



# Virtual Reality: Medical Students' Thoughts & Perspectives on The Pandemic & Chaos: A Twin City Pakistani Survey

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## Abstract

**Background:** The COVID-19 pandemic brought about drastic changes in the way we teach medical students. As the universities shut down to contain the pandemic, teachers and educationists were forced to contemplate upon ways and means to continue teaching our vast medical curriculum, while the students stayed at home, having their world turned entirely virtual. As the lockdown eased, social distancing came into play as it became impossible to teach the whole crowd.

**Objective:** The objective of our survey was to determine the level of awareness and perspectives of undergraduate medical/dental/physiotherapy students of the twin cities of Pakistan regarding the pandemic, their experience and satisfaction level to the virtual teaching strategies implemented.

**Methods:** A self-designed, validated electronic questionnaire was created using an online application (Survey Planet). The survey consisted of 30 questions and was distributed to students of 8 institutes of the twin cities via email and social media, during the second and third waves of the pandemic.

**Findings:** A total of 1490 students responded. Most demonstrated adequate knowledge of the pandemic, implemented good safety protocols, and were hopeful of the situation. Majority were satisfied with the online learning process, and gave a positive view of the handling of the pandemic by their institutes. However, most found difficulty in studying at home, felt that precious time had been lost, and

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**Keywords:** Augmented and virtual reality; Data science applications in education; Distance education and online; Distributed learning environments; Media in education; sars-cov2; Medical education; Student assessment.



feared failure in exams. Internet connectivity issues were faced by the majority. Majority were in favour of being vaccinated.

**Conclusions:** Twin city students have good knowledge, practices and positive views of online education.

**Clinical implications:** The reporting of perspectives of undergraduate students helps us in guiding and shaping our programs in future waves of this smouldering pandemic and future pandemics as well.

## Introduction & background

The COVID-19 (novel coronavirus 2019) epidemic erupted suddenly in China in December 2019 and engulfed and overwhelmed most of the world rapidly, in early 2020, as a public health emergency, much to everyone's surprise, fear and dismay [1]. We braced to face our unexpected first and worst pandemic, which saw most governments staggering to implement measures to contain the deadly SARS-CoV2 (Severe acute respiratory syndrome coronavirus 2), by shutting schools, colleges, universities, marketplaces, businesses and even hospitals! This incited chaos and uncertainty everywhere especially for students who were the most susceptible population to suffer at the hands of this pandemic.

In Pakistan, the first case of this deadly virus was reported in Karachi on February 26, 2020 and soon a country wide lockdown was implemented in March, 2020, to contain the first wave of the epidemic [2]. This closure of educational institutes forced teaching authorities to devise ways and means to deliver the extensive medical curriculum while the students stayed away, thus bringing about a culture of online teaching and activities, which had to be both cost effective, reliable and safe [3]. Live, online delivery of lectures by teachers in empty lecture theatres were widely adopted by medical schools in our country, with teachers missing the point of face-to-face teaching and learning, and with minimal student interaction. As the lockdown eased, social distancing came into place to keep students safe. For clinical teaching, the students were segregated further into smaller groups with 50% attendance each day, alternating batches every other day, with social distancing. The exams seemed even more difficult to conduct onsite with the reality of social distancing and safety precautions creeping in. For a developing country like Pakistan, it becomes even more difficult for the Higher Education Commission to provide all educational institutes with the software necessary for online teaching, to train the teachers, inadequate experience in online assessment, the availability of a dedicated Information Technology (IT) team, the reality of poor or non-availability of internet and low bandwidth for video streaming in some regions, from where the students may hail from, but also working from home also posing a challenge. The lack of a uniform set of guidelines for online teaching and assessment is also an issue [4].

Coming to terms with this ongoing pandemic, medical institutes reopened fully only to see the second wave of the pandemic forcing another shutdown in October, 2020 and a similar situation in the third wave of the pandemic in March 2021. The idea of gathering all students at once in large groups or even smaller groups is bound to have an adverse effect on the controlling of a contagious pandemic, whose curve needs to be flattened by staying six feet apart. As emergency use of vaccines was granted the world over, the reality of a vaccine

has brightened the prospects of a full return to original medical teaching and learning [5,6]. The methods of teaching employed during this strange era were online lecturing via various tools, social media groups, video demonstration, virtual sharing of useful links and actual patient teaching in small groups with social distancing and decreasing attendance to prevent spread and crowding. All safety precautions were exercised including masks mandatory for all and masks for patients and COVID-19 testing mandatory for inpatients.

The perspectives of medical students regarding virtual teaching are useful in order to assess our teaching strategies, but also to prepare for future waves or pandemics. The purpose of our cross sectional survey was to bring light to the Twin City (Rawalpindi and Islamabad are frequently referred to by this name due to close proximity) medical, dental and physiotherapy students' perspectives on this seemingly never-ending pandemic, their thoughts, hopes and fears for their future in uncertain times, and also their knowledge acquisition, learning platforms and satisfaction of the strategies implemented during this era.

## Materials and methods

### Respondents and setting

Pakistani medical schools offer a five-year Bachelor of Medicine and Surgery (MBBS) program, a four or five-year Bachelor of Dental Surgery (BDS) program and a five-year professional bachelor's degree program of Doctor of Physical Therapy (DPT), usually with two years of basic pre-clinical education followed by three years of clinical rotations. The medium of education is English. The survey was distributed to 8 medical, dental & physiotherapy students of all years of training in twin cities (Rawalpindi & Islamabad), including those colleges who consented to the survey; Foundation University Medical College (FUMC), Foundation University Dental College (FUCD), Foundation University Institute of Rehabilitation Sciences (FUIRS), medical students of Rawalpindi Medical University (RMU), Islamic International Medical College (IIMC) affiliated with Riphah International University, Fazaia Medical College affiliated with Air University, Islamabad Medical & Dental College (IMDC) affiliated with Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU) and Rawal Institute of Health Sciences, also affiliated with SZABMU. The duration of the survey is 5 months; from 30th December, 2020 to 30<sup>th</sup> May, 2021.

### Ethics and consent to participate

Ethical permission was obtained from Fauji Foundation Hospital Ethical Review Committee [460/RC/FFH/RWP] and the ethical review committees of all participating institutes. All methods were performed in accordance with the ethical guidelines and regulation, which is in concordance with the declaration of Helsinki. The survey link asks for online written consent of each student at the beginning of the survey before proceeding further.

### Survey

We developed a 30-question online survey, available in English via the Survey Planet application. The survey was developed by the first two authors and was analyzed critically by senior faculty members before final approval. The survey was validated in a pilot study. Its Cronbach's alpha was 0.853. Sample size calculation was done with Raosoft sample size calculator etc. population size 5574 students, confidence level of 99%, 5% margin of error, and 50% response distribution. Sample size

estimation was 594. Convenience sampling was used.

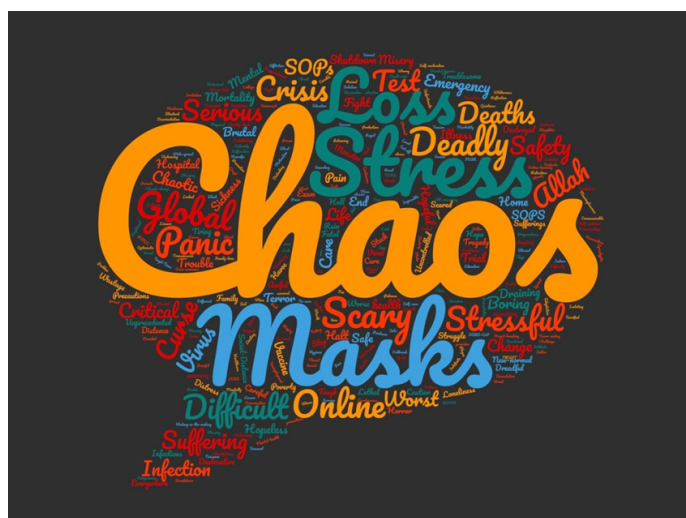
The survey consisted of queries pertaining to basic demographic characteristics; gender, year of medical schooling, and different multiple-choice questions, dichotomous ('yes/no') questions, scaled response via a Likert scale, as well as brief essay type questions, regarding knowledge, thoughts, hopes, fears and perspectives of students on the SARS-CoV2 pandemic experience and future plan as well. Questions regarding the students view on their colleges' handling of the pandemic, safety measures employed, methods of teaching during lockdown and ease of lockdown, motivation and problems faced via online learning were included in the last portion of the survey. Lastly, they were asked upon their willingness to receive a vaccine. For some quantitative survey questions, the option of an open-ended qualitative feedback was provided with a comment box, if they wanted to answer it. The survey was piloted by a medical education consultant prior to distribution (Table 1 & 2).

### Recruitment and survey distribution

We recruited collaborators via email and phone from each willing participating institute. The respondents, as well as student representatives, and class teachers agreed to disseminate the survey to their respective students' population of their home institution, via email and social media, which was strictly online. The collaborator and willing representatives then spread the survey with a brief in English and the link to access the survey to all the medical students at each institute, with one reminder sent again before the survey was closed. A total of 5574 were sent the online survey link, from the 8 participating medical schools and 1490 of them responded with free will and anonymity, resulting in a response rate of 26.7 % of our survey.

### Statistical analysis

We calculated the descriptive statistics (frequencies and percentages) for each survey question using Survey Planet application which automatically calculates the responses obtained. A word cloud was generated for question 6 [What is the one word that comes to mind when you think of the pandemic?] using a word cloud application [Available from: <https://www.wordclouds.com/>]



**Figure 1:** What is the one word that comes to mind when you think of the Pandemic?.

## Results

The results of our survey have been tabulated in Table 1 & 2 and are self-explanatory. The majority of responding students were females; 1101 (73.9%) and fourth year were maximum responders; 395 (26.5%). 812 (54.5%) were between the ages of 18-21. The majority demonstrated correct knowledge of the SARS-CoV2 virus, its spread, symptoms and therapy, with most knowledge acquisition via social media and then internet. 40.6% students were hopeful of the pandemic situation that it will resolve. The majority demonstrated clarity regarding what to do in case of exposure and obeyed Standard Operating Procedure (SOP) of the pandemic. 799 (53.6%) of the students had never been tested for the virus. 1192 (78%) reported either themselves, their family members or close friends had tested positive for the virus. 99.4% of students wore masks and/or gloves or PPE at their institute. 1025 (68.8%) students reported free use of sanitizer at their institute, and 956 (64.2%) were satisfied of the handling of the pandemic by their respective institute. Live lectures via video-conferencing was the method of teaching employed by the majority of institutes with 1240 (54.4%) student responding to it. 1028 (68.9%) were satisfied with their instructors, 1290 (86.6%) agreed that precious time has been wasted due to the pandemic, and the majority had a positive response towards the online educational shift. 1414 (94.9%) accessed the online sessions via home internet connection, using either the laptop or smart phone in the majority. 1259 (84.5%) experience software/hardware problems during their online classes. Problems faced at home were inability to focus, find motivation and set up a time schedule for online study. 763 (51.2%) found home studying to be less effective and 784 (52.6%) negated the idea of future university shutdown in case of the next wave. 885 (59.4%) felt they might fail their next exam due to the pandemic. 1300 (87.2%) showed consent to receiving the vaccine, the rest had either received 1 or 2 doses, or were reluctant due to side effects like hypersensitivity, blood clots, efficacy against multiple strains, unclear clinical trial data, herd immunity, or to allow vulnerable populations to be vaccinated first, but a few were scared of the chip implantation instead of the vaccine, current vaccine availability and waiting for other vaccines to arrive.

## Discussion

Our study was a collaborative survey carried out in 8 medical colleges of the twin cities of Pakistan, Rawalpindi and Islamabad. Good knowledge, good precaution, and positive response to the online teaching and assessment strategies have been demonstrated.

Noreen et al. [7] reported the outcomes of the *KAP study* on 1474 medical students in Pakistan which showed good *Knowledge*, positive *Attitudes* and good *Practices* amongst the majority of the students. Two thirds complained of adverse mental, social and psychological effects of the pandemic. Aziz et al. [8] conducted a survey on 765 medical students across various medical colleges of Pakistan and found a dismal response to the online education practice in the majority of students, who also felt that they had lost interest in studies because of the raging pandemic. They also missed their college classroom learning and found the interplay between home and study to be a difficult task. The pandemic has created a phobia in terms of future learning and affected the students both physically and mentally.

**Table 1:** The questions regarding knowledge of the pandemic and attitudes.

Question	
What are the symptoms of the SARS-CoV2 infection? (Tick all that apply) <ul style="list-style-type: none"> <li>Cough: 1396 (12.7%)</li> <li>Fever: 1429 (13%)</li> <li>Sore throat: 1142 (10.4%)</li> <li>Chills: 693 (6.3%)</li> <li>Muscle pains: 1195 (10.9%)</li> <li>Difficulty breathing: 1405 (12.8%)</li> </ul>	<ul style="list-style-type: none"> <li>Nasal discharge: 435(4%)</li> <li>Headache: 1039 (9.5%)</li> <li>Diarrhea: 790 (7.2%)</li> <li>Sneezing: 588(0.39%)</li> <li>Chest pain: 856 (7.8%)</li> </ul>
What are your thoughts on the Pandemic situation? <ul style="list-style-type: none"> <li>Hopeful: 317 (21.2%)</li> <li><b>Somewhat hopeful: 507 (34%)</b></li> </ul>	<ul style="list-style-type: none"> <li>Neutral: 389 (26.1%)</li> <li>Somewhat hopeless: 226 (15.1%)</li> <li>Hopeless: 51(3.4%)</li> </ul>
How does the SARS-CoV2 spread? (Tick all that apply) <ul style="list-style-type: none"> <li>Droplet: 1176 (31.5%)</li> <li>Air: 809 (21.7%)</li> <li>Fomites: 226 (6.1%)</li> </ul>	<ul style="list-style-type: none"> <li>Close contact: 1117 (29.9%)</li> <li>Bodily secretions: 279 (7.5%)</li> <li>Eating: 125 (3.3%)</li> </ul>
The Covid-19 (SARS-CoV2) [tick all that apply]: <ul style="list-style-type: none"> <li>is a zoonotic disease: 311</li> <li><b>causes a respiratory illness: 1421 (14.7%)</b></li> <li>causes a multisystem vasculitis: 398</li> <li>causes a severe illness in the majority: 373</li> <li>does not cause severe disease in the majority: 705 (7.3%)</li> <li>can be prevented by masks: 1359 (14%)</li> <li>can be prevented by hand hygiene: 1356 (14%)</li> <li>can be prevented by social distancing: 1409 (14.6%)</li> <li>children and elderly are more at risk: 990 (10.2%)</li> <li>can be spread by asymptomatic individuals: 1219 (12.6%)</li> <li>cannot be spread by asymptomatic individuals:133</li> </ul>	<ul style="list-style-type: none"> <li>Tocilizumab: 143</li> <li>Hydroxychloroquine: 219 (6.5%)</li> <li>Symptomatic: 445 (13.2%)</li> <li>None proven: 525 (15.6%)</li> </ul>
What is the treatment of the SARS-CoV2 infection? (Tick all that apply) <ul style="list-style-type: none"> <li>Vaccine: 1000 (29.7%)</li> <li>Anti-viral drugs: 522 (15.5%)</li> <li>Steroids: 415 (12.3%)</li> <li>Doxycycline: 102</li> </ul>	
What will you do in case you are exposed to the coronavirus? <ul style="list-style-type: none"> <li><b>Quarantine for 14 days: 927 (62.1%)</b></li> <li>Get tested: 500 (33.5%)</li> </ul>	<ul style="list-style-type: none"> <li>Nothing: 15</li> <li>Other (specify): 50</li> </ul>
Have you ever been tested for the SARS-CoV2? <ul style="list-style-type: none"> <li>Yes: 691 (46.4%)</li> <li><b>No: 799 (53.6%)</b></li> </ul>	
Have you someone in your family or close to you been tested positive for the SARS-CoV2? <ul style="list-style-type: none"> <li>Me: 120 (8.1%)</li> <li><b>Immediate family member: 440 (29.5%)</b></li> <li>Extended family member: 377 (25.3%)</li> </ul>	<ul style="list-style-type: none"> <li>Masks and Gloves: 140 (9.4%)</li> <li>PPE: 20 (1.3%)</li> <li>None: 9 (0.6%)</li> </ul>
How did you acquire your current knowledge on the Pandemic? <ul style="list-style-type: none"> <li>Internet: 601(40.3%)</li> <li><b>Social media: 609 (40.9%)</b></li> <li>TV: 168 (11.3%)</li> </ul>	
What precautions do you take while in college? \ <ul style="list-style-type: none"> <li><b>Surgical masks: 986 (66.2%)</b></li> <li>N95 masks: 335 (22.5%)</li> </ul>	
Is there sanitizer available for free use in your college? <ul style="list-style-type: none"> <li><b>Yes: 1025 (68.8%)</b></li> <li>No: 465 (31.2%)</li> </ul>	

**Table 2:** Questions pertaining to virtual teaching and responses obtained.

<p>How did your medical college/university implement teaching during the pandemic? (Tick all that apply)</p> <ul style="list-style-type: none"> <li>• <b>Live lectures via video-conferencing: 1240 (54.4%)</b></li> <li>• Online reading material: 574 (24.3%)</li> <li>• Simulations for case based teaching: 106 (4.5%)</li> <li>• Actual patient teaching in small groups with social distancing: 175 (7.4%)</li> <li>• Video demonstrations for clinicals: 271 (11.5%)</li> </ul>
<p>How satisfied were you with instructor preparedness and quality of course content during medical teaching in the pandemic?</p> <ul style="list-style-type: none"> <li>• Very Satisfied: 100 (6.7%)</li> <li>• Satisfied: 333 (22.3%)</li> <li>• <b>Somewhat Satisfied: 595 (39.9%)</b></li> </ul>
<p>Do you feel that precious time has been lost to the Pandemic?</p> <ul style="list-style-type: none"> <li>• <b>Strongly Agree: 971 (65.2%)</b></li> <li>• Somewhat Agree: 319 (21.4%)</li> <li>• Neither Agree nor Disagree: 128 (8.6%)</li> <li>• <b>Strongly Disagree: 40 (2.7%)</b></li> <li>• <b>Somewhat Disagree: 32 (2.1%)</b></li> </ul>
<p>Are you satisfied with your college's handling of the pandemic?</p> <ul style="list-style-type: none"> <li>• <b>Yes: 956 (64.2%)</b></li> <li>• No: 534 (35.8%)</li> </ul>
<p>Experience of online learning after shift to remote instruction: (Tick all that apply)</p> <ul style="list-style-type: none"> <li>• I was interested in the course content: 530 (13.1%)</li> <li>• I could ask questions and participate in discussions during live teaching: 640 (15.8%)</li> <li>• There was availability of help with the course content: 507 (12.5%)</li> <li>• I understood what was expected of me in the course: 349 (8.6%)</li> <li>• Frequency of quizzes/assignments was satisfactory: 335 (8.3%)</li> <li>• The instructor was aware of my strengths and weaknesses: 111</li> <li>• I was able to work on group projects separately from the course meetings: 160</li> <li>• I had opportunities to collaborate with other students on course work: 276 (6.8%)</li> <li>• I received messages of instructors on student groups to ensure access to course material: 465 (11.5%)</li> <li>• <b>Feedback was taken from me to improve the online program: 658 (16.3%)</b></li> </ul>
<p>I accessed the online sessions through an internet connection;</p> <ul style="list-style-type: none"> <li>• <b>I already had at home: 1414 (94.9%)</b></li> <li>• At another public place: 32 (2.1%)</li> <li>• Other (specify): 44 (2.9%)</li> </ul>
<p>I used the following gadget for access to online lectures:</p> <ul style="list-style-type: none"> <li>• <b>Laptop computer: 765 (51.3%)</b></li> <li>• Desktop computer: 23 (1.5%)</li> <li>• Tablet: 34 (2.3%)</li> <li>• Smartphone: 655 (44%)</li> <li>• Other (specify): 13 (0.8%)</li> </ul>
<p>I experienced hardware and software problems that interfered with course participation:</p> <ul style="list-style-type: none"> <li>• Frequently: 316 (21.2%)</li> <li>• <b>Sometimes: 943 (63.3%)</b></li> <li>• Never: 231(15.5%)</li> </ul>
<p>Challenges students faced in learning online: (Tick all that apply)</p> <ul style="list-style-type: none"> <li>• I was self-motivated to learn online: 276 (8.8%)</li> <li>• <b>With the world in chaos, it was hard to stay focused and motivated or to mentally show up for class: 957 (30.6%)</b></li> <li>• The greatest challenge was finding the motivation to get out of bed and complete assignments: 792 (25.4%)</li> <li>• It was difficult to set time and place to do work at home: 859 (27.5%)</li> <li>• It was easier to schedule my work at home: 240 (7.7%)</li> </ul>
<p>Did you feel studying at home to be more effective?</p> <ul style="list-style-type: none"> <li>• Strongly Agree: 117 (7.85%)</li> <li>• Somewhat Agree: 264 (17.7%)</li> <li>• Neither Agree nor Disagree: 346 (3.2%)</li> <li>• Somewhat Disagree: 353 (23.7%)</li> <li>• <b>Strongly Disagree: 410 (27.5%)</b></li> </ul>

Shahid et al. [9] in their survey on E-learning shared the thoughts of 1041 Rawalpindi Medical University medical students who gave a positive opinion of the teaching strategies employed, teacher-student interaction and topic coverage on Microsoft teams. A large majority complained of internet connectivity problems and Microsoft teams software issues. 60% students only had internet at home, the rest had to obtain it elsewhere. Anwar et al. [10] also reported a negative effect of the pandemic on medical students of Karachi, especially on clinical teaching and with a low satisfaction to online education. Baloch et al. [11] have also reported adverse effects of the quarantine, lockdown and online education on medical student psychology in Pakistan.

Rajab, Gazal, & Alkattan, in their study on medical students of College of Medicine (COM) of Alfaisal University in Riyadh, Saudi Arabia, conveyed the responses of 139 medical students and teachers as well on this pandemic and reported a positive view to online learning [12]. The majority wanted to integrate this in future medical education. The challenges highlighted in their study included communication problems, technology, assessment of students, anxiety and stress, and technophobia. Meo et al [13] in their study on medical students of College of Medicine, King Saud University, Saudi Arabia reported disheartening, emotional detachment and poor performance in the majority due to the long pandemic restrictions. Khalil et al [14] have reported good acceptance of the online education system in Saudi Arabia and have suggested regular evaluation of this educational approach to achieve effective results. Alsofi et al [15] in their survey on thirteen medical schools of Libya reported a negative perception of virtual learning in the majority, especially clinical teaching and emphasized the importance of bedside teaching in a safe environment. Olum et al. [16] in their survey on knowledge, attitude and practice of nine medical schools in Uganda reported good knowledge, positive attitude and good practice of preventive measures in majority and willingness to work on the frontlines if the situation arises.

Torun & Torun [17] highlighted the impact of pandemic stress on 275 medical students of Faculty of Medicine of Istanbul Yeni Yüzyıl University, Turkey and found high levels of anxiety in their cohort, with excessive fear of getting infected and the majority believing that the virus was a biological weapon developed in a laboratory! Aker & Midik have described Turkish medical students feeling mentally unwell, having good practice and welcoming strict lockdown to contain the pandemic [18].

Means & Neisler, with Langer Research Associates reported low satisfaction levels to online education amongst students and numerous problems [19]. Harries et al. [20] in their survey on 741 US medical students reported severe disruption of medical education with majority willing to return for clinicals, despite the risk, but in a safe environment, reporting moderate stress levels and majority felt that medical college lockdown was appropriate in the situation. Wilson & Shankar [21] in their literature review on this topic have enumerated the challenges faced in this situation, the greatest being clinical learning without patient contact, but also motivation and scheduling have been difficult and a mixed response to online learning and assessment was obtained. Drexler, Hambrecht, & Oldhafer [22] in their survey on German medical students showed positive attitude with the majority volunteering in the pandemic response and not wanting to be overlooked. Nishimura et al. [23] showed high levels of stress amongst Japanese medical students in response to shift to online teaching. Tempiski et al. [24] reported

in their extensive survey on Brazilian medical students that they were highly motivated by their sense of duty and professionalism rather than keenness to learn, to participate in the pandemic.

Choi et al. [25] in their survey on final year UK medical students revealed that the majority had their electives cancelled and faced difficulty in student-to-doctor transition and the majority expressed willingness to be included in the pandemic clinical response. Dost, Hossain, Shehab, Abdelwahed, & Al-Nusair [26] in their survey on UK medical students have found a positive response to online teaching due to its flexibility, with barriers to learning being family distraction and internet instability. Sani et al. [27] have outlined the pandemic consequences in UK medical system with immediate termination of clinical learning and patient contact, like everywhere else in the world, creating a void in the learning of clinical skills. They propose that virtual learning strategies should be assessed via trials, and also clinical scenarios and simulated patient learning should be implemented. They hope telecommunication will positively enhance the landscape of medical education in the coming years. O'Byrne, Gavin, & McNicholas [28] have highlighted the need for future pandemic preparedness in order to minimize adverse psychosocial effects on medical students due to gross restructuring of the curriculum, exam and clinical teaching. Early graduation and open book examinations in UK have led to reduced student anxiety according to Sandhu and de Wolf [29] Compton, Sarraf-Yazdi, Rustandy, & Radha Krishna have shared the UK students desire to return to the hospitals despite the pandemic [30].

Nguyen et al. [31] have shown that good knowledge corresponds to less fear of the pandemic amongst Vietnamese students and it is important to be healthy during this dark period.

Iancu, Kemp, & Alam [32] have predicted that incorporation of telemedicine into medical education may be adopted in future to allow effective teaching in the face of social distancing. They have also emphasized that clinical e-visits, virtual patient consultations, videoconferencing, virtual standardized patients and Objective Structured Clinical Examinations (OSCE), telestroke and tele-trauma teams should be used to help students in clinical learning. Ahmed, Allaf, & Elghazaly [33]. have listed online problem-based learning strategies may be implemented for effective student education in these unprecedented times. Bauchner & Sharfstein [34] have favoured early graduation of medical students with deployment into the pandemic response as volunteers in community surveillance, call centers and swift response teams.

Our study has had two limitations, the first of which is the response rate of 26.7 %. The survey was taken by free will and choice of each participating student and in times of uncertainty it is difficult to achieve a response.

Also, there is selection bias as our survey represents only the twin cities' institutes and not all institutes have consented to the survey and not all medical colleges of the whole of Pakistan. This shows that the majority of institutes of twin cities have satisfied their students with their teaching strategies.

These are unprecedented times. As medical teachers, it is our duty to make the most out of what we have, to deliver our curriculum with the best possible methods, whilst keeping the safety of our students and also ourselves as a top priority. Student feedback is also important to evaluate our teaching methods and strategies and also to further enhance the teaching and

learning process [35]. It is our job as teachers to deliver the best under any circumstances, favourable or unfavourable.

### Conclusions

To conclude, our survey revealed that Twin city medical students have good knowledge, practices and positive views of online education. The results of our study can help guide us in future planning for e-learning for medical students in conditions where remote learning becomes necessary, in the event of similar pandemics.

**Data sharing statement:** The data of this survey is available online via this link: <https://app.surveypplanet.com/results/5fbe4d8f08b8f57bbcaff644>

### Declarations

#### Ethics approval and consent to participate

Ethical permission was obtained from the ethical review committees of Fauji Foundation Hospital, which is a tertiary care teaching hospital affiliated with Foundation University [460/RC/FFH/RWP], and from each participating institute, Foundation University Medical College (FUMC), Foundation University Dental College (FUCD), Foundation University Institute of Rehabilitation Sciences (FUIRS), medical students of Rawalpindi Medical University (RMU), Islamic International Medical College (IIMC) affiliated with Riphah International University, Fazaia Medical College affiliated with Air University, Islamabad Medical and Dental College (IMDC) affiliated with Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU) and Rawal Institute of Health Sciences, also affiliated with SZABMU.

All methods were performed in accordance with the ethical guidelines and regulation, which is in concordance with the declaration of Helsinki.

The survey link asks for online written consent of each student at the beginning of the survey before proceeding further: "Hello! We hope you are safe & well. Please take a few minutes out of your precious time to share your thoughts on the Pandemic. By taking this survey, you give consent on sharing your thoughts. Complete anonymity is guaranteed!" Available from: <https://app.surveypplanet.com/preview/5fbe4d8f08b8f57bbcaff644>

#### Consent for publication

Online written consent was obtained from each participant for the survey before participating in the survey.

#### Availability of data and materials

The survey was completely online and its data along with results can be viewed at the Survey Planet application webpage from the following link: <https://app.surveypplanet.com/results/5fbe4d8f08b8f57bbcaff644>

The datasets generated were analysed by the Survey Planet application itself.

For Question number 6 in the survey: What is one word that comes to mind when you think of the Pandemic?; we took out all the words and converted them into a word cloud with the help of the webpage: [Available from: <https://www.wordclouds.com/>]

**Figure 1:** Word cloud depicting one word that comes to mind while thinking of the pandemic. This image is our own; gener-

ated with our own survey data of Question 6 using wordclouds.com application which provides us free copyright to use it freely.

### Competing interests

"The authors declare that they have no competing interests".

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### Authors' contributions

"SN<sup>1</sup> is the author of the article. SI<sup>2</sup> is a strong collaborator involved in validation and data procurement. UH<sup>3</sup>, SI<sup>4</sup> and ZA<sup>5</sup> are institutional collaborators who have helped in data collection. All authors read and approved the final manuscript."

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