**ORIGINAL RESEARCH**

# Medical Student Perceptions of the Learning Environment, Quality of Life, and the School of Medicine's Response to the COVID-19 Pandemic: A Single Institution Perspective

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## Abstract

**Purpose** Responding to the COVID-19 pandemic, American medical schools made swift changes to clinical education based on guidelines provided by the Association of American Medical Colleges. The purpose of this study was to collect medical student perceptions of the solely online learning environment, their quality of life (QoL), and the pandemic response by their School of Medicine (SoM) to provide suggestions to inform medical schools' responses during the continuation of this pandemic and the next.

**Methods** Between April 29, 2020 and May 16, 2020, the authors distributed a 60-item questionnaire that assessed demographics, learning environment, QoL, and the SoM response. Likert-type items were analyzed on an item-by-item basis, whereas themes were identified for open-ended questions.

**Results** A total of 330 medical students (of 632; 52.2%) responded. Those who responded had positive perceptions of the online learning environment with moderate QoL disruptions to concentration and sleep. Although most students perceived being able to contribute meaningfully to the healthcare setting, they viewed themselves as underutilized. Three themes encapsulated both positive and negative perceptions of the SoM's response—communication, learning environment, and empathy and support.

**Conclusion** These findings provide insight into medical student perceptions of their learning environment and QoL as they acclimated to changes resulting from the COVID-19 pandemic. Results can help inform a SoM's response during the continuation of the COVID-19 pandemic as well as during future pandemics or crises. Follow-up surveys of medical students at multiple institutions across the USA and abroad will be essential to better characterize student perceptions.

**Keywords** COVID-19 · Medical student · Learning environment · Quality of life

## Introduction

On January 21, 2020, the USA reported its first case of SARS-CoV-2, the novel coronavirus stain associated with the COVID-19 pandemic [1]. As of June 9, 2020, the USA led the world in both confirmed cases and deaths with nearly 2 million people infected and more than 111,000 deaths [2, 3]. As the number of cases continued to increase, many states enacted stay-at-home orders [4], and the Centers for Disease Control and Prevention recommended avoiding any gatherings with more than 10 people [5].

In response to the developing pandemic, medical professional societies released position statements regarding medical student education. On March 17, 2020, the Association of American Medical Colleges (AAMC) released guidelines recommending a minimum 2-week suspension of any clinical activities involving patient contact with the goal of conserving personal protective equipment (PPE), minimizing the potential spread of the virus, and protecting learners [6]. On March 30, these recommendations were later extended to April 14, 2020, with new guidelines suggesting lengthened suspensions in accordance with local, state, and national guidelines.

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In addition, the AAMC "strongly suggest[ed] that medical students not be involved in any direct patient care activities." [7]

Accordingly, medical schools nationwide made varying changes to clinical education. Some schools forbid any patient interaction, whereas others recruited students for hospital-based roles or even graduated medical students early in order to serve as frontline clinicians [8–10]. Many medical schools also quickly transitioned the entire pre-clinical curriculum to online formats [11]. Given the effectiveness of social distancing [12], it remains uncertain when medical students may return for in-person didactics and clinical duties with increasing recognition that there may be future periods of suspended in-person academic activities [11].

It is unknown how medical students perceive their new wholly online learning environment, quality of life (QoL), or their medical school's response amid the pandemic. Studies surveying medical students and residents during the current pandemic have asked about their experiences, especially with ethical or practical challenges, and how they have responded [13] or evaluated residency program practice changes and resident perceptions of anxiety and disease exposure [14]. However, to our knowledge, there are no published studies examining medical student perceptions of their online learning environment, QoL, and school response during the initial phase of the COVID-19 pandemic. Thus, we conducted a cross-sectional analysis to evaluate medical students' views during the early stages of this pandemic. Understanding students' perceptions and concerns during the COVID-19 pandemic will help inform medical schools' policies during the continuation of this pandemic and future crises.

## Method

### Environment

Creighton University School of Medicine (SoM) is a Jesuit institution that offers an allopathic 4-year Doctor of Medicine program divided into a pre-clinical, basic science curriculum for first-year (M1) and second-year (M2) students and a clinical curriculum in which third-year (M3) and fourth-year (M4) students engage in clinical duties as members of the healthcare team on hospital wards and in outpatient clinics. The SoM has a main campus in Omaha, NE, and a regional campus in Phoenix, AZ. After completing all pre-clinical education in Omaha, NE, approximately one-third of M3/M4 students

rotate at clinical sites in Phoenix, AZ. Both campuses subsist under the SoM and follow identical curricula.

## School of Medicine's Response to COVID-19 Pandemic

On March 9, 2020, clinical shadowing for M1s/M2s was suspended for the remainder of the academic year, and by the end of that week, they were informed that all didactics would be delivered online. Pre-pandemic, although didactic lectures were recorded, students could choose to attend in person or access the recorded lecture asynchronously. Following the suspension of in-person didactics, all lectures were delivered to students via Zoom with students having optional synchronous and/or asynchronous access. Importantly, upon suspension of clinical shadowing and in-person didactics, M2 students were on their spring break, spending time at home and/or out-of-state, many of whom became stranded due to state-specific stay-at-home orders and/or travel restrictions. On March 17, 2020, an email was sent to the M3/M4 students alerting them that clinical duties were suspended for 2 weeks. At the end of these 2 weeks, they were informed that the suspension would be continued indefinitely. The Associate Dean of Medical Education was the main point person for communication between SoM and students. Additionally, individual component directors for each year sent emails to students; students at the Phoenix regional campus received emails specific to their campus. Overall, most emails from the SoM were sent in March with several additional emails during April and May. In addition to the emails, the SoM hosted one class specific town hall meeting for M1, M2, and M3 classes during which students could state concerns and ask questions.

## Questionnaire Design

We employed a 60-item questionnaire that assessed demographics (7 items), learning environment (25 Likert-type items), QoL (15 Likert-type items), and SoM response (11 Likert-type, 2 open-ended; see online supplemental content). The learning environment items were based on the Dundee Ready Education Environment Measure (DREEM) [15] and the QoL items were based on the World Health Organization Quality of Life (WHOQOL-BREF) questionnaire [16]. For both the DREEM and WHOQOL-BREF, we identified and included items based solely on the purpose of this study (e.g., no items specific to in-person didactics), which precluded calculation of cumulative or subscale scores

for both measures. However, removing non-essential items served to reduce the students' response burden.

## Survey Procedure

This research was approved by the Institutional Review Board at Creighton University (infoEd record number 2001058). Participation was voluntary and responses were completely anonymous and confidential. The questionnaire was created in Qualtrics XM (Qualtrics, Provo, UT) and distributed via URL to the web-based version of the questionnaire. Students were contacted via class-specific email lists. The questionnaire was open to students from April 29, 2020 to May 16, 2020, during which time we sent out five reminder emails.

## Data Analysis

Continuous variables are presented as mean and standard deviation, whereas categorical variables are presented as frequency and percent. All Likert-type items were analyzed on an item-by-item basis. In addition, two authors (E.V. and H.M.) independently reviewed each student response to the two open-ended questions to identify common themes; disagreement in theme identification was remedied via consensus.

## Results

A total of 330 medical students (of 632; 52.2%) provided responses that included 58.6% of M1 students, 50.6% of M2 students, 53.5% of M3 students (74.4% of students in

Omaha, 26.1% of students in Phoenix), and 45.0% of M4 students (64.9% of students in Omaha, 22.7% of students in Phoenix). Demographic data is provided in Table 1.

## Learning Environment

As shown in Table 2, most students across all classes reported that the learning strategies that worked previously continued to work (57.1% to 74.3%). Most students stated they were confident about passing (79.7% to 100%), felt able to ask questions (75.4% to 90.0%), and were learning empathy (79.7% to 93.2%); a small percentage felt that cheating was a problem (1.1% to 4.6%). Further, a majority of M1, M3, and M4 students reported that teachers provided clear examples (75.8% to 77.3%) and were prepared for class (63.6% to 86.8%), whereas a minority of M2 students reported that the teaching was focused (20.3%), that the use of teaching time was effective (10.1%), that the learning objectives were clear (18.8%), and that long-term learning is the focus (14.5%).

## Quality of Life

As shown in Table 3, most students rated their QoL as positive (60.3% to 79.4%), felt financially and physically safe (72.1% to 80.0% and 79.1% to 86.8%, respectively), were satisfied with their living conditions (86.0% to 89.7%), had support from friends (74.4% to 80.9%), and had access to health services (50.0% to 62.8%). However, only a minority of students in all classes reported being able to concentrate (11.8% to 30.2%), and a lower percentage of M1/M2 students reported being satisfied

**Table 1** Demographic characteristics

| | M1 ($n=99$) | M2 ($n=83$) | M3 ($n=85$) | M4 ($n=63$) |
|---|---|---|---|---|
| Age | $24.1 \pm 1.5$ | $25.0 \pm 1.8$ | $25.8 \pm 1.6$ | $26.7 \pm 1.5$ |
| Biological sex | | | | |
|     Female | 63.6 | 63.9 | 51.8 | 58.7 |
|     Male | 36.4 | 36.1 | 48.2 | 41.3 |
| Race | | | | |
|     White | 80.8 | 75.9 | 83.5 | 90.5 |
|     Asian | 18.2 | 21.7 | 14.1 | 4.8 |
|     Other | 1.0 | 2.4 | 2.4 | 4.7 |
| Hispanic origin | 9.1 | 13.3 | 12.9 | 7.9 |
| Relationship status | | | | |
|     Single | 46.5 | 45.8 | 30.6 | 30.2 |
|     In a relationship/married | 53.5 | 54.2 | 69.4 | 69.8 |

Race categories were collapsed to prevent identifiability due to low observed counts. Similarly, no data is presented for number of dependents due to low observed counts

**Table 2** DREEM—learning environment—positive perspective

| Item | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| Learning strategies that worked for me before continue to work for me now | 57.1 | 58.0 | 74.3 | 68.2 |
| I am confident about my passing this year | 85.7 | 79.7 | 85.7 | 100.0 |
| I feel able to ask the questions I want | 80.2 | 75.4 | 90.0 | 84.1 |
| I have learned a lot about empathy in my profession | 91.2 | 79.7 | 84.3 | 93.2 |
| Cheating is a problem in this school | 1.1 | 2.8 | 2.8 | 4.6 |
| The teachers give clear examples | 75.8 | 37.7 | 77.1 | 77.3 |
| The teachers are well prepared for their classes | 86.8 | 40.6 | 80.0 | 63.6 |
| The teaching is well focused | 70.3 | 20.3 | 62.9 | 56.8 |
| The teaching time is put to good use | 50.5 | 10.1 | 41.4 | 56.8 |
| I am clear about the learning objectives of the courses | 70.3 | 18.8 | 68.6 | 63.6 |
| Long-term learning is emphasized over short-term learning | 40.7 | 14.5 | 61.4 | 54.5 |
| The teachers are knowledgeable | 96.7 | 85.5 | 87.1 | 90.9 |
| There is a good support system for students who get stressed | 59.3 | 44.3 | 61.4 | 65.9 |
| The teaching is engaging | 52.2 | 24.6 | 38.6 | 50.0 |
| The teaching helps to develop my competence | 76.9 | 40.6 | 47.1 | 52.3 |
| The teachers have good communication skills | 73.6 | 31.9 | 81.4 | 72.7 |
| I feel I am being well prepared for my profession | 61.5 | 47.8 | 52.9 | 65.9 |
| The teaching over-emphasizes factual learning | 30.8 | 42.0 | 18.6 | 11.4 |
| Last year's work has been good preparation for this year's work | 23.9 | 56.5 | 67.1 | 84.1 |
| I am able to memorize all I need | 36.3 | 30.4 | 64.3 | 61.4 |
| I find the medical school experience disappointing | 12.1 | 20.3 | 21.5 | 22.7 |
| My problem-solving skills are being well-developed here | 80.2 | 53.6 | 71.4 | 63.6 |
| The learning environment motivates me as a learner | 54.9 | 36.2 | 51.4 | 47.7 |
| The teaching encourages me to be an active learner | 54.9 | 33.3 | 68.6 | 61.4 |
| Much of what I have to learn seems relevant to a career in healthcare | 90.1 | 55.1 | 80.0 | 79.5 |

Data provided as percentage responding agree or strongly agree

with their sleep (48.9% and 50.0%) compared with M3/ M4 students (79.4% and 57.4%). Further, M2 students reported the highest rate of negative feelings (26.5%) compared with all other students (13.2% to 16.7%).

**Table 3** WHOQOL-BREF—quality of life—positive perspective

| Item | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| How would you rate your quality of life? | 74.4 | 60.3 | 79.4 | 65.1 |
| Do you have enough money to meet your needs? | 80.0 | 75.0 | 72.1 | 79.1 |
| How safe do you feel in your daily life? | 84.4 | 82.4 | 86.8 | 79.1 |
| How satisfied are you with the conditions of your living place? | 86.7 | 86.8 | 89.7 | 86.0 |
| How satisfied are you with the support you get from your friends? | 80.0 | 75.0 | 80.9 | 74.4 |
| How satisfied are you with your access to health services? | 61.1 | 50.0 | 58.8 | 62.8 |
| How well are you able to concentrate? | 22.2 | 16.2 | 11.8 | 30.2 |
| How satisfied are you with your sleep? | 48.9 | 50.0 | 79.4 | 57.4 |
| How often do you have negative feelings such as blue mood, despair, anxiety, depression? | 16.7 | 26.5 | 13.2 | 14.0 |
| How satisfied are you with your health? | 66.7 | 69.1 | 86.8 | 76.7 |
| To what extent do you feel your life to be meaningful? | 60.0 | 39.7 | 51.5 | 48.8 |
| Do you have enough energy for everyday life? | 64.4 | 52.9 | 66.2 | 69.8 |
| How available to you is the information that you need in your day-to-day life? | 83.3 | 64.7 | 76.5 | 83.7 |
| How satisfied are you with your ability to perform your daily living activities? | 68.9 | 57.4 | 82.4 | 69.8 |
| How satisfied are you with your personal relationships? | 73.3 | 58.8 | 75.0 | 86.0 |

Data reported as the percentage responding positively. Across items, the WHOQOL-BREF uses six different Likert-type response anchors. Depending on item, responding positively was defined with the following response anchors: good or very good, satisfied or very satisfied, very much or an extreme amount, very much or extremely, mostly or completely, and very often or always

## School of Medicine's Response

Table 4 provides item responses specific to the SoM's response to the pandemic. Compared with all other classes, M1 students responded positively to the timeliness and appropriateness of the school's response (88.9% and 90.0%, respectively), the frequency of email updates (80.0%), and the helpfulness of information provided in those updates (81.1%). In response to the larger healthcare setting, responses to items specific to student contribution and utilization during the pandemic were more homogenous. Specifically, although most students reported being able to contribute meaningfully to the healthcare setting (71.6% to 83.3%), they viewed themselves as being underutilized amid the pandemic (28.4% to 47.6%).

Of the 330 students who responded to our survey request, 170 (51.5%) responded to the open-ended items. When evaluating these open-ended responses, three consistent themes emerged both in praise and critique of the SoM's response—communication, learning environment, and empathy/support (Tables 5 and 6). Approximately 7% of respondents stated that the SoM has done about as well as possible.

**Communication.** The most commonly identified theme was communication that reflected students' perceptions of the SoM's communication with students since the removal of students from clinical duties and the transition to online learning. Praise for the response focused on the timeliness of the initial response, frequency of initial updates, and a perception of transparency amid an unprecedented and fluid environment. Students consistently mentioned their appreciation of administration and faculty informing them about safety during the pandemic and being available to answer questions. However, students also noted that updates became more infrequent as the pandemic progressed and confusion arose from inconsistency in who was delivering the updates. Further, students expressed an understanding of the fluidity of the situation while asking for communication regardless of new or definitive updates, greater transparency in decision-making, and more advancement in alerting students to return to school/clinics.

**Online Learning Environment.** This theme captured students' perceptions concerning the transition from in-person didactic and clinical education to remote online learning during the initial phase of the pandemic. Praise for the SoM's response was most apparent in M1 students. Overall, respondents praised the speed of transition to an online curriculum, the adaptability of the SoM, and the administration for being receptive to student feedback. By contrast, critiques included faculty failing to upload lectures and assignments in a timely manner, recorded lectures going over their allotted time, and student concern regarding clinical competency in the absence of in-person clinical skills simulation and practice. Although students at all levels indicated feeling overwhelmed by the amount of mandatory online video conferences, discussions, and lectures, these critiques were most notable in M2 students who were on spring break, potentially stranded out-of-state in different time zones due to state-specific stay-at-home orders, and facing the short-notice rescheduling of step 1 exam.

**Empathy and Support.** This theme related to students' perceptions of empathy and support for students by the SoM. Feeling support and empathy was related to the frequency of communication, being heard when student concerns were voiced evidenced by attempts to address those concerns, faculty providing verbal support, and administration acknowledging class-specific concerns surrounding the step 1 board exams or graduation. Conversely, some students stated that some actions seemed to conflict with the health and safety of students. For example, students cited being described as essential members of the healthcare team

**Table 4** Assessment of SOM response—positive perspective

|  | M1 | M2 | M3 | M4 |
|---|---|---|---|---|
| The overall response by the SOM has been timely | 88.9 | 55.6 | 61.2 | 71.4 |
| The overall response by the SOM has been appropriate | 90.0 | 65.1 | 73.1 | 71.4 |
| The frequency of email updates provided by the SOM has been appropriate | 80.0 | 49.2 | 56.7 | 64.3 |
| The information in the email updates provided by the SOM has been helpful | 81.1 | 61.9 | 62.7 | 71.4 |
| I believe I can contribute meaningfully to the healthcare setting | 82.0 | 82.5 | 71.6 | 83.3 |
| I believe I am being utilized appropriately in the healthcare setting | 36.0 | 28.6 | 28.4 | 47.6 |
| The SOM informed me how academic decisions are being made | 65.6 | 44.4 | 58.2 | 66.7 |
| The SOM has outlined strategies for me to return to school | 24.4 | 55.6 | 79.1 | 31.0 |
| The SOM has had the best interest of the students in mind | 86.7 | 66.7 | 76.1 | 78.6 |
| I would enroll in medical school again | 95.5 | 88.9 | 91.0 | 78.6 |
| My specialty choice has changed because of the COVID-19 pandemic | 2.2 | 6.3 | 10.4 | 0.0 |

Data provided as percentage responding agree or strongly agree

**Table 5** Themes pertaining to what the SOM had done well

| Theme | M1 (%) | M2 (%) | M3 (%) | M4 (%) | Exemplar responses |
|---|---|---|---|---|---|
| Communication | 31.6 | 63.6 | 62.2 | 64.3 | "They have communicated consistently and clearly. They have not sugar-coated things and are clear about the ambiguity of the situation."<br>"The SOM started providing information to the students early on about safety and what students needed to do during the online learning. Along with this, the staff has been readily available to answer questions if they came up." |
| Online learning environment | 45.6 | 18.2 | 4.4 | 7.1 | "The school of medicine has done a great job moving the curriculum to an all online setting. I know they have been working hard to make this transition as smooth as possible and their efforts have been successful with the modification of class delivery, TBL/CBL, and assistance from the professors"<br>"I also think they did a decent job of transitioning to online. Some things didn't go as well as others, but they were receptive to student feedback and were able to make changes during the courses." |
| Empathy and support | 24.6 | 18.2 | 33.3 | 28.6 | "I really appreciate the communication provided from faculty and how hard the school has worked to allow us to continue our education and graduate on time. As much as the future is still uncertain, and people may be frustrated, the faculty and staff have done everything they can for us. It is no one's fault."<br>"Also I have felt very certain in this time that the administration of the School of Medicine making decisions concerning students do care very much about the needs and well-being of students. Even when I have wished that different decisions were made, I was sure that those making decisions do care about my success and well-being." |

Responses to open-ended questions may have contained multiple themes; thus, the sum of theme percentages within a given class may be greater than 100%

**Table 6** Themes pertaining to what the SOM could have done better

| Theme | M1 (%) | M2 (%) | M3 (%) | M4 (%) | Exemplar responses |
|---|---|---|---|---|---|
| Communication | 15.4 | 19.7 | 33.3 | 15.4 | "We have not heard much after the first couple weeks about any updates on what the thought process is now."<br>"Having the three possible return dates has been very stressful for many of us trying to plan for the rest of the year, including what to do when leases run out, etc."<br>"This is tough, because the administration probably feels that they have little to communicate, since the situation is so fluid. However, responding from the point of view of a student, more communication to alleviate as much uncertainty as possible would be so helpful. The communication does not have to give definite timelines…." |
| Online learning environment | 49.2 | 19.7 | 17.8 | 15.4 | "They believe that since we are home, we have ample free time, but I am just as busy if not busier since coming home. Lab schedules were extended […] and now students living on West Coast may have to wake up at 6:30 [a.m.] for an 8:30 [a.m.] lab, although they promised us at the beginning of the COVID shutdown no school would be scheduled before 10am."<br>"I am concerned that I am going to be competent in terms of clinical skills because there has been little to no instruction on how to actually perform the clinical skills we are expected to learn, and outside resources have either too much or too little information relative to what exam components the clinical skills presentations say we "should" know how to/be able to perform." |
| Empathy and support | 12.3 | 23.0 | 17.8 | 15.4 | "I think that the school fails to realize the worries we are facing right now: The stress of studying for step, the stress of classes during this time was immense, many of us have family members caring for COVID 19 patients which adds an immense amount of stress and worry…."<br>"We thought we were drowning before, now we are drowning alone in a tiny box and still expected to swim." |

Responses to open-ended questions may have contained multiple themes; thus, the sum of theme percentages within a given class may be greater than 100%

while recognizing the lack of PPE for them. Further, several students reported feeling unheard regarding concerns about how the pandemic and the school's response would impact them.

## Discussion

The COVID-19 pandemic has affected all levels of medical student training from in-person didactics and clinical rotations, to the AAMC, to testing centers. To our knowledge, this is the first study to assess medical students' learning environment, QoL, and school response amid the COVID-19 pandemic. We found that the medical students who responded to our survey had positive perceptions of the online learning environment and moderate QoL with disruptions to concentration and sleep. We also identified three themes (communication, online learning environment, and empathy and support) that encapsulate their positive and negative perceptions regarding their SoM's response to the pandemic. Surveying medical students during this pandemic is both timely and relevant as the educational environment has an impact on students' perceived well-being, satisfaction, and educational achievement [17]. Overall, we believe that our findings can be used to inform a medical school's response during the continuation of the current COVID-19 pandemic [18], as well as mitigate reactionary responses by schools of medicine during future pandemics or crises.

Most respondents quantitatively reported positive perceptions of the online learning environment during the pandemic, noting knowledgeable teachers, relevant content, and the ability to ask questions. These findings may not be unexpected as medical schools have been transitioning to online curricula for more than a decade, particularly in the pre-clinical years [20, 21]. In addition, medical schools may have also applied lessons learned from medical school closures in Hong Kong and Canada during the SARS-CoV-1 epidemic from 2002 to 2004 [22]. However, M2 students reported considerably less favorable perception compared with peers in other classes. We attribute this difference to the timing of our survey given the uncertainty surrounding preparation and scheduling of the step 1 board exam. Preparing for boards is one of the greatest stressors of the M2 year. The timing of the COVID-19 pandemic significantly compounded this stress as students typically sit for step 1 in May or June, a period of the pandemic during which testing sites were forced to close, some with only 24 h of notice. Although testing site closure was occurring nationally with the closing of testing cites beyond the SoM's control, many M2 students expressed concern and frustration about a lack of a contingency plan should they be unable to take step 1 until their third year. Of concern was the amount of time, if

any, they would be given during clinical rotations to sit for the exam.

In addition to concerns about board exams, many students expressed frustration with technical difficulties in content delivery, which they attributed qualitatively to instructors' perceived lack of technological knowledge. This sentiment corroborates a study of pre-licensure nursing students in remote learning programs that found students to have considerable expectations of an instructor's technological competency [19]. Qualitative responses to our survey indicate that schools should prepare and test their online learning environment as well as provide instructors with standard recording equipment and considerable real-time coaching on the use of those technologies.

Students' quantitative responses to QoL items serve as a testament to their resilience as the majority were satisfied with their overall QoL, health, safety, and social support. However, a discouragingly low percentage of students in all classes reported being able to concentrate, which may be the result of competing demands on their time resulting from being confined to their apartment or parents' home. Closely related to overall QoL is the students' belief in their ability to contribute meaningfully to the healthcare setting. However, most students believed they were being underutilized, a view that aligns with observations made during the SARS-CoV-1 epidemic in which Canadian medical students were removed from wards to their frustration [23]. A survey of Canadian medical students following the SARS-CoV-1 epidemic found that most believed they have an obligation to volunteer during a pandemic [24]; responses to our survey provide a similar sentiment. That said, the role of the medical student during a health crisis is debated and definitely should not be taken lightly [25, 26], as any student involvement must be weighed cautiously against student safety, particularly amid shortages of PPE. Nonetheless, precedent exists for medical student involvement in patient care during crises as medical students responded during the Spanish flu outbreak of 1918, the polio epidemic, and more recently, the terrorist attacks in New York City on September 11, 2001, and Hurricane Rita in 2005 [27, 28]. In the current COVID-19 pandemic, some medical schools in the USA, Italy, and the UK graduated medical students early on the condition that they serve as frontline clinicians [10]. Students are also volunteering in call centers, creating patient-education materials, and helping with grocery shopping, among other activities, while adhering to social distancing guidelines and supervision [11]. Further, medical student involvement can provide valuable medical training at a time when other healthcare professionals may be ill and unable to work [25]; however, as this pandemic continues and students return to clinical duties, medical schools will

need to consider strategies to handle potential exposures and infections among their students. As epidemics and pandemics occur, it behooves medical schools and hospitals that medical students as future physicians are well-trained in the use of PPE and conversant with infection control measures.

In addition, medical students provided praise and criticism regarding communication from the SoM during the pandemic. Previous research on nursing students in online learning environments reported a need for open and prompt communication to reduce anxiety and minimize resistance to online learning [19]. Accordingly, students expressed praise for the SoM's communication in regard to the class-specific town halls where students could ask questions directly to administration as well as praise for the initial communication during the pandemic. This was contrasted with frustration regarding the infrequency of updates as the pandemic continued. Given the extraordinary nature of the pandemic, students did report understanding some slowing of communication; however, absence of any communication was clearly unacceptable. In our survey, students recommended weekly updates that may simply state that no changes have occurred or the presentation of several scenarios that are in the realm of possibility. Medical schools should designate a single spokesperson to deliver communication to students and student access to a continuously updated calendar.

Medical students also expressed praise and criticism in their perceptions of empathy and support provided in the SoM's response. Some students reported that administration, faculty, and staff have done everything possible to support students amid the pandemic, whereas others reported that the response to the pandemic appeared to conflict with the health and safety of students as well as their future academic success. Students in our survey proposed that the school acknowledge the possible implications of the pandemic on students' educational success and residency placement and admit to mistakes if and when they are made. Further, the school might consider involving students in the decision-making process and offer students more autonomy in scheduling their clinical experiences. Specific to M2 students, there was a perceived lack of support from the school regarding the preparation and scheduling of the step 1 board exam. Students suggested the SoM help students prepare for these exams with town halls to answer questions regarding the exams and time off during rotations.

Previous research has shown that medical students suffer from anxiety and depression at substantially higher rates than the general population worldwide [29, 30]. During the COVID-19 pandemic, social distancing policies and physical isolation may result in adverse mental health consequences in medical students [31]. Further, COVID-19-related stressors, including economic stressors, effects on daily life, and academic delays, were associated with increased anxiety symptoms of Chinese college students [32]. Our survey mirrored these findings as up to one-in-four students have feelings such as blue mood, despair, anxiety, and depression. Furthermore, one in five M2, M3, and M4 students indicated that their medical school experience had been disappointing, whereas one out of five graduating M4 students would not enroll in medical school again. These feelings of disappointment may reflect a combination of early symptoms of the aforementioned adverse mental health consequences, feelings of underutilization during a medical crisis, and fears of the effects of the pandemic on academic achievement and residency placement. For M4 students, the survey responses may be capturing frustration following the cancellation of Match Day and graduation ceremonies and festivities, which are the culmination of years of delayed gratification. Additionally, our survey may also reflect the feelings of M4 students as they grimly stare down the notoriously intense first year of residency amidst a devastating pandemic, which has seen social distancing from family, PPE shortages [33], and mounting death tolls [2]. It is important to note that our survey was conducted in the early days of the pandemic and the impact of COVID-19 on the mental health of medical students may not be fully comprehended for years. It is known that mental health distress in medical students can negatively impact their academic performance [34]. Further, studies surveying online nursing students found that perceived support from their school correlated with achievement [19]. Thus, a perceived lack of support and empathy on the part of the medical school may compound mental distress among medical students. Schools should strive to increase student perception of support and empathy from the school to improve mental health and academic achievement among their students during a pandemic.

## Summary of Suggestions

Our results indicated that amid the COVID-19 pandemic, medical schools need to be attentive to the needs of their students. As medical students continue to move through the current pandemic, we recommend medical schools prepare instructors for online content delivery as well as usability test their online learning environment. Schools should also have a plan for medical students during pandemics and crises, including strategies to handle potential exposures and infections among their students as well as training in the use of PPE and other infection control measures. If feasible, a single spokesperson should deliver frequent updates to students (e.g.,

weekly) and provide access to a continuously updated calendar, especially regarding board exams and clinical rotations. Further, students do not expect perfection, but it is important for medical schools to acknowledge the implications of the pandemic on students' educational success and more openly acknowledge mistakes if and when they occur, ensuring transparent and consistent communication regarding how mistakes are to be corrected. Finally, schools should give students flexibility during rotations to study and sit for board exams should the potential for testing site closure remain.

## Limitations

Our study was limited to medical students at a single Jesuit allopathic institution with campuses located in Omaha, NE, and Phoenix, AZ. As such, our findings may not be fully generalizable to non-Jesuit, non-allopathic institutions. The volunteer nature of the survey may have engendered unquantifiable selection bias. Although we tried to capture survey responses within a short time interval to reflect our institution's initial planning phases for the pandemic, it is possible that responses do not reflect the most current information as policies are changing in response to the fluidity of this pandemic. Perceptions regarding the online learning environment, student QoL, and school response may change as the pandemic continues and schools resume in-person pre-clinical and clinical curricula.

## Further Research

Additional follow-up surveys of medical students at multiple institutions across the country will be essential to characterize student perceptions of the learning environment, QoL, and school response during the COVID-19 pandemic. We believe these efforts are valuable and time-sensitive, particularly as we potentially face multiple waves of the COVID-19 pandemic and future pandemics.

## Declarations

**Ethical Approval** This research was approved by the Institutional Review Board at Creighton University (infoEd record number: 2001058).

**Conflict of Interest** The authors declare that they have no conflict of interest.

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