

Letters to the editor

COVID-19: an opportune period to reform the medical curriculum

Online lectures, cancelled workshops, postponed exams – these are some of the changes medical students in the UK have experienced in the past few months due to the COVID-19 pandemic. COVID-19 has forced many medical schools to re-shuffle their daily operations, contemplate their plans, and undertake bold actions – including cancelling placements and sanctioning early graduations. I found the latter particularly courageous and compelling.

Graduation is an important milestone in a doctor's career. It marks the graduate's possession of the foundational knowledge and experience to care for patients and their meeting the high standards one expects from a doctor. Due to COVID-19, many final year medical students have graduated despite having considerable proportions of their placements cancelled (and in some instances, without final assessments).¹ Many non-final year students have also had significant parts of their curriculum nulled and reassurance that the nulled curriculum would not affect their medical school progression. These actions, whilst compassionate and thoughtful, also raise hard questions about the current state of our medical curriculum – whether all components of it are absolutely essential in order to be a doctor, and, if not, why are these dispensable components still in place? After all, medical schools would surely not graduate or allow to progress, students who they deem not to have satisfied the required standards and competencies for safe clinical practice?

COVID-19 may thus present medical educators with the opportunity to enduringly reform and refine the undergraduate medical curriculum. COVID-19 has already forced medical schools to reconsider what is absolutely essential for newly graduated doctors. In the case of my medical school, COVID-19 has revealed that electives and assistantship are not that essential in becoming a doctor. Although they are important and nice to have, their absence is not incompatible with medical qualification, as evidenced by the early graduation of 200+ Edinburgh students including myself.² Perhaps a similar stance should be employed to the rest of the medical curriculum. For example, is knowing the Krebs cycle inside out essential for a newly graduated doctor? If not, why is it still part of the undergraduate medical curriculum? There had better be a good explanation, especially so when important, clinically relevant topics, such as evidence appraisal and medical leadership, remain lacking in the medical curriculum.^{3–5}

COVID-19 may refocus the undergraduate medical curriculum from peripheral to substantive topics but only if the opportunity is seized. Similar to how pruning one's

plants and composting their soil promote the plants' vitality, the shedding of non-essential topics and adapting the undergraduate medical curriculum with topics fundamental in the practice of the twenty-first century medicine should better serve the population these future doctors will one day serve. There are many instances whereby challenging circumstances have primed scientific discoveries, better healthcare delivery and other positive advancements. COVID-19 may just be the nudge our medical curriculum needs.

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Aequanimitas in a pandemic: a personal viewpoint

'Thou must be like a promontory of the sea, against which, though the waves beat continually, yet it both itself stands, and about it are those swelling waves stilled and quieted.'
Marcus Aurelius

In his valedictory address to newly qualified medical graduates at the Pennsylvania School of Medicine in 1889, Sir William Osler spoke of two qualities that a doctor must possess in the practice of his or her craft, 'imperturbability' and 'equanimity'.¹ The address, published as an essay under the title 'Aequanimitas', is a classic of medical literature that has been read by thousands of medical students and doctors over the years.

Aequanimitas, derived from the Latin *aequo animo* 'with even mind', implies a state of equanimity and calmness. These attributes do not necessarily distinguish medicine from other vocations such as law, but are of particular importance to our profession. It requires of us as doctors to keep our clinical interaction with patients free of excessive emotion while at the same time ensuring that we are empathetic. It is to maintain *aequanimitas* that a doctor must avoid treating his or her relatives and close friends and always keep a 'social

and emotional' distance with patients. Above all, professional confidence must be maintained at all times.

Osler employs his excellent oratory skills and addresses young doctors on the need to maintain *aequanimitas* with an eloquence that cannot be bettered:

'So for you, fresh from Clotho's spindle, a calm equanimity is the desirable attitude. How difficult to attain, yet how necessary, in success as in failure!'

Since the emergence of the COVID-19 pandemic, we have witnessed many examples of doctors and other healthcare workers conducting themselves in a manner contrary to Osler's advice on equanimity. The sight of doctors and nurses lining hospital corridors, applauding while a bemused patient is wheeled out of intensive care, is one such example. These events appear to be staged and are filmed by staff to be posted on social media. The videos are then forwarded online and often go viral. Notwithstanding the display of emotions by doctors and nurses which is then transmitted globally at the touch of a few buttons on a mobile device, no evidence is provided that the patient being wheeled out has given consent for sharing what is a very personal and often traumatic experience.

One has witnessed clips on social media of doctors dressed in scrubs and PPE, engaged in choreographed dancing in wards, and selfies revealing facial scars from fitted PPE masks. The general public also started applauding healthcare workers in a concerted manner, throughout the streets of Britain on Thursday evenings. What started as a supposed one-off laudable gesture by the public became a weekly ritual in which even the doctors and nurses themselves were filmed clapping outside their hospitals wearing uniforms and scrubs, often failing to adhere to social distancing guidelines. These weekly clapping events were also choreographed, with groups of citizens and emergency services staff putting on increasingly extravagant displays to the delight of the national media and press. This pandemic has claimed thousands of lives, affecting and leaving behind their loved ones who are often not even able to attend funerals of the deceased. We must be mindful of the effect our celebrations must have on the survivors.

Doctors, like anyone else, are sentient beings and are not bereft of emotions. Calm equanimity, however, is a hallmark of our profession and my criticism of this extravagant, often staged, display of jollity by no means implies that one must always remain stolid and impassive; quite the contrary. But that display of emotion which is often jovial and at times lachrymose must always be exercised with dignity.

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Has the use of hand sanitiser substituted hand hygiene in the current COVID-19 pandemic? A perilous path

Hand hygiene is of utmost importance in preventing the spread of the coronavirus pandemic. During this pandemic, it is unfortunate to see that hand hygiene has been replaced by the use of hand sanitisers alone. This trend has largely been seen due to the use of social media, the scientific content of which is largely unchecked. It is imperative that we, as health care professionals, educate the general population about misconceptions regarding the use of hand sanitisers as a stand-alone policy for hand hygiene.

The retail cost of 100 ml alcohol-based hand sanitiser varies from 1.3 USD to 3.9 USD, whereas 100 g of plain soap costs only 0.46 USD in India. The blind promotion and usage of hand sanitisers in resource-limited countries entails additional expense and puts a strain on the already overburdened and poorly financed healthcare systems. The efficacy of hand sanitisers in reducing the transmission of infection has been proven in many studies; however, there are certain conditions like dirt-soiled or greasy hands¹ and certain microbes² where hand washing with soap and water has proven to be superior. A study by Grayson et al. proved that hand washes with soap and water were more effective than hand sanitiser in reducing the presence of the H1N1 influenza virus.³ There is evidence from some studies that hand sanitiser dispensers can themselves act like fomites and can cause hospital-acquired infections.⁴ Also, there have been numerous cases of serious poisonings due to sanitiser ingestion; this raises serious safety concerns.

There are other issues too, like the availability of substandard sanitisers on the market. This is of particular concern as the FDA recommends 60–95% of ethanol or isopropyl alcohol for a hand sanitiser to be effective, but there are many sanitisers available online which have a much lower concentration or the concentration information is not available.

We would like to conclude that although hand sanitisers are a very effective measure of hand hygiene, their blind promotion should be avoided. The public should be educated in hand hygiene measures and should be made aware that hand sanitisers are not a substitute for the age-old, time-tested technique of hand washing with soap and water.⁵ Judicious use of standardised hand sanitisers is the need of the hour and we as healthcare workers should take the front line in educating the public about the same.

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Prevalent fears and inadequate understanding of COVID-19 among medical undergraduates in India: results of a web-based survey

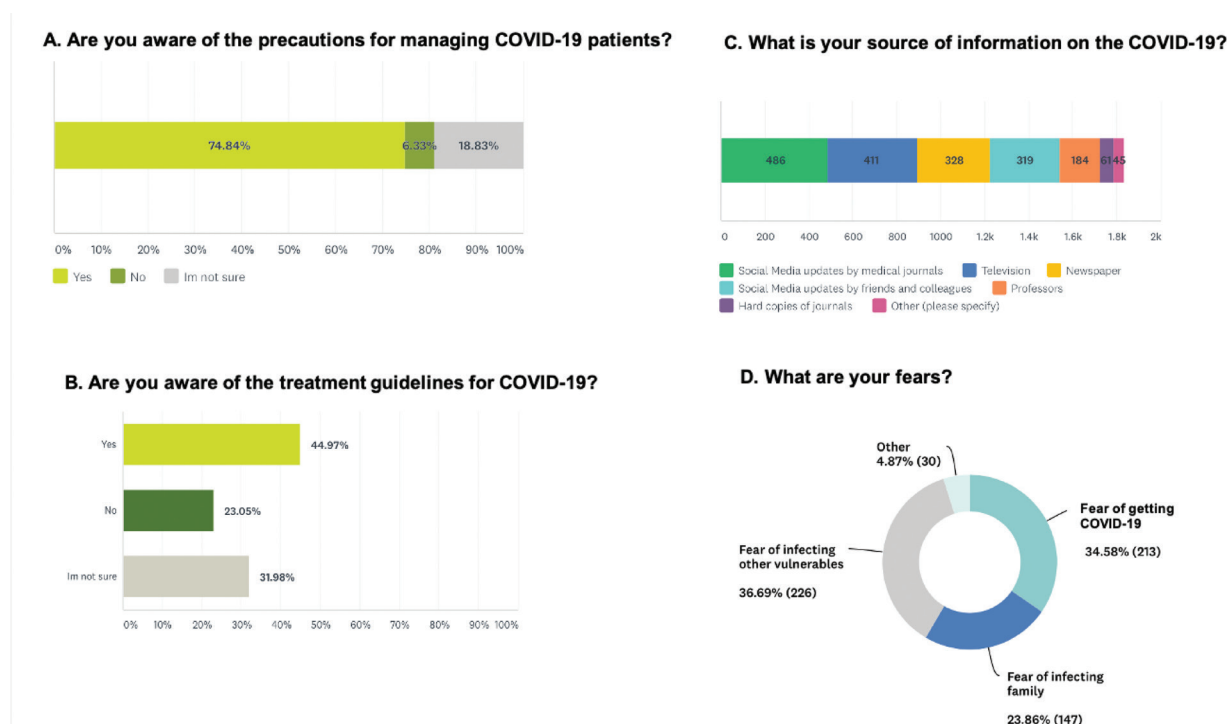
The COVID-19 pandemic has had a devastating effect on healthcare systems across the globe. One such effect is increasing demand for healthcare workers, especially doctors, as well as the need for intensive care unit beds and ventilators.¹ A potential solution could be incorporating undergraduate medical students into the healthcare workforce.^{2,3} An online survey featuring 33 questions was distributed amongst undergraduate medical students to understand their knowledge, attitude and preparedness towards COVID-19 (detailed methods in Supplementary file, online only).

Of 2,507 invitees across six medical colleges in India, 616 (24.6%) responded. Most undergraduates (21.5 years, 46.1% males) had recently completed (16.7%), or were in the final year of their undergraduate training (54.1%). Knowledge regarding the viral transmission (97.7%), clinical-radiologic features (72.1%), laboratory diagnosis (87%) and drugs being tried out to treat COVID-19 (95%), was adequate among most students (Supplementary Table 1, online). However, the understanding of the incubation period (20%) and time to symptoms (4.8%) was less than satisfactory.

Three-quarters of students were not aware of the treatment guidelines for COVID-19 and one quarter were unaware of the precautions needed while managing patients with the disease (Supplementary Table 2, online). Moreover, 29.1% were unaware that COVID-19 causes an asymptomatic or minor illness in most young individuals. Nearly 20% were not sure if they had been in contact with or cared for someone with COVID-19 in the prior two weeks, and another 10% continued to attend clinical rotations, ignoring their symptoms suggestive of COVID-19. Moreover, over two-thirds (69.3%) expressed reluctance to attend clinics from fear of getting infected or passing the infection on to others. Besides, 40.6% were not up-to-date on COVID-19, and most (78.9%) resorted to social media for information on COVID-19 (Figure 1).

This survey identifies a knowledge deficit and insufficient awareness of the preventive and treatment strategies amid poor reading practices among students.^{4,5} While students were adept with the clinical features and diagnoses, the knowledge base was inadequate regarding the incubation and time to symptoms, which is vital to advise on precautions, especially the quarantine duration. This raises serious concerns at a time when their services are being considered.⁶

Figure 1 Knowledge and prevalent fears pertaining to the pandemic



Under supervision, medical students could support telehealth services, establish co-ordination of interdepartmental efforts, and engage in the care of non-COVID patients, thus allowing experienced doctors to tend to critical patients, and maintaining the continuity of medical education, development of competency and, most importantly, gaining the unique experience of serving the community in a pandemic. However, it is vital to assess the preparedness of interns whose knowledge, skill and confidence may differ from final year students, our primary respondent population. We fully acknowledge the limitations, a low response and the inherent biases of self-reported questionnaires. However, this first assessment of the knowledge and attitude of medical students in India may pave the way for larger efforts to understand their preparedness for greater participation in the fight against COVID-19.

Thus, we conclude that there exists an inadequate understanding and fear of COVID-19 amongst young medical undergraduates. If their services are to be utilised during the pandemic, focused education should first be imparted.

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Impact of COVID-19 on the ‘art’ of physical examination: a sincere concern

The centuries-old art of physical examination of the patient seems to be at great risk of extinction due to the COVID-19 pandemic. This pillar of clinical medicine has successfully withstood similar onslaughts over the years, but the present situation seems totally different.

Bedside physical examination, a cornerstone of clinical diagnosis has been overlooked and ignored by modern medical practitioners with the advent of modern medical technological tools. Many doctor training programmes in developed countries are also following the trend, but a good number of doctors who are labelled as ‘old guards’ have tried their best to keep this art of bedside physical examination alive and relevant. They believed that the right place for a doctor is at the bedside of the patient and not at the computer terminal of the hospital completing the electronic medical records. However, the new generation of physicians have found this entire exercise just a waste of time, especially in the light of evidence-based studies showing that physical signs are not as useful in diagnosis and management compared with modern diagnostic tools and tests.¹

But the lack of physical examination skills amongst doctors is not only a threat to patient safety, but also leads to delayed diagnosis and unnecessary tests adding to the cost.² Overdependence on technology and electronic health record maintenance has further shortened the time spent with patients.

As the art of physical examination was at the crossroads, the COVID-19 pandemic has struck like a bolt from the blue. This pandemic is unprecedented and clinicians are expected to follow the best practice of social distancing to check the spread of this viral disease, further limiting the scope of detailed physical examination. It is imperative that medical tools like a stethoscope, knee hammers etc. are to be avoided as far as possible, as they could be potential fomites. The time has come for the clinicians to part with the practice of physical examination at least for now, if not forever.³

Gentle reassuring physical touch of the healers would be missed forever and patient–doctor relationship could dip to a new low. Physical examination used to help physicians not only to know the disease, but also to know the patients, and the nostalgic grand rounds and bedside clinics could become the thing of the past. With new medical graduates lacking the basic skills of physical examination, the diagnostic tools could well move from the status of complementary to a confirmatory one.⁴

Telemedicine offers a unique opportunity for the physician to listen and observe the patient at length before actually seeing the patient, which could make up for the detailed physical examination. The clinician can assess vital signs using patient’s self-monitoring home digital devices and

carry out a video general physical examination. The clinician can also have a close look at the oropharynx, tonsils, and patient-directed palpation for the presence of lymph nodes.⁵ Physicians should view all these developments as ‘man with the machine’ rather than ‘man vs machine’.

Amid this COVID-19 scare, clinicians should be contemplating not the end of the all-important ancient art of physical examination, but its reappearance in a new avatar, of course in a more efficient and newer form with due innovations. It is imperative that clinicians adapt rather than avoid the physical examination in the best interest of patients and the art itself.

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Declaration to improve biomedical and health research

We would like to thank the *Journal of the Royal College of Physicians of Edinburgh* for thoughtful editorials on publication ethics and best practice. The recent editorial by Misra and Ravindran on reporting standards highlighted the key thematic concepts in scientific reporting: funding and conflict of interest declarations, transparency, ethical research reporting, research planning (including power and sample size calculation), appropriateness of statistical analysis, and methodological rigour.¹ We would like to share a list of achievable demands that we believe will improve biomedical and health research when widely implemented,² and which echo and build on the key themes in your editorial highlights.¹

Systemic problems in planning, conduct and reporting significantly undermine the trust we can place in medical research. Strong incentives which reward ‘positive’ results along with insufficient transparency have led to an untenable situation in which the findings of high-profile studies cannot be reproduced.³ The dysfunctional culture and practices that have created this ‘reproducibility crisis’ impede genuine scientific discovery and mean that the majority of research expenditure is wasted unnecessarily.⁴ These systemic weaknesses

have been further exposed by the flurry of research activity unleashed by the SARS-CoV-2 (COVID-19) pandemic and can no longer be ignored.⁵ As well as recognising these problems, we believe it is time to campaign for effective and achievable measures to address them.

The ‘Declaration to improve biomedical and health research’ is a collaboration between researchers, clinicians and patients to establish a practical programme for improving medical research, which we believe will be of interest to the *JRCPE* readership.²

The Declaration calls for three simple and achievable measures to improve transparency and reduce avoidable waste in health research:

1. Mandatory registration of conflicts of interest. Researchers could maintain a comprehensive and up-to-date register of their interests, for example through ORCID, which could be linked to all publications. This should include both financial and non-financial conflicts of interest and apply to peer reviewers and editors as well as researchers.⁶
2. Widespread adoption of Registered Reports. Registered Reports are a publication format whereby authors submit methods prior to data collection and analysis and, if these satisfy peer review, journals commit to publication, whatever the results. This would ensure appropriate research planning is undertaken, with a rigorous methodology and appropriate analysis plan¹ and should reduce positive results bias.
3. Mandatory registration of publicly funded research. Comprehensive documentation such as protocols and data for all publicly funded research should be made available on a single World Health Organization affiliated repository. This would improve transparency and would ease inclusion of quantitative research in systematic reviews.¹

We believe these common sense measures will improve research, ultimately benefitting patients. They will not fix all the problems; however, achieving these measures could start to restore confidence in health research. This Declaration is a work in progress, and we welcome criticism, discussions and suggested improvements. The Declaration can be accessed and signed at <https://osf.io/k3w7m/>² and readers can follow on Twitter @TA Declaration. As the Declaration gains support and evolves with suggested improvements, it will be important to evaluate its impact and adherence to the finalised measures.²

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Why is knowledge about fluid prescribing so poor?

Mathur and colleagues reviewed the Scottish National Intravenous Fluid Improvement Programme and described current poor knowledge and understanding of those prescribing IV fluids.¹ Why do our students fail to graduate with sufficient knowledge to prescribe an everyday treatment for many hospital patients?

We studied coverage of this subject in medical student textbooks.² When asked to teach about a subject, many will consult a textbook to see what is known about the subject, and how this knowledge is structured. Authors may do the same. Although logical, this approach has an important weakness, because the material consulted provides a ‘menu’ to be followed. Topics that are emphasised get taught, and those that are neglected are omitted. The basic concepts introduced may not even be the most appropriate.

To avoid this concern, we constructed a list of 26 topics that we felt should be addressed, without looking at the books. Our interests were slanted towards surgery (where most IV fluids are used), and we drew on our clinical experience. We then rated the 29 books for how well each topic was considered. We gave no mark if the topic wasn’t addressed at all, one if it was, and two for good coverage. We made no judgement whether the facts were right or wrong, because clinical opinions can vary, we only wanted to see the topic included.

Three of our criteria were too esoteric for any book to score. One of the books we looked at addressed all of the remaining topics, scoring 45 out of a possible 46, so our checklist of topics was probably reasonable. However, the median score achieved by the books was a dismal 11, with 14 out of the 29 books scoring less than 10. Topics associated with blood loss and volume replacement were more often considered and better covered than routine maintenance. We concluded that this mundane topic was very poorly presented by most medical textbooks.

Mathur and colleagues cite Forryan and Mishra, whose audits suggested that as well as poor basic knowledge, there is ‘endemic trivialisation of intravenous fluid prescribing’.³ Although the GMC sets standards for medical education, these are very generic, not even mentioning prescribing fluids other than blood. Perhaps a systematic approach to answer the question ‘what should medical schools teach?’ is needed more frequently. This would probably detect other gaps in medical school curricula, some concerning the workaday basics. Many teachers, particularly the young and enthusiastic, tend to favour interesting, exciting and, frankly, esoteric material and fail to look for and detect the edges of the holes in the foundation knowledge of their students. In fact, subjects such as fluids for maintenance of fluid balance are so mundane, that they are only recently being assessed systematically,⁴ and some regimens are chosen for simplicity alone, rather than clinically appropriate reasons.^{5,6}

The Royal College of Physicians of Edinburgh’s teaching programme contains updates on new and possibly important material. Would it also be useful teaching to identify and even attempt to fill the lacunae, the ‘unknown knowns’, in doctors’ knowledge?

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Authors’ reply

We thank Dr Drummond for his insightful comments on our recent review¹ and for highlighting the systemic study into the (in)adequacy of information on intravenous fluids in undergraduate medical and surgical textbooks.² We read this study with interest and agree with the conclusions that medical graduates should have sufficient knowledge to prescribe fluids safely – and that deficiencies in reference texts are contributing to the overall trends of suboptimal fluid prescribing.

Our local experience in teaching IV fluid prescribing involves delivering a ‘blended learning’ experience to our undergraduates through a mixture of online educational resources, face-to-face tutorials and lectures punctuated along the curriculum in medical, renal, surgical and anaesthetic blocks. We deliver this teaching in accordance with national guidelines,³ but appreciate that not all 26 topics that Dr Drummond has highlighted are easily covered in packaged teaching resources. We agree that the use of textbooks to support adult learners is important here and echo concerns raised about the current insufficiencies.²

Lastly, we agree with the comments surrounding the focus of medical curricula and the importance of ‘getting the basics right’. We highlight the notable work of Kashou and colleagues who tackle another workaday topic: interpretation of the electrocardiogram (ECG).⁴ The authors highlight that despite the importance of the ECG in medical practice, few practitioners feel confident with independent interpretation. They describe a set of competency standards expected for different levels of interpretation – beginner, intermediate and advanced. Do we need to define similar competency-based standards for other ‘mundane’ tasks?

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Some potential unintended consequences from open access publication

The results of biomedical research which have the capacity to improve significantly the care of patients and the public, should instinctively be shared and disseminated for the benefit of all, and as soon as possible. This especially applies to research funded via the public purse. Consequently, the increasing move to open access publishing (OAP) is welcome, ethical, timely, and was recently well covered by Misra and Ravindran.¹ However, before insisting on this for

all publications and journals, we need to consider some unintended consequences, and how these might be mitigated. Traditionally, journals were funded via the subscription model, i.e. individuals or libraries paid for the costs, and this also applied to journals owned by societies or other professional organisations. There was no charge for the authors, but they had to fund the research to generate the publication. The OAP model shifts the burden of funding scientific publications to the researcher/author, but assumes that they can pay. This works well for funded research where most awarding bodies now allow for page charges under dissemination costs. However, in the absence of such costs being met, there is a problem for unfunded research as for many journals, page charges are not insignificant and may amount to four figures.

Many of us wrote our first paper in the form of a case report or a case series, with no funding required. It mainly required diligence and persistence on our part, and some guidance from senior colleagues. There was no financial obstacle to publication in the pre-OAP era, but access to the resultant publication was restricted to subscribers and libraries, often for an indefinite period. Immediate access to research via OAP is very welcome, but will it restrict publications that emerge from research or clinical activity that has no funding for publication charges? If so, that would be hugely regrettable as it would restrict the depth of clinically-related research that is published. It might also inadvertently block off an avenue for doctors during the early part of their careers, and discourage a potential research career. This is an even bigger challenge in the arts and humanities where most publications are not supported by research grants.²

The plethora of emails that many of us receive to submit articles for publication in unfamiliar journals, funded by the author, suggests that there is money to be made via online OAP. This may potentially be at the expense of quality, even for well-regarded journals, as there is pressure on editors to publish to ensure ongoing funding of the journal. This is in contrast to traditional publishing where funding is secure via the subscription model, and where there is less pressure to compromise standards required for publication.

The increasing move to OAP is ‘a train that has left the station’, and it is justified by the moral need to share research and expertise as quickly as possible and with as many as possible. However, we need to ensure that journals will continue to publish unfunded research, because if we don’t, this will stymie clinical curiosity. It may also result in many of us not being able to share important lessons that are not generated by funded research. Finally, the change to the author paying for publication, and not the subscriber, must not compromise quality.

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Awareness and attitude regarding the COVID-19 outbreak among newly qualified medical students prior to starting internships in Kerala, India

The COVID-19 pandemic has become a major public health problem. Though the mortality is low, many have already lost their lives, including healthcare workers, through human-to-human transmission. Being able to work during a pandemic is a great opportunity for new medical graduates, but introducing them to the midst of a major pandemic is a matter of concern, too. Medical students were allowed to serve in clinical roles in pandemics before, such as in the Spanish Flu pandemic of 1918 and the 1952 polio epidemic in Denmark.^{1,2} In the current pandemic, medical schools in countries such as the United States and Italy have considered graduating medical students early, on the condition that they serve as frontline clinicians.^{3–5} Kerala is a coastal state in southern India and one of its most densely populated states. Like other states in India, Kerala also has been bearing the brunt of the COVID-19 pandemic since the end of January 2020. Internships of one year's duration for those medical students who have passed their final MBBS examinations usually start on 1 April in Kerala. During internship they rotate through various clinical departments and have many supervised direct patient care related responsibilities. This study was planned to assess the knowledge and attitude regarding COVID-19 in newly qualified medical students before starting such internships.

An online survey was conducted among fully qualified MBBS students who matriculated in 2015 and who were waiting to start their internship, using a self-reported questionnaire in multiple choice response format using the SurveyMonkey® application. Institutional Ethics Committee approval was obtained for the study. A total of 670 new medical graduates from 22 medical colleges in Kerala responded to the survey out of 850 approached (response rate was 79%).

Respondents were well aware of the COVID-19 outbreak and the prevailing situation in Kerala. About one quarter of them had relatives working in the health sector during the outbreaks of Nipah or COVID-19 (Table 1). This factor appears to directly enhance the awareness of the disease and knowledge regarding infection control practices (ICP). While the majority of the students were willing and enthusiastic to work during this period, 97% expressed the need for proper training before starting clinical work and an adequate supply of personal protective equipment (PPE). They also pointed out difficulties of transportation during the lockdown period and personal reasons such as a parent's illness, pregnancy, having a small baby or inexperience working during a pandemic. They also conveyed that a significant proportion of parents (78%) were worried about their children starting

Table 1 Response to key survey questions

Awareness of the outbreak	n (%)
1. Well informed about the COVID -19 outbreak	666 (99)
2. Aware of the present situation in Kerala	670 (100)
3. Relatives working as health care providers during the present outbreak or past Nipah outbreak	152 (23)
4. History of travel outside India within the last 14 days	10 (1.5)
5. History of contact with any person who had recently come from abroad	26 (4)
6. Any relatives under isolation/home quarantine	77 (11.5)

internship during that period. Half of the respondents were worried about contracting COVID-19 during their internship.

To summarise, in this survey, though a positive attitude, commitment and enthusiasm among the newly qualified students to work as interns in the COVID-19 outbreak was noted, there were also concerns about the unusual and challenging professional environment, and the need for training and PPE. Our survey suggests that incorporating training in ICPs and appropriate use of PPE would enhance the confidence of this workforce. If also trained in essential skills such as basic life support and basic ventilator support during the final year of the medical curriculum, the students could be used more effectively in facing challenges like COVID-19 in the coming years.

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