

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

**Running title:** COVID-19 and doctors' training

## **Abstract**

### **Introduction**

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

### **Aims and objectives**

This is the first international survey assessing the perceived impact of the COVID-19 pandemic on training of doctors of all grades and specialties.

### **Methods**

An online global survey was disseminated using Survey Monkey® between 4<sup>th</sup> August 2020 and 17<sup>th</sup> November 2020. A global network of collaborators facilitated participant recruitment. Data was collated anonymously with informed consent and analysed using univariate and adjusted multivariable analysis.

### **Results**

743 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. 69.2% (n=514) reported an overall perceived negative impact of the COVID-19 pandemic on their training. A significant decline was noted among non-virtual teaching methods such as face-to-face lectures, tutorials, ward-based teaching, theatre sessions, conferences, simulation sessions and morbidity and mortality meetings ( $p \leq 0.05$ ). Doctors from low or middle-income countries were associated with perceived inadequate supervision while performing invasive procedures under general, local or regional anaesthetic. ( $p \leq 0.05$ )

### **Conclusion**

In addition to the detrimental impact of the COVID-19 pandemic on healthcare infrastructure, there has been an indirect consequence of disrupted training within medical and surgical subspecialties. A focus on reconfiguration of training programs through a variety of additional resources will become imperative to reduce the long-term sequelae of COVID-19 on doctors' training.

**Keywords:** COVID-19, medical education, medical training, surgical training, doctors

### **What is already known about this topic?**

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

### **What does this article add?**

This is the first international survey assessing the perceived impact of the COVID-19 pandemic on 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 among non-virtual teaching methods such as face-to-face lectures, tutorials, ward-based teaching, theatre sessions, conferences, simulation sessions and morbidity and mortality meetings. Doctors from low or middle-income countries were associated with perceived inadequate supervision while performing invasive procedures under general, local or regional anaesthetic.

## **Introduction**

On the 11<sup>th</sup> 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<sup>1-5</sup>, resulting in the implementation of emergency strategies such as cancellation of elective services, and re-allocation of the medical and surgical workforce in order to maintain patient safety.<sup>6-9</sup> The medical and surgical workforce 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 exceptional circumstances, thus restricting 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 were requested to remain on standby from home to minimise viral exposure, whilst others were re-deployed to cover rota deficiencies.<sup>10-12</sup> Surgical trainees were occasionally restricted from attending operating lists, with procedures predominantly undertaken by the senior most staff in order to reduce operating time, preserve PPE, whilst minimising viral spread.<sup>12</sup>

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

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

## **Method**

### **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 4<sup>th</sup> August 2020 and 17<sup>th</sup> 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>; Supplementary Document 1).<sup>17</sup> The questionnaire can be found in the supplementary documents (Supplementary Document 2). Data was anonymously collected, stored and analysed in compliance with the General Data Protection Regulations (GDPR) of the European Union.<sup>18</sup>

### **Survey participation**

Medical and surgical doctors globally of all grades, aged eighteen 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.

### **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).

### **Participant experiences and outcomes**

Data was 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) was crucially elicited. The overall perceived impact of the pandemic on training and learning was scored using a Likert scale.

### **Data analysis**

Data was collated using Excel (Microsoft, Redmond, Washington, USA) and non-parametric data represented as median and interquartile range (IQR). Categorical data was summarised

in tables as proportions and percentages. Countries of residence were based on data from the World Bank and categorised as low-, middle- or high-income.<sup>19</sup> 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  $\chi^2$ -tests to assess the association among 19 independent variables (Table 1 and Table 2) and doctors reported overall negative impact on training and learning. Univariate (un-adjusted) analysis was used to assess the association among doctors' training experiences (Table 3) and training status or economic status of country of residence. Multivariable (adjusted) analysis using a binary logistic regression analysis was performed among 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 <0.05 was defined as the level of statistical significance.

## 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 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 Supplementary Document 3. 19.0% (n=141) reported contracting symptomatic Covid-19 infection at the time this survey was completed.

Doctors reported a 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 an increase in the utilisation of virtual learning 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 reduced overall supervision with respect to clerking patients (40.8%, n=303). Respondents also felt inadequately supervised 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).

### **Factors associated with an overall negative impact on doctors' training.**

Overall, 69.2% (n=514) doctors reported that the Covid-19 pandemic had a negative impact on their medical or surgical training and learning. Factors associated with an overall negative impact on training and learning in a 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 ( $p < 0.05$ ; Table 1 and Table 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 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 (Table 1 and Table 2) comparing participants reported 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);  $p < 0.001$ ) (Table 4).

### **Doctors' experiences during the COVID-19 pandemic**

Univariate analysis demonstrated that the doctors who were residents of low- or middle-income countries were associated with a greater 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 felt inadequately supervised while performing invasive procedure under general anaesthesia (22.8% vs 14.3%), local or regional anaesthesia (31.7% vs 23.8%) ( $p < 0.001$ ; 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 ( $p < 0.001$ ).

## **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.<sup>20</sup> 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.<sup>21</sup> This has recently been utilised in a flipped classroom model to enhance training efficacy through a global exchange of knowledge.<sup>22,23</sup> 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 among doctors with the benefit of reflection and discussion in a risk-free environment.<sup>13,24,25</sup>

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.<sup>26</sup> 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 March 16<sup>th</sup> 2020.<sup>27</sup> The 2020 UK GMC survey highlighted that 80% of doctors reported limited access to learning required to facilitate career progression due to the COVID-19 pandemic.<sup>28</sup> A review of UK trainee logbooks identified a 50% reduction in operations with trainees as the primary operating surgeon in 2020 compared to 2019.<sup>29</sup> The COVIDSTAR survey highlighted that 41% of surgical trainees within the UK and Republic of Ireland underwent redeployment.<sup>30</sup> 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”.<sup>31</sup> Moving forward, urgent restoration of operating theatre training opportunities will be crucial to achieve surgical competencies required for continued career progression.<sup>32</sup> Despite the disruption to training for junior doctors undergoing redeployment to intensive care units and medical wards, the opportunity for enhancing communication and collaboration among different medical teams should not be overlooked as this skill is invaluable for developing higher calibre trainees.<sup>33,34</sup>

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 associated with doctors working in low-and middle-income countries compared to high-income countries. 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 limit their ability to provide adequate supervision for surgical trainees compared to high-income countries.<sup>35</sup> The COVID-19 pandemic may have exacerbated these circumstances. Moving forward, it is important that doctors flag up 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.<sup>27</sup>

The physical fatigue and mental stress associated with working as a healthcare professional during the pandemic has likely contributed to the negative impact on doctors’ training.<sup>36-38</sup> A UK survey of mental health disorders among 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.<sup>38</sup> 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 which need to be maximised.<sup>39</sup> 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.<sup>32</sup>

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.<sup>41-43</sup>

### **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 among 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.

### **Conclusion**

Our novel global survey supports the view that the negative impact of COVID-19 global pandemic on medical training will continue to reverberate for a prolonged period of time. Whilst the medical community has adapted to the limitations on delivery of education by implementing virtual resources, the lack of real-life exposure will inevitably result in a detrimental impact on the perceived confidence levels of some trainees in a variety of domains as highlighted by our results.

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	Total	Reported an overall negative impact on training/learning		
		n (%)	Yes (%)	No (%)
<b>Total</b>	743 (100)	514 (69.2)	229 (30.8)	-
<b>Age (years)</b>				
≤27	514 (69.2)	316 (61.5)	138 (38.5)	
>27	229 (30.8)	198 (86.5)	91 (13.5)	.753
<b>Gender</b>				
Male	422 (56.8)	231 (72.0)	90 (28.0)	
Female	321 (43.2)	283 (67.1)	139 (32.9)	.152
<b>Doctor training status</b>				
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
<b>Doctor grade</b>				
Junior	616 (82.9)	422 (68.5)	194 (31.5)	
Senior	127 (17.1)	92 (72.4)	35 (27.6)	.382
<b>Specialty</b>				
Surgical	393 (52.9)	268 (68.2)	125 (31.8)	
Non-surgical	350 (47.1)	246 (70.3)	104 (29.7)	.538
<b>Redeployed</b>				
Yes	270 (36.3)	198 (73.3)	72 (26.7)	
No	473 (63.7)	316 (66.8)	157 (33.2)	.064
<b>Increased clinical responsibility</b>				
Yes	416 (56.0)	282 (67.8)	134 (32.2)	
No	327 (44.0)	232 (70.9)	95 (29.1)	.355
<b>Increased working hours</b>				
Yes	260 (35.0)	174 (66.9)	86 (33.1)	
No	483 (65.0)	340 (70.4)	143 (29.6)	.329
<b>Resident nation economic status</b>				
Low/middle income	394 (53.0)	265 (67.3)	129 (32.7)	
High income	349 (47.0)	249 (71.3)	100 (28.7)	.228
<b>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

**Table 1:** Factors associated with doctors-reported overall negative impact on training/learning during the Covid-19 pandemic

+ Pearson  $\chi^2$  statistical test used for univariate analysis to obtain *p*-values.

\*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.

	Total n(%)	Reported an overall negative impact on training/learning		
		Yes (%)	No (%)	<i>p</i> -value <sup>+</sup>
<b>Total</b>	743 (100)	514 (69.2)	229 (30.8)	
<b>Non-virtual teaching methods</b>				
<b>Lectures</b>				
<i>Declined</i>	494 (66.5)	376 (76.1)	118 (23.9)	
<i>Did not report a decline*</i>	249 (33.5)	138 (55.4)	111 (44.6)	<0.001
<b>Tutorials</b>				
<i>Declined</i>	407 (54.8)	304 (74.7)	103 (25.3)	
<i>Did not report a decline*</i>	336 (45.2)	210 (62.5)	126 (37.5)	<0.001
<b>Ward-based teaching sessions</b>				
<i>Declined</i>	463 (62.3)	350 (75.6)	113 (24.4)	
<i>Did not report a decline*</i>	280 (37.7)	164 (58.6)	116 (41.4)	<0.001
<b>Theatre sessions</b>				
<i>Declined</i>	453 (61.0)	331 (73.1)	122 (26.9)	
<i>Did not report a decline*</i>	290 (39.0)	183 (63.1)	107 (36.9)	0.004
<b>Conferences</b>				
<i>Declined</i>	482 (64.9)	370 (76.8)	112 (23.2)	
<i>Did not report a decline*</i>	261 (35.1)	144 (55.2)	117 (44.8)	<.0001
<b>Simulation sessions</b>				
<i>Declined</i>	335 (45.1)	256 (76.4)	79 (23.6)	
<i>Did not report a decline*</i>	408 (54.9)	258 (63.2)	150 (36.8)	<0.001
<b>Morbidity and Mortality meetings</b>				



<b>Examinations</b>							
<i>Reported postponement</i>	306 (41.2)	166 (42.1)	140 (40.1)		199 (40.3)	107 (43.0)	
<i>Did not report a postponement</i>	437 (58.8)	228 (57.9)	209 (59.9)	.577	295 (59.7)	142 (57.0)	0.482
<b>Choice of career specialty</b>							
<i>Negatively affected</i>	405 (54.5)	243 (61.7)	162 (46.4)		262 (53.0)	143 (57.4)	
<i>Not negatively affected</i>	338 (45.5)	151 (38.3)	187 (53.6)	<.001	232 (47.0)	106 (42.6)	0.256
<b>Postponement of next stage of career</b>							
<i>Reported negatively affected</i>	418 (56.3)	263 (66.8)	155 (44.4)		262 (53.0)	156 (62.7)	
<i>Did not report being affected</i>	325 (43.7)	131 (33.2)	194 (55.6)	<.001	232 (47.0)	93 (37.3)	0.013
<b>Preparation for next stage of training</b>							
<i>Reported preparation affected</i>	509 (68.5)	282 (71.6)	227 (65.0)		367 (74.3)	142 (57.0)	
<i>Did not report being affected</i>	234 (31.5)	112 (28.6)	122 (35.0)	.056	127 (25.7)	107 (43.0)	<0.001
<b>Confidence in clinical skills</b>							
<i>Reported negatively affected</i>	535 (72.0)	294 (74.6)	241 (69.1)		367 (74.3)	168 (67.5)	
<i>Did not report negatively affected</i>	208 (28.0)	100 (25.4)	108 (30.9)	.092	127 (25.7)	81 (32.5)	0.051
<b>Clerking patients without adequate supervision</b>							
<i>Reported</i>	303 (40.8)	169 (42.9)	134 (38.4)		209 (42.3)	94 (37.8)	
<i>Did not report</i>	440 (59.2)	225 (57.1)	215 (61.6)	.213	285 (57.7)	155 (62.2)	0.233
<b>Performing invasive procedures under GA without adequate supervision</b>							
<i>Reported</i>	140 (18.8)	90 (22.8)	50 (14.3)		87 (17.6)	53 (21.3)	
<i>Did not report</i>	603 (81.2)	304 (77.2)	299 (85.7)	.003	407 (82.4)	196 (78.7)	0.227
<b>Performing invasive procedures under LA or RA without adequate supervision</b>							
<i>Reported</i>	208 (28.0)	125 (31.7)	83 (23.8)		140 (28.3)	68 (27.3)	
<i>Did not report</i>	535 (72.0)	269 (68.3)	266 (76.2)	.016	354 (71.7)	181 (72.7)	0.768
<b>Assessing or managing acutely unwell patients without</b>							

<b>adequate supervision</b>							
<i>Reported</i>	283 (38.1)	182 (46.2)	101 (28.9)		190 (38.5)	93 (37.3)	
<i>Did not report</i>	460 (61.9)	212 (53.8)	248 (71.1)	<.001	304 (61.5)	156 (62.7)	0.768

**Table 3:** Doctors experiences during the pandemic by resident nation economic status and training status.

+ Pearson  $\chi^2$  statistical test used for univariate analysis to obtain *p*-values.

<b>Risk factor</b>	<b>Overall negative impact on doctor's training/learning. OR (95% CI), <i>p</i>-value</b>
Age <27	1.1 (0.7-1.6); <i>p</i> =0.744
Female gender	1.4 (1.0-1.9); <i>p</i> =0.084
<b>Doctor in training</b>	<b>1.5 (1.0-2.1); <i>p</i>=0.027</b>
Junior doctor	0.8 (0.5-1.4); <i>p</i> =0.459
Low/Middle income country	1.0 (0.7-1.5); <i>p</i> =0.798
COVID infection	0.8 (0.5-1.2); <i>p</i> =0.311
Redeployment	1.1 (0.8-1.7); <i>p</i> =0.510
Increased clinical responsibility	0.8 (0.6-1.2); <i>p</i> =0.379
Increased working hours	0.8 (0.5-1.1); <i>p</i> =0.186
Decreased tutorials (non-virtual)	0.9 (0.6-1.3); <i>p</i> =0.522
<b>Decreased ward-based teaching</b>	<b>1.7 (1.2-2.5); <i>p</i>=0.007</b>
Decreased theatre opportunities	1.0 (0.7-1.5); <i>p</i> =0.809
Decreased simulation training	1.3 (0.9-1.9); <i>p</i> =0.170

<b>Decreased lectures (non-virtual)</b>	<b>1.6 (1.0-2.4); <i>p</i>=0.034</b>
Increased online lectures	0.9 (0.6-1.4); <i>p</i> =0.546
Increased webinars	1.3 (0.8-2.0); <i>p</i> =0.252
Decreased morbidity and mortality meetings	0.8 (0.6-1.2); <i>p</i> =0.361
<b>Decreased conferences</b>	<b>2.0 (1.4-3.0); <i>p</i>&lt;0.001</b>
Surgical specialties	0.9 (0.7-1.3); <i>p</i> =0.631

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

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

## Appendix A:

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