Medical Students’ Commitment during the SARS-CoV-2 Pandemic: Preparedness, Motivation, and Impact on Students’ Skills

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Abstract

**Background:** During the SARS-CoV-2 pandemic, many authors have suggested a commitment of medical students to support overworked health care staff. However, whether the students are prepared for such an occupation remains unclear. Therefore, the aim of this study was to evaluate medical students’ preparedness for a commitment in the pandemic and to assess the impact on their skills and attitudes.

**Methods:** In April 2020, the CoronaPreventMainz (CPM) study was initiated to test 3300 employees with direct patient contact at the University Medical Center Mainz. To accomplish the huge logistic effort, medical students were recruited as support staff.

Using a web-based questionnaire, the participating students were asked 27 questions covering six different topics.

**Results:** Of the 75 recruited students, 63 (84.0%) participated in this survey. The median age was 24 years, and 66.6% (n = 42) were female. The vast majority agreed that students should be used as voluntary helpers during this crisis (87.3%) and had the feeling of contributing in the fight against the pandemic (90.5%). Most of the students (80.6%) even reported an improvement in their practical skills. Fear of self-infection was low (7.9%), and overextending situations occurred for just 3.2%. However, less than one-fifth (19.4%) of the students felt prepared for the SARS-CoV-2 pandemic by medical school, and two-thirds (67.7%) demanded special preparation.

**Conclusion:** Through their commitment, the medical students felt that they were taking part in the fight against the pandemic. However, only a few felt well-prepared by medical school and the students’ need for special preparation courses is huge. Therefore, single-center initiatives can only be the beginning. Dedicated courses on how to support health care staff in natural disasters should be integrated into the medical curriculum to better prepare medical students for the next crisis.

**Background**

In early 2020, the SARS-CoV-2 pandemic was clearly one of the most terrifying worldwide crises in recent history. Almost all countries were impacted by a fast spreading virus and their health care systems had difficulties coping with the situation (1,2). In addition to a bottleneck of urgently needed materials, a lack of health care professionals was critical (2–6). To deal with this, politicians and scientists suggested involving medical students to prevent a health care system breakdown (7–12). Students themselves asked for rapid involvement in the fight against the pandemic, and recent studies indicate that successful student recruitment and assignment to different tasks is possible on short notice during the crisis (13–15). At our University Medical Center, more than 1000 medical students responded to a pertinent call and registered themselves as voluntary helpers in a dedicated database called "I want to help" (16).

The medical students’ support was urgently needed when the CoronaPreventMainz (CPM) study was initiated in April 2020. The CPM study is a large-scale SARS-CoV-2 cohort study of all employees with direct patient contact, as they have a higher risk of infection and are more likely to be virus carriers (17,18). Overall, 3300 participants were tested for current disease and antibody status at enrollment, after 2 weeks, and after 3 months. As the study was planned and initiated within only 2 weeks, great logistical effort was needed. Therefore, assistant staff were required immediately. For this purpose, 75 medical students were recruited within 3 weekdays and currently work as study assistants.

However, besides the reportedly high motivation and willingness to help, the medical students’ commitment has to be discussed controversially. Whether their short training is enough to cope with difficult situations, both medically and psychologically, is unclear. The British Medical Association recently emphasized that “medical students should not work outside their competency” and warned of unsafe work practices (19). Furthermore, no sufficient data are available on the students’ preparedness for the commitment and the effects of this work during the crisis.
Thus, the aim of this study was to evaluate the students’ preparedness for a commitment in the pandemic and to assess the impact on their skills and attitudes.

**Methods**

**Recruitment of the participants**

For this prospective survey, all medical students recruited for the CPM study at the University Medical Center Mainz were contacted via electronic mail on April 22, 2020, during their commitment in the first stage of the CPM study (ethics committee permit number: 2020-14968). The possibility to participate voluntarily in this online survey was offered to them independent of their task in the CPM study. Furthermore, they were informed that the results of the survey would be used for further scientific analysis, and that their anonymity was guaranteed. A reminder was sent to them via electronic mail after 5 days. The questionnaire was closed after 7 days.

**The questionnaire**

The electronic questionnaire was designed using the SurveyMonkey web application (SurveyMonkey Europe UC). The students were asked about their level of agreement on various items using a 7-point Likert scale (1 = “strongly disagree”, 2 = “disagree”, 3 = “somewhat disagree”, 4 = “neutral”, 5 = “somewhat agree”, 6 = “agree”, 7 = “strongly agree”). We chose a 7-point Likert scale because it provides higher variance and reliability compared to a 5-point scaling system (20). Scaling systems with a higher range of points are not expected to yield added value regarding the information obtained, but would have strained the respondents’ abstraction capabilities (21).

The questionnaire consisted of six sections, each addressing different aspects. The first section of the survey captured the basic demographics (gender and age) of the student assistants, information on any medical apprenticeship before entering medical school, current semester, and details of the students’ commitment in the CPM study (type of work within the study, average hours of work, etc.). The second section asked about their preparedness for the pandemic in medical school. In particular, they were asked for their opinion on dedicated preparation courses for pandemics and whether medical students should be used as additional health care workers during crises like the current SARS-CoV-2 pandemic. The third section comprised questions on their feelings about participating in the fight against the crisis due to their work in the CPM study and their opinion on the appropriateness of students’ participation in this project. Furthermore, the students were asked about the safety precautions taken during their work and possible fear of self-infection. The fourth section asked about the students’ organizational and practical skills and their potential development during the study. Section five focused on their opinion regarding the large-scale testing, their own work within it, and the potential benefit of the study for coping with the SARS-CoV-2 pandemic. The last section of the questionnaire asked about the scientific results of the CPM study and the impact on their own interest in doing research. The entire questionnaire is attached in the supplement (Figure S1).

**Statistical analysis**

After the closing date, the results of the completed questionnaires were exported as a CSV file. This file was imported into RStudio 1.2.5042 and the results analyzed using R 4.0.0 (22,23). Figure 1 was plotted using the ggplot2 and likert packages (24,25). To increase comprehensibility, the scores “strongly disagree”, “disagree” and “somewhat disagree” were rated as disagreement and “somewhat agree”, “agree” and “strongly agree” as agreement. P<0.05 was considered significant. The study followed the CHERRIES statement for reporting results of an internet e-survey (26).

**Results**

**Students’ demographics**
A total of 63 of the 75 CPM student assistants answered the questionnaire during the 1-week period, resulting in a response rate of 84%. Of these, 42 were female (66.7%) and 21 male (33.3%). The median age was 24 years (interquartile range 21 – 27 years). Additional demographics and basic information on the students’ work regarding the study are provided in Table 1.

**Preparedness, motivation, and attitude**

Of all respondents, less than one-fifth (n = 12, 19.0%) felt well prepared due to medical school alone and two-thirds (n = 42, 66.7%) agreed with the statement that special preparation courses for pandemics are needed in medical school (Figure 1). The vast majority (n = 55, 87.3%) of the participants agreed that medical students should work as additional helpers during crises like the SARS-CoV-2 pandemic. Most of the students (n = 57, 90.5%) had the feeling of participating in the fight against the crisis due to their work in the CPM study, and an overwhelming majority agreed with the statement that it is appropriate to have medical students assisting in the CPM study (n = 59, 93.7%). The majority of the students (n = 47, 74.6%) felt well protected during the study work, and the fear of self-infection was low (n = 5, 7.9%). More than half of the students said they would feel safer after nationwide testing (n = 35, 55.6%). For more details, see Table 2.

**Students’ skills and their development**

For most of the students (n = 54, 85.7%), the expectations of them within the study work were appropriate. Overextending situations occurred for just 3.2% (n = 2). Most students stated that they possess good organizational skills (n = 61, 96.8%). More than four-fifths (n = 51, 81.0%) deemed these skills useful for their study workplace. The same tendencies appeared for the medical-practical skills: 81.0% (n = 51) stated that they possess good medical-practical skills and 76.2% (n = 48) deemed these skills useful for their study workplace. Broad agreement was reached on the positive impact of the study on their own skills, as the vast majority reported that their work within the study improved existing skills (n = 51, 81.0%) and even fostered the development of new skills (n = 48, 68.3%). However, only 44.4% (n = 28) of the students thought that the skills learned in medical school helped during the commitment. For more details, see Table 3.

**Opinion of study commitment and large-scale testing**

For the vast majority of the participants (n = 53, 84.1%), the work in the study was fun, and most of them had their expectations satisfied (n = 49, 77.8%). Almost all students were able to imagine being part of this kind of study again (n = 58, 92.1%). In addition, there was general agreement about the usefulness of large-scale testing of health care staff (n = 59, 93.7%). More than two-thirds of the students agreed on a nationwide expansion of systematic SARS-CoV-2 testing (n = 44, 69.8%). Almost all students (n = 62, 98.4%) would participate in such testing themselves.

**Impact on own motivation for scientific research**

Regarding the scientific aspects of the CPM study, with the exception of one neutral answer, all students agreed on having great interest in the scientific results of the study (n = 62, 98.4%). For most of the students, their commitment further motivated them to do their own research in the future (n = 40, 63.5%). More in-depth details are provided in Table 4.

Detailed results for all questionnaire items can be found in Figure 1.

**Discussion**

At the beginning of the SARS-CoV-2 pandemic in early 2020, the commitment of medical students as supporters of health care staff and their possible roles in the system were discussed more than ever before (8–13,19,27). This discussion led us to perform a survey of medical students voluntarily working in a large-scale SARS-CoV-2 cohort study. Most of them had the feeling of participating in the fight against the pandemic due to their commitment. In addition, most of the students recognized it as a chance to improve their skills. However, they did not feel well prepared by medical school and demanded dedicated preparation courses on crises and pandemics.
The idea of student commitment during crises is not new; students successfully supported health care staff during the Spanish flu epidemic in 1918 in Pennsylvania and the Polio outbreak in 1952 in Copenhagen (28,29). During times of increased fear of health staff shortages, the advantages of the commitment of medical students to supporting the health care system are obvious, as medical students represent a group that knows the health care system well due to mandatory internships. Depending on their progress in medical school, the students may also already have knowledge of basic skills needed for clinical patient care, such as taking histories and doing blood draws (10). Furthermore, as most of the students are young and healthy, Thomson et al. argued that they are a low-risk group regarding infection with SARS-CoV-2, especially in contrast to reactivated retired health care staff (13).

Nevertheless, not only the challenged health care system may benefit: For the medical students the help during the crisis can be seen as project problem-based learning (project-PBL) (15). Project-PBL not only broadens students’ metacognitive competencies, but fosters skills relevant to medical problems and research (30). This means that the CPM study work enabled the students to further develop organizational, communication, and basic medical skills (e.g., blood or swab sampling) during a time when medical schools are closed and most courses held online without the possibility of hands-on training. Furthermore, actively taking part in the fight against the pandemic can strengthen the “sense of cohesion”, which can increase the motivation of the group and further improve their performance (31). In addition, the “social connectedness” of the students may be strengthened, which is an integral part of mental health, especially in a time when contact restrictions constrain social interactions (32).

Despite all of these advantages of student commitment during the pandemic, there are some drawbacks that have to be addressed. As the students are clearly not permitted to perform all tasks, their work has to be regularly supervised or even repeated by professional staff. Some authors argue that, through this redundant work, the transmission rate may be increased (27). Furthermore, this may lead to a waste of personal protective equipment, for which a shortage has already been reported (3).

Another possible source of mistakes to consider may be the insufficient preparation of the students for the pandemic by their medical school. Dedicated preparation courses are lacking. Our study underlined that the students did not feel well-prepared for dealing with the pandemic. Even though overextending situations occurred rarely, the goal has to be to further minimize them, especially as today’s medical students may be first-line fighters in the next crisis. Thus, the demand for special courses is great. To solve this problem, several training and recruitment initiatives have emerged during the current crisis (14,15). However, single-center initiatives can only be the beginning. To be better prepared for the next crisis, systematic and nationwide standardized preparation courses may be the solution. Such a program in association with a dedicated database would also allow for faster, more extensive, and especially more specific recruitment. High motivation and a feeling of preparedness are the basis of the commitment, but not enough to make the students an indispensable support during the crisis.

Our study has several limitations. First and foremost, the students were only recruited at a single center for a dedicated SARS-CoV-2 cohort study to perform limited and clearly defined tasks. However, the students signalized their assistance before even knowing their exact task within the study, so the influence of this bias on students’ motivation and attitude towards their commitment can be expected to be low. Secondly, the recruitment of the questionnaire participants could have led to a response bias, interested students may be more likely to have completed the questionnaire. To minimize this potential bias, we sent a reminder to the students, which eventually led to a very high response rate of more than 80%. In addition, the SARS-CoV-2-prevalence in Germany was moderate (33). A higher prevalence in a region may lead to a higher chance of having relatives and friends directly affected by COVID-19, which could lead to a more negative psychological impact and possible anxiety towards a commitment. However, it may also further increase motivation to help in the fight against the pandemic, as experiences from greater affected countries also report highly motivated students (13,14).

Conclusion
Through their commitment, the medical students have the feeling of taking part in the fight against the SARS-CoV-2 pandemic. The fear of self-infection is low, and overextending situations are rare. Furthermore, the majority reported an improvement in their practical skills and an increasing interest in performing their own scientific research. However, only a few felt well-prepared by medical school, and the students need special preparation courses. Therefore, single-center initiatives can only be the beginning. Dedicated courses on how to support health care staff in natural disasters should be integrated into the medical curriculum to better prepare medical students for the next crisis.

Tables

Table 1: Demographic characteristics of the participants

| Variable                                | All (n = 63) |
|-----------------------------------------|--------------|
| Age, years                              | Median (IQR) 24 (21-27) |
| Sex                                     | Female 42 (66.7%) Male 21 (33.3%) |
| Future medical profession               | Medicine 57 (90.5%) Dentistry 6 (9.5%) |
| Semester                                | Median (IQR) 7 (3-11) |
| Prior medical apprenticeship*           | Yes 27 (42.9%) No 36 (57.1%) |
| Task within the study                   | Blood withdrawal 23 (36.5%) Processing of the samples 5 (7.9%) Organization 5 (7.9%) A combination of these 27 (42.9%) Others 3 (4.8%) |
| Weekly working hours                    | Less than 10 14 (22.2%) Between 10 and 15 25 (38.7%) Between 15 and 20 18 (28.6%) More than 20 6 (9.5%) |

*Defined as a medical apprenticeship prior to entering medical school (e.g., nursing, ambulance service, radiographer, medical technical assistant).

IQR, interquartile range.

Data are given as n (%) unless otherwise noted.

Table 2: Students’ (n=63) opinions of the preparedness, motivation, and attitude towards voluntary help during the pandemic
In your personal opinion, how accurate are the following statements?

| Statement                                           | Disagree | Neutral | Agree | Mean value |
|-----------------------------------------------------|----------|---------|-------|------------|
| 2.1 Medical school prepared me well for the pandemic| 37 (58.7%) | 14 (22.2%) | 12 (19.0%) | 3.3        |
| 2.2 Dedicated courses for pandemic preparation are needed | 9 (14.3%) | 12 (19.0%) | 42 (66.7%) | 4.8        |
| 2.3 Students should work as helpers during the crisis | 0        | 8 (12.7%) | 55 (87.3%) | 5.8        |
| 3.1 Through my study work, I take part in the fight against the pandemic | 3 (4.8%) | 3 (4.8%) | 57 (90.5%) | 5.5        |
| 3.2 I am afraid of self-infection                  | 48 (76.2%) | 10 (15.9%) | 5 (7.9%) | 2.6        |
| 3.3 It is appropriate that students work in the study | 0        | 4 (6.4%) | 59 (93.7%) | 6.3        |
| 3.4 I feel protected while working                 | 11 (17.5%) | 5 (7.9%) | 37 (74.6%) | 5.2        |
| 3.5 Nationwide testing would make me feel safer    | 20 (31.7%) | 8 (12.7%) | 35 (55.6%) | 4.5        |

Data are given as n (%) unless otherwise noted.

Table 3: Students’ (n=63) opinions of statements on their own skills and their development during the study work

In your personal opinion, how accurate are the following statements?

| Statement                                                                 | Disagree | Neutral | Agree | Mean value |
|---------------------------------------------------------------------------|----------|---------|-------|------------|
| 4.1 The expectations of the students are appropriate                      | 6 (9.5%) | 3 (4.8%) | 54 (85.7%) | 6.1        |
| 4.2 There were no situations in which I felt overextended during the commitment | 2 (3.2%) | 1 (1.6%) | 60 (95.2%) | 6.2        |
| 4.3 I have good organizational skills                                     | 1 (1.6%) | 1 (1.6%) | 61 (96.8%) | 6.2        |
| 4.4 My organizational skills helped me during the commitment              | 5 (7.9%) | 7 (11.1%) | 51 (81.0%) | 5.7        |
| 4.5 I have good medical-practical skills                                  | 6 (9.5%) | 6 (9.5%) | 51 (81.0%) | 5.4        |
| 4.6 My practical skills helped me during the commitment                   | 11 (17.5%) | 4 (6.4%) | 48 (76.2%) | 5.4        |
| 4.7 Skills I learned in medical school helped me during the commitment     | 20 (31.8%) | 15 (23.8%) | 28 (44.4%) | 4.2        |
| 4.8 I learned new skills due to the commitment                            | 13 (20.6%) | 7 (11.1%) | 43 (68.3%) | 5.1        |
| 4.9 I improved existing skills due to the commitment                      | 7 (11.1%) | 5 (7.9%) | 51 (81.0%) | 5.6        |
Table 4: Students’ (n=63) opinions of the study and their attitude towards doing their own scientific research and
development through the study work

In your personal opinion, how accurate are the following statements?

| Statement                                                                 | Disagree | Neutral | Agree  | Mean value |
|---------------------------------------------------------------------------|----------|---------|--------|------------|
| 5.1 The study work is fun                                                 | 2 (3.2%) | 8 (12.7%) | 53 (84.1%) | 5.8        |
| 5.2 The commitment met my expectations                                    | 10 (15.9%) | 4 (6.4%) | 49 (77.8%) | 5.3        |
| 5.3 I would help again during another SARS-CoV-2 testing study            | 1 (1.6%) | 4 (6.4%) | 58 (92.1%) | 6.1        |
| 5.4 I think health care staff testing is a reasonable prevention strategy | 2 (3.2%) | 2 (3.2%) | 59 (93.7%) | 6.3        |
| 5.5 Large-scale testing should be rolled out for the whole population     | 12 (19.1%) | 7 (11.1%) | 44 (69.8%) | 5.1        |
| 5.6 I would participate in large-scale testing myself                      | 0        | 1 (1.6%) | 62 (98.4%) | 6.6        |
| 6.1 I would like to lead and organize large-scale testing myself           | 17 (27.0%) | 8 (12.7%) | 38 (60.3%) | 4.8        |
| 6.2 I am interested in the results of the CPM cohort study                 | 0        | 1 (1.6%) | 62 (98.4%) | 6.7        |
| 6.3 I am interested in doing scientific research myself                    | 13 (20.6%) | 10 (15.9%) | 40 (63.5%) | 4.8        |
| 6.4 My commitment to the study increased my own interest in scientific research | 9 (14.3%) | 14 (22.2%) | 40 (63.5%) | 4.8        |
Consent for publication:

Not applicable.

Availability of data and material:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests:

RK has received speaker fees from BTG, Guerbet, Ipsen, SIRTEX, MSD Sharp & Dohme, and personal fees from Boston Scientific, Bristol-Myers Squibb, Guerbet, and SIRTEX. None of these companies played any role in drafting this manuscript. None of the other authors reports any disclosures.

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Authors’ contributions:

LM, MH, LH, AMK, and RK devised the study, assisted in data collection, participated in the interpretation of the data, and helped draft the manuscript. JW, SG, and CD supported interpretation of the data and drafting of the manuscript. LM, and RK performed the statistical analysis. All authors read, revised and approved the final version of the manuscript.

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References

1. World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2020 May 12]. Available from: https://covid19.who.int

2. Sima L, Muñoz Ratto H, Talmazan Y. Medical workers in Spain and Italy “overloaded” as more of them catch coronavirus [Internet]. 2020 [cited 2020 May 12]. Available from: https://www.nbcnews.com/news/world/medical-workers-spain-italy-overloaded-more-them-catch-coronavirus-n1170721

3. Ranney ML, Griffeth V, Jha AK. Critical Supply Shortages — The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. N Engl J Med [Internet]. 2020 Mar 25;382(18):e41. Available from: https://doi.org/10.1056/NEJMp2006141

4. Schlanger Z. Begging for Thermometers, Body Bags, and Gowns: U.S. Health Care Workers Are Dangerously Ill-Equipped to Fight COVID-19 [Internet]. 2020 [cited 2020 May 12]. Available from: https://time.com/5823983/coronavirus-ppe-shortage/

5. Blech J. A Dearth of Nurses: COVID-19 Highlights Staff Shortages at German Hospitals [Internet]. Spiegel International. 2020 [cited 2020 May 12]. Available from: https://www.spiegel.de/international/germany/covid-19-highlights-staff-shortages-at-german-hospitals-a-dc13b683-3884-4683-b9c0-68e0084a1f70

6. The Lancet. COVID-19: protecting health-care workers. Lancet [Internet]. 2020 Mar 21;395(10228):922. Available from: https://doi.org/10.1016/S0140-6736(20)30644-9
7. Deutsches Ärzteblatt. Corona: Spahn verspricht Krankenhäusern finanzielle Hilfe [Internet]. 2020 [cited 2020 May 12]. Available from: https://www.aerzteblatt.de/nachrichten/111050/Corona-Spahn-verspricht-Krankenhaeusern-finanzielle-Hilfe

8. Stokes DC. Senior Medical Students in the COVID-19 Response: An Opportunity to Be Proactive. Acad Emerg Med [Internet]. 2020 Apr 1;27(4):343–5. Available from: https://doi.org/10.1111/acem.13972

9. DeWitt DE. Fighting COVID-19: Enabling Graduating Students to Start Internship Early at Their Own Medical School. Ann Intern Med [Internet]. 2020 Apr 7; Available from: https://www.acpjournals.org/doi/abs/10.7326/M20-1262

10. Miller DG, Pierson L, Doernberg S. The Role of Medical Students During the COVID-19 Pandemic. Ann Intern Med [Internet]. 2020 Apr 7; Available from: https://www.acpjournals.org/doi/abs/10.7326/M20-1281

11. Baker DM, Bhatia S, Brown S, Cambridge W, Kamarajah SK, McLean KA, et al. Medical student involvement in the COVID-19 response. Lancet [Internet]. 2020 Apr 18;395(10232):1254. Available from: https://doi.org/10.1016/S0140-6736(20)30795-9

12. Bauchner H, Sharfstein J. A Bold Response to the COVID-19 Pandemic: Medical Students, National Service, and Public Health. JAMA [Internet]. 2020 Apr 8; Available from: https://doi.org/10.1001/jama.2020.6166

13. Thomson E, Lovegrove S. 'Let us Help': Why Senior Medical Students are the Next Step in Battling the COVID-19 Pandemic. Int J Clin Pract [Internet]. 2020 Apr 16;n/a(n/a). Available from: https://doi.org/10.1111/ijcp.13516

14. Soled D, Goel S, Barry D, Erfani P, Joseph N, Kochis M, et al. Medical Student Mobilization During A Crisis: Lessons From A COVID-19 Medical Student Response Team. Acad Med [Internet]. 9000;Publish Ah. Available from: https://journals.lww.com/academicmedicine/Fulltext/9000/Medical_Student_Mobilization_During_A_Crisis_97220.aspx

15. Rasmussen S, Sperling P, Poulsen MS, Emmersen J, Andersen S. Medical students for health-care staff shortages during the COVID-19 pandemic. Lancet [Internet]. 2020 May 2;395(10234):e79–80. Available from: https://doi.org/10.1016/S0140-6736(20)30923-5

16. Frankfurter Allgemeine Zeitung. Tausende Medizinstudenten sind im Einsatz [Internet]. 2020 [cited 2020 May 12]. Available from: https://www.faz.net/aktuell/karriere-hochschule/hoersaal/corona-hilfe-tausende-medizinstudenten-sind-im-einsatz-16697231.html

17. Team TNCPERE. The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020. China CDC Wkly [Internet]. 2(8):113–22. Available from: http://weekly.chinacdc.cn//article/id/e53946e2-c6c4-41e9-9a9b-fea8db1a8f51

18. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus–Infected Pneumonia in Wuhan, China. JAMA [Internet]. 2020 Mar 17;323(11):1061–9. Available from: https://doi.org/10.1001/jama.2020.1585

19. Harvey A. Covid-19: medical students should not work outside their competency, says BMA. BMJ [Internet]. 2020 Mar 24;368:m1197. Available from: http://www.bmj.com/content/368/bmj.m1197.abstract

20. Saris WE, Gallhofer IN. Design, evaluation, and analysis of questionnaires for survey research. John Wiley & Sons; 2014.

21. Stoehr F, Schotten S, Pitton MB, Dueber C, Schmidt F, Hansen NL, et al. Endovascular simulation training: a tool to increase enthusiasm for interventional radiology among medical students. Eur Radiol [Internet]. 2020; Available from: https://doi.org/10.1007/s00330-019-06646-2

22. RStudio Team. RStudio: Integrated Development for R [Internet]. RStudio, Inc., Boston, MA; 2020. Available from: http://www.rstudio.com/

23. R Core Team. R: A language and environment for statistical computing. [Internet]. Vienna, Austria; 2020 [cited 2020 May 12]. Available from: https://www.r-project.org/

24. Wickham H. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York; 2016.

25. Bryer J, Speerschneider K. Package ‘likert’ [Internet]. 2016 [cited 2020 May 20]. Available from: https://bryer.org/project/likert/
26. Eysenbach G. Improving the Quality of Web Surveys: The Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res [Internet]. 2004;6(3):e34. Available from: http://www.jmir.org/2004/3/e34/

27. Menon A, Klein EJ, Kollars K, Kleinhenz ALW. Medical Students Are Not Essential Workers: Examining Institutional Responsibility During the COVID-19 Pandemic. Acad Med [Internet]. 9000;Publish Ah. Available from: https://journals.lww.com/academicmedicine/Fulltext/9000/Medical_Students_Are_Not_Essential_Workers_.97192.aspx

28. Starr I. Influenza in 1918: Recollections of the Epidemic in Philadelphia. Ann Intern Med [Internet]. 2006 Jul 18;145(2):138–40. Available from: https://www.acpjournals.org/doi/abs/10.7326/0003-4819-145-2-200607180-00132

29. West JB. The physiological challenges of the 1952 Copenhagen poliomyelitis epidemic and a renaissance in clinical respiratory physiology. J Appl Physiol [Internet]. 2005 Aug 1,99(2):424–32. Available from: https://doi.org/10.1152/japplphysiol.00184.2005

30. Stentoft D. Problem-based projects in medical education: extending PBL practices and broadening learning perspectives. Adv Heal Sci Educ [Internet]. 2019;24(5):959–69. Available from: https://doi.org/10.1007/s10459-019-09917-1

31. Beal DJ, Cohen RR, Burke MJ, McLendon CL. Cohesion and Performance in Groups: A Meta-Analytic Clarification of Construct Relations. Vol. 88, Journal of Applied Psychology. Beal, Daniel J.: Military Family Research Inst, Purdue U, 14 North 2nd Street, Suite 300, Layfayette, IN, US, 47901, dbeal@purdue.edu: American Psychological Association; 2003. p. 989–1004.

32. Martino J, Pegg J, Frates EP. The Connection Prescription: Using the Power of Social Interactions and the Deep Desire for Connectedness to Empower Health and Wellness. Am J Lifestyle Med [Internet]. 2015 Oct 7,11(6):466–75. Available from: https://pubmed.ncbi.nlm.nih.gov/30202372

33. Robert Koch Institut. COVID-19: Fallzahlen in Deutschland und weltweit [Internet]. [cited 2020 May 12]. Available from: https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Fallzahlen.html

Figures
Figure 1

Centered stacked bar plot presenting the detailed responses of the participants for “Preparedness, motivation, and attitude” (A), “Students’ skills and their development” (B), and “Opinion of study commitment and impact on interest in research” (C).

Supplementary Files

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