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The perceived global impact of the COVID-19 pandemic on doctors' medical and surgical training: An international survey

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Abstract

Introduction: The COVID-19 pandemic has resulted in a significant burden on healthcare systems causing disruption to the medical and surgical training of doctors globally.

Funding information
The study was wholly funded by The Master Surgeon Trust (UK Small Charity EW03332). No external funding was received.

Aims and Objectives: This is the first international survey assessing the perceived impact of the COVID-19 pandemic on the training of doctors of all grades and specialties.
Methods: An online global survey was disseminated using Survey Monkey® between 4th August 2020 and 17th November 2020. A global network of collaborators facilitated participant recruitment. Data were collated anonymously with informed consent and analysed using univariate and adjusted multivariable analyses.
Results: Seven hundred and forty-three doctors of median age 27 (IQR: 25-30) were included with the majority (56.8%, n = 422) being male. Two-thirds of doctors were in a training post (66.5%, n = 494), 52.9% (n = 393) in a surgical specialty and 53.0% (n = 394) in low- and middle-income countries. Sixty-nine point two percent (n = 514) reported an overall perceived negative impact of the COVID-19 pandemic on their training. A significant decline was noted amongst non-virtual teaching methods such as face-to-face lectures, tutorials, ward-based teaching, theatre sessions, conferences, simulation sessions and morbidity and mortality meetings ($P \leq .05$). Low or middle-income country doctors' training was associated with perceived inadequate supervision while performing invasive procedures under general, local or regional anaesthetic. ($P \leq .05$).
Conclusion: In addition to the detrimental impact of the COVID-19 pandemic on healthcare infrastructure, this international survey reports a widespread perceived overall negative impact on medical and surgical doctors' training globally. Ongoing adaptation and innovation will be required to enhance the approach to doctors' training and learning in order to ultimately improve patient care.

1 | INTRODUCTION

On the 11th March 2020, the World Health Organisation declared a pandemic following an outbreak of the severe acute respiratory syndrome 2 (SARS-CoV-2) virus. This resulted in an almost immediate and significant burden on healthcare systems globally,[1-5] resulting in the implementation of emergency strategies such as the cancellation of elective services, and re-allocation of the medical and surgical workforce in order to maintain patient safety.[6-9] The medical and surgical workforces were required to rapidly adapt to the dynamic needs of healthcare systems. Social distancing rules limited gatherings and mandated people staying at home except in specific circumstances, thus restricting the delivery of traditional training for doctors.

As intensive care units expanded to accommodate the influx of deteriorating patients, many doctors were mobilised from their respective specialties. A proportion of the workforce was requested to remain on standby from home to minimise viral exposure, whilst others were re-deployed to cover rota deficiencies.[10-12] Surgical trainees were occasionally restricted from attending operating lists, with procedures predominantly undertaken by the most senior staff in order to reduce operating time, preserve PPE, whilst minimising viral spread.[12]

In an attempt to salvage training opportunities, online platforms such as Microsoft Teams and Zoom were utilised to deliver virtual lectures, webinars and conferences, while simulation models were

What's known

- The COVID-19 pandemic has significantly impacted the training of medical and surgical doctors globally because of redeployment and reduced exposure to training opportunities derived from elective surgery, face-to-face clinics and teaching sessions.

What's new

- This is the first international survey assessing the perceived impact of the COVID-19 pandemic on the training of doctors of all grades and specialties.
- It highlights that 69.2% of participants reported an overall perceived negative impact of the COVID-19 pandemic on their training.
- A significant decline was noted amongst non-virtual teaching methods such as face-to-face lectures, tutorials, ward-based teaching, theatre sessions, conferences, simulation sessions and morbidity and mortality meetings.
- Low and middle-income country doctors' training was associated with perceived inadequate supervision, while performing invasive procedures under general, local or regional anaesthetic.

introduced to facilitate procedural skills training in some centres.[13-16] It is hypothesised that the impact of the pandemic on doctors' perceived confidence in clinical skills, career progression and mental health is likely to be significant.

The primary aim of this survey was to assess doctors' perceived impact of the COVID-19 pandemic on surgical and medical training and learning globally.

2 | METHOD

2.1 | Survey setting and design

This electronic cross-sectional study was designed and conducted as a survey by TMS Collaborative (The Master Surgeon Trust, United Kingdom [UK], HMRC small medical education charity reference: EW03332), and disseminated using the SurveyMonkey (San Mateo, California, USA) online platform between 4th August 2020 and 17th November 2020. Informed consent was obtained from all participants and recorded electronically. Research ethics committee approval was not required and this was confirmed using the UK Health Research Authority "Is my study research?" online decision tool (http://www.hra-decisiontools.org.uk/research; Document S1).[17] The questionnaire can be found in the supplementary documents (Document S2). Data were anonymously collected, stored and analysed in compliance with the General Data Protection Regulations (GDPR) of the European Union.[18]

2.2 | Survey participation

Medical and surgical doctors globally of all grades, aged 18 or over and currently employed were eligible to participate. Promotional strategies included electronic mail and social media platforms (Facebook, LinkedIn and Twitter) by an international team of volunteer collaborators. Participant email and IP addresses were stored and audited as an internal quality control measure in order to remove duplicates.

2.3 | Independent variables

This survey collected 19 independent variables including participant demographic data including age, gender and country of residence; current stage of training, specialty/ sub-specialty; a diagnosis of symptomatic COVID-19 infection; redeployment status; a change in clinical responsibility, working hours and teaching modalities (*non-virtual*: lectures, tutorials, ward-based teaching, operating theatre, conferences and simulation sessions; *virtual*: online lectures, tutorials, webinars and conferences).

2.4 | Participant experiences and outcomes

Data were collected on doctors' perceived impact of the COVID-19 pandemic on their training and learning (Table 3). The impact on their preparation for the next stage of training, confidence in clinical and procedural skills and choice of future career speciality were also evaluated. Changes in the levels of clinical supervision relating to clinical tasks (clerking/ admissions, clinical procedures under local/ regional/ general anaesthesia and independently assessing or managing acutely unwell patients) were crucially elicited. The overall perceived impact of the pandemic on training and learning was scored using a Likert scale.

2.5 | Data analysis

Data were collated using Excel (Microsoft, Redmond, Washington, USA) and non-parametric data represented as median and interquartile range (IQR). Categorical data were summarised in tables as proportions and percentages. Countries of residence were based on the data from the World Bank and categorised as low-, middle- or high-income.[19] Doctors' responses in the form of Likert scales and categorical ranges were combined to generate binary data. Statistical analysis was performed using SPSS (IBM, New York, USA). Univariate (un-adjusted) analysis was performed using χ^2 tests to assess the association amongst 19 independent variables (Tables 1 and 2) and doctors reported an overall negative impact on training and learning. Univariate (un-adjusted) analysis was used to assess the association amongst doctors' training experiences (Table 3) and training status or economic status of the country of residence. Multivariable (adjusted) analysis using a binary logistic regression analysis was performed amongst the 19 independent variables and perceived overall negative impact on training and learning (Table 4). These results were displayed as odds ratios (OR) and 95% confidence intervals. A *P*-value of $<.05$ was defined as the level of statistical significance.

3 | RESULTS

The median age of our cohort was 27 (IQR: 25-30). Male doctors accounted for 56.8% (n = 422) of participants. Two-thirds of all doctors were in a training post (66.5%, n = 494), while 33.5% doctors (n = 808) were in a non-training post. The majority of respondents within the cohort (82.9%, n = 616) were categorised as junior doctors (foundation year, house officers, senior house officers, core medical trainees, core surgical trainees), whilst only 17.1% (n = 127) were categorised as senior doctors (registrars, ST3 and above or equivalent). More than half of the respondents (52.9%, n = 393) were working within a surgical specialty, whilst 47.1% were working in a non-surgical specialty. Increased working hours were reported for 35.0% (n = 260); 36.3% (n = 270) reported undergoing redeployment and 56.0% (n = 416) reported increased clinical responsibility. Doctors from low and middle-income countries comprised 53.0% (n = 394) of the study cohort, while 47.0% (n = 349) worked in high-income countries. A full list of participant countries of residence is included in Document S3. Nineteen percent (n = 141) reported contracting symptomatic Covid-19 infection at the time this survey was completed.

TABLE 1 Factors associated with doctors-reported overall negative impact on training/learning during the COVID-19 pandemic

	Total	Reported an overall negative impact on training/learning		
	n (%)	Yes (%)	No (%)	*P*-value[a]
Total	743 (100)	514 (69.2)	229 (30.8)	—
Age (y)				
≤27	514 (69.2)	316 (61.5)	138 (38.5)	
>27	229 (30.8)	198 (86.5)	91 (13.5)	.753
Gender				
Male	422 (56.8)	231 (72.0)	90 (28.0)	
Female	321 (43.2)	283 (67.1)	139 (32.9)	.152
Doctor training status				
Currently in training	494 (66.5)	361 (73.1)	133 (26.9)	
Currently not in training	249 (33.5)	153 (61.4)	96 (38.6)	.001
Doctor grade				
Junior	616 (82.9)	422 (68.5)	194 (31.5)	
Senior	127 (17.1)	92 (72.4)	35 (27.6)	.382
Specialty				
Surgical	393 (52.9)	268 (68.2)	125 (31.8)	
Non-surgical	350 (47.1)	246 (70.3)	104 (29.7)	.538
Redeployed				
Yes	270 (36.3)	198 (73.3)	72 (26.7)	
No	473 (63.7)	316 (66.8)	157 (33.2)	.064
Increased clinical responsibility				
Yes	416 (56.0)	282 (67.8)	134 (32.2)	
No	327 (44.0)	232 (70.9)	95 (29.1)	.355
Increased working hours				
Yes	260 (35.0)	174 (66.9)	86 (33.1)	
No	483 (65.0)	340 (70.4)	143 (29.6)	.329
Resident nation economic status				
Low/middle income	394 (53.0)	265 (67.3)	129 (32.7)	
High income	349 (47.0)	249 (71.3)	100 (28.7)	.228
Contracted symptomatic COVID-19 infection[b]				
Yes	141 (19.0)	93 (66.0)	48 (34.0)	
No	602 (81.0)	421 (69.9)	181 (30.1)	.357

[a]Pearson χ^2 statistical test used for univariate analysis to obtain *P*-values.

[b]Includes all with symptoms and diagnosed on a PCR swab test, antibody test, or by a clinician or self-diagnosed based on symptoms as per the World Health Organisation criteria.

Doctors reported a perceived decline in face-to-face lectures (66.5%, n = 494), tutorials (54.8%, n = 407), ward-based teaching (62.3% n = 463), morbidity and mortality meetings (38.8%, n = 288), operating theatre sessions (61.0%, n = 453), conferences (64.9%, n = 482) and simulation sessions (45.1%, n = 335). However, doctors reported a perceived increase in the utilisation of virtual learning

TABLE 2 Changes in teaching methods during the pandemic and association with doctors reported an overall negative impact on medical and surgical training

	Total	Reported an overall negative impact on training/learning		
	n (%)	Yes (%)	No (%)	*P*-value[a]
Total	743 (100)	514 (69.2)	229 (30.8)	
Non-virtual teaching methods				
Lectures				
Declined	494 (66.5)	376 (76.1)	118 (23.9)	
Did not report a decline[b]	249 (33.5)	138 (55.4)	111 (44.6)	<.001
Tutorials				
Declined	407 (54.8)	304 (74.7)	103 (25.3)	
Did not report a decline[b]	336 (45.2)	210 (62.5)	126 (37.5)	<.001
Ward-based teaching sessions				
Declined	463 (62.3)	350 (75.6)	113 (24.4)	
Did not report a decline[b]	280 (37.7)	164 (58.6)	116 (41.4)	<.001
Theatre sessions				
Declined	453 (61.0)	331 (73.1)	122 (26.9)	
Did not report a decline[b]	290 (39.0)	183 (63.1)	107 (36.9)	.004
Conferences				
Declined	482 (64.9)	370 (76.8)	112 (23.2)	
Did not report a decline[b]	261 (35.1)	144 (55.2)	117 (44.8)	<.001
Simulation sessions				
Declined	335 (45.1)	256 (76.4)	79 (23.6)	
Did not report a decline[b]	408 (54.9)	258 (63.2)	150 (36.8)	<.001
Morbidity and mortality meetings				
Declined	288 (38.8)	213 (74.0)	75 (26.0)	
Did not report a decline[b]	455 (61.2)	301 (66.2)	154 (33.8)	.025
Virtual teaching methods				
Online lectures				
Increased	590 (79.4)	413 (70.0)	177 (30.0)	
Did not report an increase[c]	153 (20.6)	101 (66.0)	52 (34.0)	.341
Webinars				
Increased	558 (75.1)	396 (71.0)	162 (29.0)	
Did not report an increase[c]	185 (24.9)	118 (63.8)	67 (36.2)	.067

[a]Pearson χ^2 statistical test used for univariate analysis to obtain *P*-values.

[b]Includes all participants who reported increased, significantly increased, no change and not applicable

[c]Includes all participants who reported decreased, significantly decreased, no change and not applicable.

TABLE 3 Doctors experiences during the pandemic by resident nation economic status and training status

	Total	Resident of low/middle income country			Doctor currently in training programme		
	N (%)	Yes (%)	No (%)	*P*-value[a]	Yes (%)	No (%)	*P*-value[a]
Total		394 (100.0)	349 (100.0)		494 (100.0)	249 (100.0)	
Examinations							
Reported postponement	306 (41.2)	166 (42.1)	140 (40.1)		199 (40.3)	107 (43.0)	
Did not report a postponement	437 (58.8)	228 (57.9)	209 (59.9)	.577	295 (59.7)	142 (57.0)	.482
Choice of career specialty							
Negatively affected	405 (54.5)	243 (61.7)	162 (46.4)		262 (53.0)	143 (57.4)	
Not negatively affected	338 (45.5)	151 (38.3)	187 (53.6)	<.001	232 (47.0)	106 (42.6)	.256
Postponement of next stage of career							
Reported negatively affected	418 (56.3)	263 (66.8)	155 (44.4)		262 (53.0)	156 (62.7)	
Did not report being affected	325 (43.7)	131 (33.2)	194 (55.6)	<.001	232 (47.0)	93 (37.3)	.013
Preparation for next stage of training							
Reported preparation affected	509 (68.5)	282 (71.6)	227 (65.0)		367 (74.3)	142 (57.0)	
Did not report being affected	234 (31.5)	112 (28.6)	122 (35.0)	.056	127 (25.7)	107 (43.0)	<.001
Confidence in clinical skills							
Reported negatively affected	535 (72.0)	294 (74.6)	241 (69.1)		367 (74.3)	168 (67.5)	
Did not report negatively affected	208 (28.0)	100 (25.4)	108 (30.9)	.092	127 (25.7)	81 (32.5)	.051
Clerking patients without adequate supervision							
Reported	303 (40.8)	169 (42.9)	134 (38.4)		209 (42.3)	94 (37.8)	
Did not report	440 (59.2)	225 (57.1)	215 (61.6)	.213	285 (57.7)	155 (62.2)	.233
Performing invasive procedures under GA without adequate supervision							
Reported	140 (18.8)	90 (22.8)	50 (14.3)		87 (17.6)	53 (21.3)	
Did not report	603 (81.2)	304 (77.2)	299 (85.7)	.003	407 (82.4)	196 (78.7)	.227
Performing invasive procedures under LA or RA without adequate supervision							
Reported	208 (28.0)	125 (31.7)	83 (23.8)		140 (28.3)	68 (27.3)	
Did not report	535 (72.0)	269 (68.3)	266 (76.2)	.016	354 (71.7)	181 (72.7)	.768
Assessing or managing acutely unwell patients without adequate supervision							
Reported	283 (38.1)	182 (46.2)	101 (28.9)		190 (38.5)	93 (37.3)	
Did not report	460 (61.9)	212 (53.8)	248 (71.1)	<.001	304 (61.5)	156 (62.7)	.768

[a]Pearson χ^2 statistical test used for univariate analysis to obtain *P*-values.

resources (79.4%, n = 590) and webinars (75.1%, n = 558). Less than half of all doctors reported postponement of examinations (41.2%, n = 306).

Over two-thirds of respondents reported an overall perception that preparation for their next stage of training was adversely affected (68.5%, n = 509), as was a decision regarding future career pathway (54.5%, n = 405). Career progression was perceived to be negatively affected in over half of responses collated (56.3%, n = 418). An overwhelming majority of doctors (72.0%, n = 535) reported reduced confidence in performing clinical skills, coupled with perceived reduced overall supervision when clerking patients (40.8%, n = 303). Respondents reported a perception of inadequate supervision while performing invasive procedures under general anaesthetic (18.8%, n = 140), invasive procedures under local anaesthetic (28.0%, n = 208) and managing acute emergencies (38.1%, n = 283).

3.1 | Factors associated with an overall negative impact on doctors' training

Overall, 69.2% (n = 514) doctors reported a perceived overall negative impact of the COVID-19 pandemic on their medical or surgical training and learning. Factors associated with an overall perceived negative impact on training and learning in univariate analysis included: doctors in a training post, a decline in face-to-face lectures, tutorials, ward-based teaching, operating theatre sessions, conferences, simulation sessions and morbidity and mortality meetings ($P < .05$; Tables 1 and 2). Age, gender, seniority of doctors, specialty, redeployment status, increased clinical responsibility, increased working hours, economic status of resident country, COVID-19 infection status and increased online lectures and webinars did not significantly affect the overall perceived

TABLE 4 Adjusted analysis of factors associated with doctors reporting an overall negative impact on training/learning during the COVID-19 pandemic

Risk factor	Overall negative impact on doctor's training/learning. OR (95% CI), *P*-value
Age <27	1.1 (0.7-1.6); $P = .744$
Female gender	1.4 (1.0-1.9); $P = .084$
Doctor in training	**1.5 (1.0-2.1); $P = .027$**
Junior doctor	0.8 (0.5-1.4); $P = .459$
Low/Middle-income country	1.0 (0.7-1.5); $P = .798$
COVID-19 infection	0.8 (0.5-1.2); $P = .311$
Redeployment	1.1 (0.8-1.7); $P = .510$
Increased clinical responsibility	0.8 (0.6-1.2); $P = .379$
Increased working hours	0.8 (0.5-1.1); $P = .186$
Decreased tutorials (non-virtual)	0.9 (0.6-1.3); $P = .522$
Decreased ward-based teaching	**1.7 (1.2-2.5); $P = .007$**
Decreased theatre opportunities	1.0 (0.7-1.5); $P = .809$
Decreased simulation training	1.3 (0.9-1.9); $P = .170$
Decreased lectures (non-virtual)	**1.6 (1.0-2.4); $P = .034$**
Increased online lectures	0.9 (0.6-1.4); $P = .546$
Increased webinars	1.3 (0.8-2.0); $P = .252$
Decreased morbidity and mortality meetings	0.8 (0.6-1.2); $P = .361$
Decreased conferences	**2.0 (1.4-3.0); $P < .001$**
Surgical specialties	0.9 (0.7-1.3); $P = .631$

Note: Binary logistic regression analysis was performed with 19 independent variables. Significant results have been highlighted in bold.

negative impact of the COVID-19 pandemic on doctors' training and learning.

Covariate-adjusted binary logistic regression analysis was performed for 743 participants and 19 independent variables (Tables 1 and 2) comparing participants who reported a perceived overall negative impact on training as the outcome variable. Associated factors included: doctors in a training post (OR 1.5 (1.0-2.1); $P = .027$), decreased ward-based teaching (OR 1.7 (1.2-2.5); $P = .007$), decreased face-to-face lectures (OR 1.6 (1.0-2.4); $P = .034$) and decreased conferences (OR 2.0 (1.4-3.0); $P < .001$) (Table 4).

3.2 | Doctors' experiences during the COVID-19 pandemic

Univariate analysis demonstrated that when compared with doctors working in high-income countries, the doctors residing in low- or middle-income countries were associated with a greater perceived negative impact on their choice of career specialty (61.7% vs 46.4%), postponement of the next stage of training (66.8% vs 44.8%) and perceived inadequate supervision while performing the invasive procedure under general anaesthesia (22.8% vs 14.3%), local or regional anaesthesia (31.7% vs 23.8%) ($P < .001$; Table 3). Doctors who were not in a training post were associated with a postponement in the next stage of their career, while doctors currently in a training post were associated with a perceived negative impact on preparation for their next stage of training ($P < .001$).

4 | DISCUSSION

Amongst the 743 doctors surveyed, the majority of participants reported a perceived overall negative impact of the COVID-19 pandemic on their training and learning with associated factors including: doctors in a training post, a decline in face-to-face lectures, tutorials, ward-based teaching, theatre sessions, conferences, simulation sessions and morbidity and mortality meetings.

With rising concerns for the quality of medical and surgical training amongst doctors worldwide, the workforce has witnessed tremendous adaptation and innovation.[20] Digital resources such as video teleconferencing, virtual lectures, grand rounds, case conferences, journal clubs, webinars and e-books have been shown to supplement traditional bedside teaching and enhance both theoretical knowledge and technical skill acquisition.[21] This has recently been utilised in a flipped classroom model to enhance training efficacy through a global exchange of knowledge.[22,23] With the ease of access to information, it is equally imperative that doctors seek high-quality online educational content from reputable sources. Surgical simulators and virtual reality platforms have the ability to enhance technical skill amongst doctors with the benefit of reflection and discussion in a risk-free environment.[13,24,25]

As the majority of face-to-face academic conferences were cancelled, trainees missed out on the opportunity to present and discuss their research findings, thus impacting their learning. With the increasing utilisation of virtual conference platforms such as MedAll, conferences have resumed and are once again providing trainees with the opportunity to share knowledge globally.[26] In this survey, a decline in conferences was associated with doctors being twice as likely to report an overall negative impact on training and learning.

The Royal College of Surgeons had suspended examinations by 16th March 2020.[27] The 2020 UK GMC survey highlighted that 80% of doctors reported limited access to learning required to facilitate career progression because of the COVID-19 pandemic.[28] A review of UK trainee logbooks identified a 50% reduction in operations with trainees as the primary operating surgeon in 2020 compared with 2019.[29] The COVIDSTAR survey highlighted that 41% of surgical trainees within the UK and the Republic of Ireland underwent redeployment.[30] Our findings in this global survey of medical and surgical doctors demonstrated a similar redeployment rate of 36.3%. At the Annual Review of Competency Progression for senior UK surgical trainees, 12% were identified as "delayed due to COVID-19."[31] Moving forward, urgent restoration of operating theatre training opportunities will be crucial to achieve surgical competencies required for continued career progression.[32] Despite the disruption to training for junior doctors undergoing redeployment to intensive care

units and medical wards, the opportunity for enhancing communication and collaboration amongst different medical teams should not be overlooked as this skill is invaluable for developing higher calibre trainees.[33,34]

Our survey revealed that a proportion of doctors globally felt inadequately supervised while performing invasive clinical procedures under local or regional anaesthesia (28.0%) and general anaesthesia (18.8%). This perception was more commonly reported amongst doctors working in low-and middle-income countries compared with high-income countries. Moving forward, it is important that doctors highlight situations where they require additional support and supervision and communicate those concerns to senior doctors within the clinical teams in order to maintain high standards of patient safety.[27] In 2016, a systematic review of postgraduate surgical education in low and middle-income countries highlighted that limited financial resources and trainers at teaching sites alongside competing needs for both clinical and educational trainer responsibilities often limited their ability to provide adequate supervision for surgical trainees compared with high-income countries.[35] Cecilio-Fernandes et al recently outlined challenges in using technology for medical education in low and middle-income countries including faculty shortage, areas of unreliable internet connectivity or electricity and difficulty in adapting medical curricula from face-to-face to online delivery.[36] The COVID-19 pandemic may have exacerbated these circumstances in areas with limited access to online and simulation learning resources. This may be linked to our survey findings where the majority of doctors working in low and middle-income countries reported a perceived negatively affected choice of future career specialty (61.7%) and postponement of their next career stage (55.8%) because of the pandemic. The opposite trend was observed amongst doctors from high-income countries where the minority reported a perceived negative impact on the choice of career specialty (46.4%) and postponement of next stage of career (44.4%).

The physical fatigue and mental stress associated with working as a healthcare professional during the pandemic have likely contributed to the negative impact on doctors' training.[37-39] A UK survey of mental health disorders amongst 2638 healthcare workers in 2020 highlighted prevalence rates of clinically significant symptoms of anxiety, depression and PTSD in 34.3%, 31.2% and 24.5% of the cohort respectively.[39] As we emerge from the COVID-19 pandemic, concerted efforts to reconfigure both medical and surgical education and provide ongoing support for doctors' mental health will be paramount in order for trainees to achieve essential skills and milestones. The resumption of outpatient clinic appointments and elective surgery will hopefully facilitate an influx of training opportunities that need to be maximised.[40] In the UK, current trends being adopted include introducing elective surgical training within the independent sector, individualising training trajectories, expanding e-learning and simulation platforms for all specialties and establishing online examinations.[32] Acknowledgement of the negative impact of the COVID-19 pandemic on doctors' learning and flexibility surrounding doctors' portfolios and learning requirements will be imperative to enable them to achieve their maximum potential moving forward.[41-44] The COVID-19 pandemic is likely to encourage and inspire medical professionals to change their approach to training and learning which will ultimately improve the care we offer to our patients.

4.1 | Strengths and limitations

To the best of our knowledge, this is the first international survey assessing the perceived impact of the COVID-19 pandemic on both medical and surgical doctors of all grades and specialties. It positively contributes to the existing evidence base to allow clinicians to better understand how training has been impacted in order to inform strategies to enhance the quality of doctors of the future as we emerge from the pandemic.

The external validity of these findings may be limited by the sample size of 743 participants. Although the results demonstrated no statistically significant differences amongst participant gender, age, stage of training, resident country economic status and specialties, there is a risk of sampling bias within this survey. Participants with negative training experiences may have been more likely to respond, thus affecting the reliability of results. Participants may have also experienced response bias based on the wording of the questionnaire.

5 | CONCLUSION

Our international survey reports the perceived overall negative impact of the COVID-19 pandemic on medical and surgical doctors' training globally. Lessons learnt in adaptation and innovation will certainly serve as a stimulus to enhance the delivery of training and learning for doctors in order to ultimately improve patient care.

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DISCLOSURE

The authors declared no conflict of interest.

AUTHOR CONTRIBUTIONS

See Appendix A. The paper was written by the writing committee. The survey design, operations management and data analysis were performed by the writing committee and steering committee. The remaining collaborators recruited participants for the survey.

ETHICAL APPROVAL

Research ethics committee approval was not required for this non-experimental cross-sectional survey and this was confirmed using the UK Health Research Authority "Is my study research?" online decision

tool (http://www.hra-decisiontools.org.uk/research; Supplementary Document 1). Informed consent was obtained from all participants and recorded electronically at the start of the survey. Data were processed confidentially, anonymously and in compliance with the General Data Protection Regulations (GDPR) of the European Union.

STATISTICAL ANALYSIS

Statistical analysis was performed by Dr Kasun Wanigasooriya and Dr Ryan Laloo.

DATA AVAILABILITY STATEMENT

All relevant data and results included in this article have been published along with the article and its supplementary information files. Anonymised data can be obtained on reasonable request from the corresponding author.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the Supporting Information section.

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APPENDIX A

Corporate authorship title

The TMS Collaborative

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