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Original Article

Medical Student Teleconferencing Experiences and Financial Status: A Cross-Sectional Survey

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Abstract

Background: Teleconferencing issues may affect the online experiences of medical students during medical education and residency interview evaluation. Yet, teleconferencing experiences among medical students with varying financial status have not been examined. **Methods:** Cross-sectional study based on a single-institution survey of fourth-year University of California Los Angeles (UCLA) medical students on self-reported financial status, teleconferencing issues experienced, preparations made for online residency interviews, and satisfaction with teleconferencing equipment. Responses of students who self-identified as financially disadvantaged were compared to those of students without financial hardship using Fisher's exact tests. **Results:** Of 268 students invited to complete the survey, 67 responded (25%), and 27 (40%) of respondents identified as financially disadvantaged. A majority of students reported problems with internet connectivity (75%) and audio quality (51%). Nearly one-third of students (30%) reported plans to improve their internet connectivity for online residency interviews. Of respondents, 58% were satisfied with the quality of their teleconferencing equipment. Students dissatisfied with their equipment were more likely to report audio problems (68% vs. 38%, P=0.03) and internet connectivity issues (89% vs. 64%, P=0.01). Financial status was not significantly associated with teleconferencing issues, device age, satisfaction with teleconferencing equipment, or the amount that students would be willing to spend on acquiring new equipment. **Conclusion:** Teleconferencing issues, particularly audio and internet problems, are highly prevalent among fourth-year medical students at UCLA and are associated with dissatisfaction with teleconferencing equipment but not self-reported financial status. The influence of teleconferencing issues on student evaluation outcomes warrants further investigation.

Key Words: Financial stress; Internet; Medical education; Medical students; Videoconferencing (Source: MeSH-NLM).

Introduction

Due to the Coronavirus Disease 2019 (COVID-19) pandemic, teleconferencing was applied broadly to medical student classes, meetings, and residency interviews. In May of 2020, the Coalition for Physician Accountability recommended that all United States residency programs conduct applicant interviews remotely during the 2020-2021 recruitment cycle.[1] Acknowledging the potential effect of teleconferencing factors on interview performance, the Association of American Medical Colleges (AAMC) and American Association of Colleges of Osteopathic Medicine (AACOM) published recommendations on optimizing self-presentation while teleconferencing.[2-5] However, students with financial hardship may have fewer resources to adhere to these recommendations.

The COVID-19 pandemic has disproportionately affected economically disadvantaged populations with an unequal impact on employment and mortality, underscoring a need to scrutinize how financially disadvantaged medical students may be unduly affected by the shift to online platforms.[6-8] Although online interviews benefit applicants by eliminating travel and lodging expenses, optimizing teleconferencing experiences with high-quality technology such as modern laptop computers can be costly, and access may vary. Consequently, a student's financial ability to purchase new teleconferencing equipment or upgrade existing equipment may affect whether they experience teleconferencing issues during learning opportunities and high-stakes assessments such as residency interviews.

For instance, teleconferencing factors such as lighting, audio quality, and internet connectivity can affect a participant's voice and appearance, which play a role in how they are perceived by others.[9-11] As interviews are a critical yet subjective component of the resident selection process, many organizations released guidelines to help students optimize their online presentation.[12-17] Recommendations included reducing distracting noises, using Ethernet cables to avoid unstable internet connection, and investing in high-quality equipment. Consequently, a student's

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financial means not only potentially affects their teleconferencing experiences but may also influence how they are perceived by instructors and residency program interviewers. However, no existing studies have investigated the association of financial status with teleconferencing issues experienced by medical students.

In this study, we characterized the teleconferencing experiences of fourth-year medical students at University of California Los Angeles (UCLA) and determined whether there was an association between self-reported financial status and teleconferencing issues. We further examined whether medical students were satisfied with their teleconferencing experiences and what resources students considered useful for future residency interviews.

Methods

We conducted a cross-sectional online survey of fourth-year medical students at the UCLA David Geffen School of Medicine (DGSOM) to evaluate demographic characteristics, teleconferencing experiences, and resources required.

Setting and Participants

Over a two-week period in October of 2020, we emailed an online survey to all UCLA DGSOM medical students in the Class of 2021 student directory using an institutional email list. The inclusion criterion was fourth-year medical students participating in the 2020-2021 National Residency Matching Program (NRMP). We excluded junior classes of medical students as they would not have been actively preparing for online residency interviews. Fourth-year medical students that were not participating in the NRMP this academic year were also excluded. Random sampling was not conducted, as we aimed to elicit a broad variety of perspectives and teleconferencing experiences from students to maximize the richness of data collected. The survey instrument was hosted on the Qualtrics platform (Qualtrics, Provo, UT), and was anonymous, confidential, and voluntary. This study was reviewed and granted an exemption by the University of California Los Angeles Institutional Review Board (IRB #20-001623).

Survey Design

The authors developed the survey items, piloted the survey with five medical students, and revised the questions based on student feedback prior to administering the survey to the target study population. The complete survey instrument is available as *Supplementary Material 1*.

In the survey, participants provided demographic information and whether they self-identified as financially disadvantaged. Respondents described the type of teleconferencing equipment they planned to use for residency interviews and the age of their devices. Survey items included teleconferencing issues experienced during online classes and meetings (such as problems with internet or audio quality), plans to prepare for online interviews, satisfaction with existing equipment, and the amount of money one would be willing to spend on additional or new equipment. Survey participants were asked to indicate whether specific resources, such as equipment to borrow, would be useful if provided by their medical school.

Study Outcomes

We compared responses of students who self-identified as financially disadvantaged to responses of students who did not. The primary outcome was the proportion of students experiencing teleconferencing problems. Secondary outcomes included satisfaction with existing teleconferencing equipment and plans to purchase new equipment. We additionally compared responses of students who were satisfied with the quality of their teleconferencing equipment with responses of students who were not satisfied. In this analysis, the primary outcome was the proportion of students experiencing teleconferencing problems. Lastly, we assessed the proportion of participants who perceived a variety of potential teleconferencing resources to be useful for residency interviews.

Statistical Analysis

We compiled descriptive statistics for demographic data and reported the mean and standard deviation (SD) for parametric data. To compare groups of survey respondents, independent samples t-tests were applied to continuous variables, and Fisher's exact tests and Pearson's chi-squared tests were applied to categorical variables with binary and multiple outcomes, respectively. Participants who did not disclose whether they were financially disadvantaged were excluded from the analyses which compared financially disadvantaged students to students who were not financially disadvantaged. Kendall's correlation test was used to assess the association between device age and satisfaction with the quality of teleconferencing equipment. We presented descriptive statistics of whether students reported that specific resources would be useful for interviews. P values of <0.05 were considered statistically significant. We conducted all analyses using the R programming language (RStudio, Boston, MA).

Results

Of 268 students contacted for the survey, 67 (25%) responded. Among the 67 respondents, 27 (40%) self-identified as financially disadvantaged, while 9 (13%) preferred not to answer. Self-reported financial disadvantage was associated with race ($P < 0.01$) and Hispanic ethnicity ($P < 0.01$) (***Table 1***).

Nearly all students (99%, 66 of 67) owned their teleconferencing equipment, and 91% (61 of 67) planned to use a laptop to conduct online residency interviews (***Table 2***). The mean device age was 3.3 years (SD: 1.8). Of the 67 respondents, 50 (75%) reported internet connectivity issues and 34 (51%) had audio problems during teleconferencing, with many experiencing daily or weekly problems with internet connectivity (48%) and audio (34%). Over half (51%) reported challenges with finding a quiet or private space for classes and meetings and 42 (63%) had purchased

Table 1. Demographic Characteristics of Fourth-Year Medical Student Survey Respondents, UCLA, 2020.

Characteristic	All students (n=67)[a]	Financially disadvantaged (n=27)	Not financially disadvantaged (n=31)	p-value
Gender, n (%)				0.80
Female	34 (51)	15 (56)	16 (52)	
Male	32 (48)	12 (44)	15 (48)	
Prefer not to answer	1 (2)	0 (0)	0 (0)	
Age in years, mean (SD)	28 (2)	28 (2)	27 (2)	>0.99
Race, n (%)[b]				<0.01
White American	20 (30)	6 (21)	12 (34)	
Asian American	22 (33)	3 (11)	17 (49)	
Black or African American	13 (19)	9 (32)	4 (11)	
American Indian and Alaska Native	2 (3)	2 (7)	0 (0)	
Other	7 (11)	4 (14)	2 (6)	
Prefer not to answer	8 (12)	4 (14)	0 (0)	
Ethnicity, n (%)				<0.01
Hispanic or Latinx	18 (27)	13 (48)	3 (10)	
Not Hispanic or Latinx	46 (69)	14 (52)	28 (90)	
Prefer not to answer	3 (5)	0 (0)	0 (0)	
Financially disadvantaged, n (%)				-
Yes	27 (40)	-	-	
No	31 (46)	-	-	
Prefer not to answer	9 (13)	-	-	

Legend: Abbreviation: SD, standard deviation. [a] Respondent numbers of all students do not equal the sum of respondent numbers of financially disadvantaged and not financially disadvantaged students, as 9 students declined to answer the survey question on financial status. [b] Respondent numbers of all students do not equal the sum of respondent numbers of race categories as some respondents identified with multiple categories of race.

Table 2. Associations Between Self-Reported Medical Student Financial Status and Teleconferencing Equipment, Experiences, and Preparations for Residency Interviews, UCLA, 2020.

Characteristic	All students (n=67)[a]	Financially disadvantaged (n=27)	Not financially disadvantaged (n=31)	*p*-value
Device type, n (%)				>0.99
Laptop	61 (91)	26 (96)	29 (94)	
Desktop	6 (9)	1 (4)	2 (6)	
Owner of device, n (%)				0.47
Me	66 (99)	26 (96)	31 (100)	
Friend or family	1 (2)	1 (4)	0 (0)	
Device age in years, mean (SD)	3.3 (1.8)	2.7 (1.6)	3.1 (1.7)	0.37
Satisfied with owned equipment, n (%)	39 (58)	15 (56)	21 (68)	0.42
Problems experienced while teleconferencing, n (%)				
Internet connectivity issues, any	50 (75)	21 (78)	20 (64)	0.38
Daily or weekly	32 (48)	13 (48)	13 (42)	0.79
Poor lighting	50 (75)	20 (74)	23 (74)	>0.99
Audio problems, any	34 (51)	12 (44)	16 (52)	0.61
Daily or weekly	23 (34)	8 (30)	10 (32)	>0.99
Inability to find a quiet location	34 (51)	14 (52)	15 (48)	>0.99
Inability to join a meeting	10 (15)	5 (19)	1 (3)	0.09
Purchased or planned to purchase new equipment, n (%)	42 (63)	15 (56)	20 (65)	0.59
Average dollar amount spent or willing to spend on new equipment, mean, $USD (SD)	149 (214)	89 (65)	175 (230)	0.08
Preparations and plans for online interviews, n (%)				
Adjust the camera to eye level	59 (88)	25 (93)	27 (87)	0.68
Alter lighting	58 (87)	24 (89)	26 (84)	0.71
Select a quiet location	56 (84)	22 (82)	27 (87)	0.72
Change background	51 (76)	20 (74)	24 (77)	>0.99
Use earphones	37 (55)	14 (52)	17 (55)	>0.99
Improve internet connectivity	20 (30)	6 (22)	10 (32)	0.56
Use plug-in webcam	12 (18)	4 (15)	7 (23)	0.52
Use plug-in microphone	6 (1)	1 (4)	4 (13)	0.36
Use headphones	4 (1)	3 (11)	1 (3)	0.33

Legend: Abbreviation: SD, standard deviation. [a] Respondent numbers of all students do not equal the sum of respondent numbers of financially disadvantaged and not financially disadvantaged students, as 9 students declined to answer the survey question on financial status.

Table 3. Association of Satisfaction with Teleconferencing Equipment with Medical Student Characteristics and Teleconferencing Issues Experienced, UCLA, 2020.

Characteristic	Satisfied with equipment (n = 39)	Not satisfied with equipment (n = 28)	*p*-value
Age in years, mean (SD)	28 (2)	28 (2)	0.38
Gender, n (%)			
Female	18 (46)	16 (57)	0.46
Male	21 (54)	12 (43)	
Race, n (%)			0.73
White American	13 (33)	7 (25)	
Asian American	15 (38)	7 (25)	
Black or African American	8 (21)	5 (18)	
American Indian or Alaskan Native	1 (3)	1 (4)	
Other	6 (16)	1 (4)	
Prefer not to answer	1 (3)	7 (25)	
Ethnicity, n (%)			
Hispanic or Latinx	7 (18)	11 (39)	0.09
Device age in years, mean (SD)	3.2 (1.8)	3.4 (1.9)	0.78
Problems experienced while teleconferencing, n (%)			
Internet connectivity issues, any	25 (64)	25 (89)	0.02
Daily or weekly	14 (36)	18 (64)	0.03
Poor lighting	28 (71)	22 (79)	0.58
Audio problems, any	15 (38)	19 (68)	0.03
Daily or weekly	9 (23)	14 (50)	0.04
Inability to find a quiet location	18 (46)	16 (57)	0.46
Inability to join a meeting	2 (5)	8 (29)	0.01

Legend: Abbreviation: SD, standard deviation.

or planned to purchase additional teleconferencing equipment. Specifically, 20 (30%) students reported that they planned to improve their internet connectivity through some capacity in preparation for online residency interviews. Students who planned to purchase additional equipment were willing to spend an average of $149 (SD: $214).

Of the 58 students who self-reported their financial status, there was no association between financial status and the proportion of students who reported teleconferencing issues, such as internet connectivity issues (P = 0.38) or audio problems (P = 0.61) (***Table 2***). Self-reported financial status was not significantly associated with device age, satisfaction with teleconferencing equipment, or plans to purchase new equipment. Students who identified as financially disadvantaged were willing to spend an average of $89 on additional equipment compared to $175 by students who did not identify as financially disadvantaged (P=0.08).

Of 67 survey respondents, 39 (58%) were satisfied with the quality of their teleconferencing equipment. Compared with students who were satisfied with their equipment, students who were dissatisfied were significantly more likely to report problems with audio (68% vs. 38%, P = 0.03) and internet connectivity (89% vs. 64%, P = 0.01). Device age was not associated with satisfaction with teleconferencing equipment (***Table 3***).

Regarding teleconferencing resources provided by the medical school, 69% of students (46 of 67) reported that a conference room with reliable internet connectivity available for reservation would be useful for their upcoming interviews. In addition, 33 (49%) felt a standardized virtual background would be useful, and 23 (34%) responded that plug-in webcams would be useful. Few students indicated utility in borrowing plug-in microphones (27%) or laptops (16%) for residency interviews (***Table 4***).

Discussion

Audio and internet connectivity problems are frequently experienced by fourth-year medical students during teleconferencing and are associated with decreased satisfaction with teleconferencing equipment. Self-reported financial disadvantage was not significantly associated with experiencing teleconferencing problems or satisfaction with teleconferencing equipment.

In the past year, numerous guidelines have been published to assist medical students in optimizing teleconferencing, yet no studies have reported the prevalence of teleconferencing issues faced by students.[2-5] In this study, we found that nearly half of the students surveyed experienced daily or weekly internet connectivity problems while teleconferencing, and over half experienced challenges finding a quiet location to attend classes. Many students expressed a need to purchase additional equipment or upgrade their internet plans, which emphasized the disruptiveness of the teleconferencing issues they experienced. The high prevalence of teleconferencing issues experienced by medical students underscores the importance of assessing the consequences of poor teleconferencing conditions, such as potentially being disadvantaged during online residency interviews, medical education, or student assessments. A prior

study found that mock job candidates with poor audio-visual quality during online interviews were significantly less likely to be considered hirable.[18] Halting speech and gaze aversion may negatively influence perceptions of performance by lowering impressions of a person's social skill, intelligence, and confidence.[10,19] Combined with the results of prior studies, our results raise concerns that teleconferencing issues are highly prevalent and have the potential to negatively affect high-stakes interactions, such as residency interviews.

As teleconferencing may be a fixture of future education and residency recruitment practices, programs must consider interventions to mitigate the effect of technical problems that will inevitably occur. [20-22] The first is to optimize teleconferencing conditions during interviews and exams. Ballejos et al. (2018) found that when online medical school interviews occurred on-site and admissions staff provided the equipment, admission rates for applicants were not affected by interview modality.[23] Medical schools can also consider providing access to teleconferencing-enabled spaces that have been quality-checked by administrative staff.[24] In our study, 69% of students reported that this resource would be useful for online interviews. Additionally, medical schools and residency programs can employ technology check-ins to identify and address teleconferencing issues in advance.[20,21,25] For interviews, program staff can allocate extra time in scheduling as a buffer to troubleshoot technical issues and provide non-punitive opportunities to reschedule applicant interviews as needed. Finally, programs may have faculty document whether major teleconferencing issues occurred during the assessment, factor this into the overall applicant assessment, and review whether students with teleconferencing issues were rated equitably as a measure of quality control.

Given the potential negative ramifications of suboptimal teleconferencing quality on online assessment and residency applicant outcomes, we investigated whether financial status was associated with experiencing teleconferencing issues. Prior studies have demonstrated that outdated technology and software may contribute to teleconferencing issues.[9,18] As a result, applicants who have the financial means to purchase up-to-date equipment may have an advantage over financially disadvantaged students during online interviews. However, we found no significant association between self-reported financial status and likelihood of experiencing teleconferencing problems. Furthermore, satisfaction with teleconferencing equipment did not vary by financial status, indicating that the quality of equipment used may be comparable between the two groups. This finding may be influenced by our institution's requirement for all matriculating medical students to have laptop computers that meet minimum technical standards, and by the provision of need-based financial aid to meet this requirement.[26] Among our respondents, mean device age and plans to purchase new equipment did not vary with self-reported financial disadvantage, which is consistent with this policy. Consequently, baseline access to equipment that meet minimum standards may have promoted similar, but mediocre, teleconferencing experiences across student strata.

Furthermore, teleconferencing factors that were not assessed in this study, such as internet speed and household environment, also have the potential to contribute to teleconferencing differences. Residential internet speeds can vary by usage time, household size, and the internet service provider.[27,28] Home internet connections with lower bandwidth may not be able to support the demands of multiple devices and users, resulting in lower speeds.[29] Accordingly, household conditions and internet service factors may have had a greater influence than financial status on the teleconferencing experiences of students in this study. In a future where virtual education and assessment may become the norm rather than the exception, programs and institutions must anticipate factors that may be out of the control of medical students and disrupt the quality of learning and assessment in medical education.

Limitations of this study include a low response rate of 25% and potential response bias as students with more negative teleconferencing experiences may have been more likely to respond. As the survey was conducted at a single institution as a targeted needs assessment of student experiences and resource requirements, the results may not be generalizable across institutions in other regions. Some results in this study may have

Table 4. Association between Medical Student Self-Reported Financial Status and Resource Utility for Residency Interviews, UCLA, 2020.

Resources that would be useful for residency interviews	All students, No. (%) (N = 67)[a]	Financially disadvantaged, No. (%) (N = 27)	Not financially disadvantaged, No. (%) (N = 31)	P value
Conference room with adequate Wi-Fi available for reservation	46 (69)	19 (70)	20 (65)	0.78
Standardized virtual background	33 (49)	14 (52)	14 (45)	0.79
Plug-in webcam to borrow	23 (34)	6 (22)	11 (36)	0.39
Plug-in microphone to borrow	18 (27)	7 (26)	7 (23)	>0.99
Laptop or tablet to borrow	11 (16)	3 (11)	4 (13)	>0.99

Legend: [a] Respondent numbers of all students do not equal the sum of respondent numbers of financially disadvantaged and not financially disadvantaged students as 9 students declined to answer the survey question on financial status.

been statistically significant if provided sufficient analytic power with a larger sample size, including students from multiple institutions. Statistical analyses were not corrected for multiple comparisons thus limiting the reproducibility of the results. In addition, we asked students to self-report financial status, and objective measures of financial status were not included on the survey. Finally, students may perceive or report their experiences differently, and respondents did not provide objective teleconferencing data such as internet speed or cost of their current equipment.

In conclusion, teleconferencing issues due to audio problems and internet connectivity were highly prevalent among medical students in this study and were negatively associated with user satisfaction. Self-reported financial status was not significantly associated with experiencing teleconferencing issues or satisfaction with existing teleconferencing equipment. As teleconferencing issues will inevitably occur, steps should be taken to minimize and mitigate those problems in the future, in particular for high-stakes assessments such as online residency interviews. The circumstances of this year offer a unique opportunity to explore teleconferencing experiences during assessment, scrutinize the effect of online modalities on the outcomes of assessments, and inform future practices in resident selection processes.

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