, fellowship programmes might express concern over a perceived lack of ability or exposure for potential candidates, and postpone fellowship employment discussions. This, together with a similar scenario relating to other job opportunities, has been experienced by trainees and is a cause for concern.

The upheaval that COVID-19 has wrought on individuals' education may prove a stimulus for trainees to re-evaluate their chosen path in the medical world. As major events are often a cause for reflection, this pandemic might reinforce their desire to practise in their specialty, or stimulate a decision to alter specialty or even medical practice entirely. While there is no indication of what the alternative choices are that have been considered by the 15% of trainees who did consider career change as surveyed, it would be interesting to discover the underlying motives for these changes.

Publication demographics

The existing literature in this area demonstrates the far-reaching impact of the pandemic. Studies have been published worldwide from nearly all continents, with the majority from North America and Europe, perhaps representing the continents which initially suffered the greatest disease burden in the pandemic. The widespread impact on surgery is further evidenced by sources from nearly all surgical specialties being included in this review. A median response rate calculated from those studies reporting response rates was 60.9%, which not only reflects a large degree of interest in this subject, but also adds weight to the generalisability of results from this review.

It was surprising that the majority of journals in which sources were identified were surgical journals given the focus of this review on education and training. However, the reliance of medical education on clinical experience may account for this finding, and is laudable in the importance afforded to education within these clinical publications. Of note, there was only one source identified in an 'internal medicine' journal, published by an internal medical specialty (although somewhat procedurally impacted).[22] It is worth considering the perceptions of junior medical staff in medical specialties (as contrasted against surgical specialties) as to what comprises their education, and how readily qualifiable that process. It may be that surgical specialties distinguish education from training, and have witnessed a significant impact on training, rather than on the educational process as a whole.

Future directions

This scoping review has identified the impact COVID-19 has had on junior medical staff education and training, and has demonstrated the modifications made to training programmes which were clearly necessary. It is plausible that medical education programmes may look on the pandemic as an inflection point, recognising the need for reflection, innovation, pivoting and advancing in new directions. Thus, modifications made due to COVID-19 may be permanent rather than temporary. Therefore, adequate evaluation of the impact of limitations in face to face supervision of tasks, as well as the benefits and impact of providing training via alternative means such as online platforms and their potential permanent incorporation into curricula, is necessary. Similarly, with the concerns raised by trainees regarding their ability to satisfy specific training requirements and assessment of competence, a re-evaluation of competence definitions and curricula is required. This provides an opportunity for future studies in this field to advance current optimal standards for medical education.

Strengths and limitations

A significant strength of performing a scoping review at this time is its inherent iterative nature, which has enabled us to modify our search strategy and outcomes as we have progressed with this review. Despite this, our scoping review has certain limitations. The overriding concern throughout this study was the time-sensitive nature of publication in a rapidly evolving field. First, our search excluded studies in languages other than English. While this decision ensured our ability to proceed with this review rapidly without being encumbered with translation services, it perhaps excluded studies in other languages which address these issues. Second, given the extensive pool of references gleaned in our search, we did not seek more studies from the grey literature, which might have yielded additional results. Third, this process has highlighted something inherent to scoping reviews—the difficulty in comparing studies reporting different outcomes. To that end, the scoping review is an ideal tool for use, in that it seeks to describe the literature rather than analyse the data. Fourth, these results are early findings in a rapidly evolving field. Given the contemporaneous nature of this study in the time of the pandemic, the references examined are all early entrants to an exponentially expanding field, and no doubt there are subsequent studies that will continue to be produced investigating similar concepts. Additionally, apart from the editorials included in our source selection, all studies were cross-sectional studies which were retrospective in nature, and relied on individuals' perceptions and recall. Accordingly, the very nature of these study designs introduces an element of recall bias. The impact of reviewing these studies is the inevitable influence exerted by the publication bias on inclusion of these studies; namely that findings reported are reliant on those existing sources, rather than on independently collated data. Finally, it must be noted that high quality research often is the result of laborious processes and multiple iterations. The need to produce early reports at times comes at the expense of higher quality research. We are impressed with the volume of work that has already been produced, even if, as our MERSQI Scale results demonstrate, the quality of studies might not be as impressive as elsewhere. Even within our study, we have worked rapidly to describe the existing literature. It may be that subsequent studies are produced, which are of greater quality.

CONCLUSION

The impact of the COVID-19 pandemic on junior medical staff education and training has been significant both in terms of current educational programmes and modalities, as well as relating to training requirements and career progression. Whether the changes to education are temporary measures adapting to the pandemic, or permanent fixtures in education, remain to be seen. Furthermore, this pandemic has potentially prompted a re-evaluation of training requirements and the

Main messages

- ► Globally, trainees report substantive (change substantive word) impacts of COVID-19 on surgical education and training.
- ► Most research papers are set in the context of surgical education and training.
- ► The pandemic has provided an opportunity to re-evaluate contemporary design of surgical education and training.

Current research questions

- ► What is known about the perceptions of junior medical staff regarding the impact of the COVID-19 pandemic on their education and training?
- ► What are the publication demographics of sources investigating the impact of the COVID-19 pandemic on education and training?
- ► What is the impact of the COVID-19 pandemic on training requirements and career progression?

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Self-assessment questions

1. The MERSQI as an instrument used to evaluate the quality of medical education research reports. True/false
2. The main impact of the COVID-19 pandemic has been on available study time. True/false
3. The reduced exposure to the clinical environment has afforded junior doctors more time for other educational modalities. True/false
4. The impact of the COVID-19 pandemic is far-ranging, affecting career progression and choices. True/false
5. A scoping review is intended to describe the existing literature and form a foundation for future study. True/false

assessment of competence within training. While the effects of the disruptions resulting from COVID-19 have been alluded to in this early study, the lingering impact remains to be seen.

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Answers

1. True
2. False
3. True
4. True
5. True