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ZOOM FATIGUE AMONG PARAMEDICINE STUDENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT

The COVID-19 global pandemic changed how higher education was delivered in response to frequent lockdowns and social distancing rules. Universities around the world transformed quickly, often with little planning, from classroom-based face-to-face learning to remote online learning, particularly using Zoom conferencing. Elements of this still occur today. Despite the obvious benefits of Zoom, which enabled continued communication with work, family, and friends, extended and frequent Zoom meetings quickly turned into video conferencing fatigue, or what has become known as 'Zoom fatigue'.

Our study aimed to answer three research questions: Did paramedicine students experience Zoom fatigue after transitioning to online learning during COVID-19? If so, were there differences in the level of fatigue experienced by students in different years of the degree? And did gender influence the level of fatigue experienced?

This cross-sectional study used the Zoom Exhaustion and Fatigue (ZEF) scale with students from all 3 years of the Bachelor of Paramedicine at Monash University in Australia.

Of the 224 students who participated, 61.1% identified as female, 36.3% as male, and 1.8% as non-binary. Most students were in the third year of the degree (48.7%), while 27.4% and 23.9% were in the first and second year, respectively. Our study found that students did experience Zoom fatigue. General and motivational fatigue were experienced most by all students. Students in year 2 experienced less fatigue than students in year 1 and year 3. For example, the mean general fatigue score differed significantly between years, $F(2,223) = 4.288$, $p = .015$. Female students experienced more fatigue than male students across all factors, including general, visual, social, motivational, and emotional fatigue.

This study provides empirical support for the existence of Zoom fatigue among paramedicine students and suggests it increases with meeting frequency and is greater for female students. More research is required to explore its contextual, methodological, and practical aspects.

In 2020 and 2021, the COVID-19 global pandemic changed the way that higher education is delivered in response to frequent lockdowns and the adherence to social distancing rules. Universities around the world transformed quickly, without much plan-

ning, from classroom-based face-to-face learning to remote online learning, particularly using Zoom conferencing. Despite the obvious benefits of Zoom that enabled continued communication with work, family, and friends, extended and frequent Zoom meetings quickly turned into video conferencing fatigue (Dobson, 2021; Massner, 2021). Video conference fatigue is therefore a recent phenomenon that has emerged during the COVID-19 pandemic and is defined as the degree to which people feel exhausted, tired, or worn out, attributed to engaging in video conferencing (Bennett et al., 2021; Massner, 2021). Some definitions suggest that the definition includes extensive and extended use (Massner, 2021). Video conference fatigue is synonymous with 'Zoom fatigue' as Zoom became the leading software, proving to be an easy-to-use and robust tool for productivity, learning, and social interaction (Bailenson, 2021). Bennett et al. (2021) note that videoconference fatigue is similar to other fatigue constructs, such as compassion fatigue (Williams et al., 2022) and citizenship fatigue (Bolino et al., 2015), but it has distinct antecedents and a unique temporal structure, making it a unique phenomenon. For example, compassion fatigue occurs after cumulative experiences, but videoconference fatigue can occur after a one-off event. Video conferencing has been shown to impact people differently, and some of the differences mentioned in the literature include a person's gender, age, culture, and personality type (Bennett et al., 2021; Fauville et al., 2023; McConnon, 2021). For example, women experience more Zoom fatigue than men (Fauville et al., 2023), and younger students and workers are more susceptible to Zoom fatigue than older students and workers (Beyea et al., 2025; Epstein, 2020), and introverts experienced higher levels of fatigue than extroverts (Dobson, 2021). Zoom fatigue has also been shown to increase with meeting frequency and timing (Asgari et al., 2021; Bennett et al., 2021). To capture the complexity of Zoom fatigue, some researchers have developed models, such as Massner (2021), whose model is comprised of situational, individual traits, environmental, and communication factors. Bailenson (2021) describes nonverbal communication in face-to-face as remarkable, explaining that it is simultaneously effortless and incredible complex; and compares this to the nonverbal communication required for videoconferencing is not only complex but also requires a person to work hard to deliver and interpret signals and messages. Most studies about Zoom fatigue are in the context of the workplace (Epstein, 2020; Toney et al., 2021); however, some studies have focused on Zoom fatigue in higher education (Fauville et al., 2023; McArthur, 2021; Peper et al., 2021). In a study by (Rouse, 2020), university students who were asked if they had experienced Zoom fatigue after transitioning over to online learning. All responded 'yes', regardless of whether they had only taken part in a few online classes or had the majority of their classes online. In another study by Peper et al. (2021), 80% of students found it harder to focus their attention and stay present during online classes and reported experiencing more isolation, anxiety, and depression, than in face-to-face classes. Fauville et al., (2021) explored the impact of Zoom fatigue on nursing students and found that Zoom fatigue increased with the frequency of teleconference meetings and was also influenced by participant characteristics such as age, gender, and attitude. Rather than trying to understand the Zoom fatigue phenomenon through the perspective of the student, (McArthur, 2021) explored ways that teachers in higher education modified, altered, or transformed their face-to-face nonverbal behaviors into nonverbal behaviors more suitable for online learning environments, including what strategies they used to reduce Zoom fatigue. Many reasons for Zoom fatigue are mentioned in the literature. Epstein (2020) mentions a range of issues that cause virtual interactions to be very hard on the brain by increas-

ing the intensity of focus required to absorb the content. These include communication not always being synchronous, being distracted using chat boxes or navigating to unmute or ask questions, challenging the brain's central vision by seeing multiple people at the same time, paying attention with a constant gaze, and limited sensory dynamism by only being able to take in visual information. Bailenson (2021) provides four arguments on why the Zoom interface is likely to lead to Zoom fatigue through nonverbal overload. These include:

- Excessive amounts of close-up eye gaze that violate interpersonal distance rules
- Cognitive load
- Increased self-evaluation
- Constraints on physical mobility

In a study by Asgari et al. (2021), reasons for Zoom fatigue included unreliable internet access, work-life balance issues, a lack of motivation, focus, peer support, private space to attend classes, and clear guidelines from instructors.

While a recent meta-analysis by Beyea et al., (2025) synthesized the Zoom fatigue literature, finding important contributing and conditioning factors across the higher education sector, our study recognizes the limited research on Zoom fatigue in higher education, with no studies identified in the field of paramedicine. Our study also assumes that paramedicine educators and higher education in general, need to understand the complexity inherent in Zoom fatigue as suggested by Ozainne et al. (2023). It aimed to answer three research questions:

- Did paramedicine students experience Zoom fatigue after transitioning to online learning during COVID-19?
- If so, were there any differences in Zoom fatigue between students in different years of the degree?
- Did gender influence the level of fatigue experienced?

This study explored this using the Zoom Exhaustion and Fatigue (ZEF) scale with students from all three years of the Bachelor of Paramedicine at Monash University in Australia.

METHODS

Study Design

This was a cross-sectional study. The study was designed and reported consistently with the STROBE guidelines (Vandenbroucke et al., 2007). No formal sample size was calculated as the study was exploratory in nature.

Participants

Students were invited to participate in the study if they enrolled in the Bachelor of Paramedicine, Monash University. No exclusion criteria were applied. All students enrolled in the Bachelor program were invited to participate in the study to reduce selection bias. Data were collected from a cohort of undergraduate paramedicine students from a large Australian university. Students were provided with an explanatory statement and were informed that participation and completion of the questionnaire were voluntary and

anonymous. The paper-based questionnaire took less than 10 minutes to complete. No follow-ups were undertaken.

Procedure

The paper-based questionnaire was provided to all willing students, and they were asked to read through the explanatory statement before considering participating in the study. Completed questionnaires were returned to a non-teaching research assistant.

Instrumentation

The questionnaire included two parts: the demographics and the ZEF questionnaire. The demographic section collected demographic data including the year of course, age group, and gender. The second section included the Zoom Exhaustion & Fatigue Scale developed by Fauville et al. (2021b). This is a 15-item scale where items are scored on a 5-point Likert scale with 1= "Strongly Disagree" and 5= "Strongly Agree", with higher scores indicating a higher level of Zoom exhaustion & fatigue. The 15 items represent 5 factors, including General Fatigue (items 1-3), Visual Fatigue (items 4-6), Social Fatigue (items 7-9), Motivational Fatigue (items 10-12), and Emotional Fatigue (items 13-15). The ZEF scale is a valid and reliable measure for Zoom fatigue and limited any measurement bias in this study.(Fauville et al., 2021; Riedl et al., 2023; Simbula et al., 2024)

Analysis

The Statistical Package for Social Sciences (SPSS) version (27) was used for all data analysis. Descriptive statistics were reported as count and proportions and mean and standard deviations. Differences in the mean score of fatigue levels across age groups, gender, and year level were assessed using analysis of variance (ANOVA) and Student t-test as appropriate. A two-tailed p-value of <0.05 will be considered statistically significant.

Ethics

The study was approved by the Monash University Human Ethics Committee (Approval #: 29964). Implied consent was provided through participation and completion of the questionnaire.

RESULTS

Demographics

A cohort of 224 (overall 53% response rate) undergraduate paramedicine students from a large Australian University participated in the study. Table 1 presents the frequency and percentages of participants in each category. Among the 224 participants included in the study, 61.1% identified as female, 36.3% identified as male, and 1.8% identified as non-binary. Most students were in the third year of the Bachelor's degree (48.7%), and 27.4% and 23.9% were in the first and second year, respectively. Approximately half (50.9%) of the students were in the

Category	Variable	Frequency	%
Age	< 21	89	39.4
	21-25	115	50.9
	>25	20	8.9
Gender	Female	138	61.1
	Male	82	36.3
	Non-binary	4	1.8
Year Level	1	62	27.4
	2	54	23.9
	3	108	48.2

Table 1. Participant demographics.

21-25 age group, and almost 40% of the students were under 21 years of age.

ZEF

Table 2 illustrates the item responses and scale reliability, showing the mean answers to each item between students and the Cronbach's Alpha (α) of each scale corresponding to each of its items. The analysis shows that the mean and standard deviation of answers ranged from 2.04 ±1.18 (Item 7) to 3.62 ±1.031 (Item 1). The Cronbach alpha coefficient is acceptable for all scales as they range from .86 for the motivational and social scales to .88 for the emotional scales. This indicates a very good internal consistency between items. This means that the questions are holding the meaning of their scale, and we can rely on these in testing this specific type of fatigue.

Factor	Item	Mean (SD)	α
General fatigue	1	3.62 (1.03)	.87
	2	2.99 (1.11)	
	3	3.53 (1.12)	
Visual fatigue	4	2.42 (1.31)	.86
	5	2.65 (1.28)	
	6	2.08 (1.16)	
Social fatigue	7	2.04 (1.18)	.86
	8	2.23 (1.23)	
	9	2.44 (1.30)	
Motivational fatigue	10	2.63 (1.27)	.88
	11	3.11 (1.27)	
	12	2.88 (1.24)	
Emotional fatigue	13	2.54 (1.28)	.88
	14	2.38 (1.30)	
	15	2.28 (1.22)	

Table 2. Mean score of ZEF and the reliability value.

For the general fatigue scale, the mean in year 1 was 10.45±2.83, year 3 was 10.45± 2.99, and year 2 was 9.13±2.71. For the visual fatigue scale, the mean in year 1 was 7.74±3.17, year 3 was 7.44± 3.43, and year 2 was 5.89±2.99. For the social fatigue scale, the mean in year 1 was 7.16±3.51, year 3 was 6.93± 3.41, and year 2 was 5.76±2.85. For the motivational fatigue scale, the mean in year 1 was 9.48±3.58, year 3 was 8.71± 3.22, and year 2 was 7.43±3.26. For the emotional fatigue scale the mean in year 1 was 7.85±3.42, year 3 was 7.49± 3.61, and year 2 was 5.85±2.69.

The results of the ANOVA tests show that the mean general fatigue score is significantly different between students of different years f (2,223) = 4.29, p= .015. Also, the mean visual fatigue score is significantly different between students of different years f (2,223) = 5.49, p= .005. The mean social fatigue score is significantly different between students of different years f (2,223) = 3.03, p= .05. The mean motivational fatigue score is significantly different between students of different years f (2,223) = 5.597, p= .04., and the mean emotional fatigue score is significantly different between students of different years f (2,223) = 5.94, p= .003.The results show that when the mean fatigue score for each scale is calculated for each year group and then compared with each other, there is a difference in fatigue scores between the students, and the difference has not happened to chance. That is, students in year 1 and year 3 experienced more fatigue than students in year 2, with students in year 1 experiencing the most fatigue.

Table 4 presents the descriptive analysis of each fatigue scale by gender. There were higher levels of fatigue among female

Factor	Mean Score Across the Year Level			F-Value	P-Value
	Year 1 (n=62)	Year 2 (n=54)	Year 3 (n=110)		
General fatigue	10.45 (2.83)	9.13 (2.71)	10.45 (2.99)	4.29	.015
Visual fatigue	7.74 (3.17)	5.89 (2.99)	7.44 (3.43)	5.49	.005
Social fatigue	7.16 (3.51)	5.76 (2.85)	6.93 (3.41)	3.03	.050
Motivational fatigue	9.48 (3.58)	7.43 (3.26)	8.71 (3.22)	5.59	.004
Emotional fatigue	7.85 (3.42)	5.85 (2.69)	7.49 (3.61)	5.94	.003

Table 3. Differences in the mean factor score of fatigue level across year level (ANOVA).

students for all factors (general, visual, social, motivational, and emotional). For example, the mean score for general fatigue for women was 10.8, and the mean for men was 9.07 (p= .000). Since the p-value is less than 0.05, the study can conclude that women have significantly higher general fatigue levels than men.

Fatigue levels for the other factors were also significantly higher for women than men, with mean differences of 2.038, 1.512, 1.68, and 1.268 for visual, social, motivational, and emotional fatigue, respectively. The greatest difference was for visual fatigue, and the least difference was for emotional fatigue. In addition, general and motivational fatigue were the two highest experienced forms of fatigue by both female and male students.

Factor	Females (n=138)	Males (n=82)	P-Value
General fatigue	10.80 (2.67)	9.07 (2.98)	.000
Visual fatigue	7.86 (3.24)	5.82 (3.04)	.000
Social fatigue	7.23 (3.45)	5.72 (2.73)	.001
Motivational fatigue	9.25 (3.25)	7.57 (3.34)	.000
Emotional fatigue	7.70 (3.43)	6.43 (3.24)	.007

Table 4. Mean factor score of fatigue level in males compared to females (Student t-test).

DISCUSSION

This study explored the impact of Zoom meetings on undergraduate university students and found that students experienced Zoom fatigue. General and motivational fatigue were experienced the most by all students. Second, students in year 2 experienced less fatigue than students in year 1 and year 3. Finally, results indicated that female students experienced more fatigue than male students for all factors, including general, visual, social, motivational, and emotional fatigue. Our results can be compared with other studies. One study with 597 nursing university students in the Philippines Oducado et al., (2021) showed that high and very high levels of Zoom fatigue were experienced by 46.9% and 19.8% of students, respectively, using the ZEF scale. The composite mean score for these was 3.82 ± .7. Higher levels of fatigue were also experienced by students who were female, younger, had lower income status, poorer academic performance, unstable internet connection, longer and more frequent meetings, and had a negative attitude toward videoconferencing, where gender and academic performance were the two highest influencers (Oducado et al., 2021). The effects of Zoom fatigue also seem to be compounding, with a study by Shockley et al., (2021) showing that fatigue not only affects same-day meeting performance but also the performance of next-day meetings. Nesher Shoshan & Wehrt, (2022) also conducted a study to compare video conference meetings to meetings during the pandemic to rule out the possibility that Zoom fatigue was just meeting fatigue and found that Zoom fatigue was its own type of fatigue.

Similar findings were reported in Zoom fatigue studies in the workplace. For example, Fauville et al., (2023) found that daily usage predicts the amount of fatigue. They also showed that women reported 13.8% higher Zoom fatigue than men. In our study women experienced 16%, 26%, 21%, 18%, and 16.5% higher Zoom fatigue than men for general, visual, social, motivational, and emotional fatigue, respectively. One explanation given in Fauville et al's study is that women often have longer meetings and shorter breaks between meetings than men, accounting for women experiencing higher overall Zoom fatigue. In addition, Fauville et al., (2023) also showed in their study that women are highly susceptible to visual fatigue, and confirmed that mirror anxiety leading to visual fatigue mediates the gender difference in fatigue. Visual fatigue was also the highest influencer

for gender difference in our study; however, we saw gender differences across all factors. Several studies refer to mirror anxiety that occurs when a person is exposed to digital and physical mirrors, and how this heightens (Clanton, 2021; Fauville et al., 2023) 'self-focused attention' that can lead to depression. Shockley et al. (2021) particularly looked at the impact of camera use on videoconference fatigue over 4 weeks with 103 employees (recording 1408 daily observations) and found that having a camera on produced more fatigue than the camera being off, with women and new employees experiencing the most fatigue when the camera was on. This finding of new employees experiencing more fatigue may also explain, in part, the higher levels of fatigue in our first-year students (in conjunction with more daily use). A possible explanation for this is that people who feel more connected to others in meetings are less likely to experience fatigue (Kaplan & Berman, 2010). Although this is speculation, we do know that year 1 and year 3 students in our study did experience more Zoom meetings than year 2 students.

Given that videoconferences have continued beyond the COVID-19 pandemic, it is important to provide clear practical recommendations on how to reduce videoconference fatigue. Some studies have focused on reducing videoconference fatigue (Bennett et al., 2021; Massner, 2021; Rouse, 2020). Samara & Monzon (2021) highlight the challenges that arose in medical education because of the pandemic, the major difficulty being Zoom burnout. They suggest that to combat Zoom burnout, there is a need to use different technology, such as virtual reality, creating an authoritative presence by directly looking at the camera, and interspersing Zoom meetings with other learning activities to limit screen time and provide variety. Other suggestions include holding meetings earlier in the workday, enhancing the perceptions of group belongingness, muting your microphone to reduce stress related to maintaining a quiet atmosphere (Bennett et al., 2021), activity switching, online small groups, and asynchronous lectures (Toney et al., 2021), and enabling instructors or supervisors to reflect on their practice in terms of new research on videoconferencing fatigue to make better decisions in videoconference meeting design (McArthur, 2021; Nesher Shoshan & Wehrt, 2021).

Rößler et al. (2021) explored how the emotions of 35 students influenced the outcomes of videoconference meetings during a one-semester course where Zoom meetings were held twice a week, with students divided into eight groups. Emotion was tracked through snapshots of both the supervisor and the student using facial emotion recognition that recognized six emotions: happy, sad, fear, anger, neutral, and surprise. Findings included:

- The happier the speaker is, the happier and less neutral the audience is
- The more neutral the speaker is, the less surprised the audience is
- Triggering diverse emotions such as happiness, neutrality, and fear leads to a higher presentation score
- Triggering too much neutrality among the participants leads to a lower presentation score

In addition, they found that keeping the audience constantly happy is not very engaging and a good presenter needs to challenge the audience by puzzling it and providing unexpected and even temporarily painful information, which is then resolved throughout the presentation (Rößler et al., 2021). Just as Oducado et al. (2021) concluded that nursing schools should consider the undesirable impact of videoconferences on students and seek protective factors against videoconference fatigue, we suggest this for paramedicine

schools as well. In addition, both nursing and paramedicine are disciplines that require a large degree of hands-on learning with a large focus on problem-solving approaches and critical thinking. These are similar qualities that Asgari et al. (2021) mention about engineering education (i.e., content-centered, hands-on, design-oriented, critical thinking skills) shows that urgent and careful planning is needed to mitigate the negative effects of abrupt conversions of conventional face-to-face instruction in these types of disciplines.

LIMITATIONS

Although our study shows that paramedic students experienced Zoom fatigue in all its forms and that some students experienced it more than others, there are still opportunities to gain a greater and more detailed understanding of this area. Our study was simply a cross-sectional study with a self-reporting questionnaire and is limited by response bias and non-response bias. The results of this study are also limited by using students from one university and we did not collect any data on the extent of Zoom use and time.

FUTURE RESEARCH

There are several opportunities for future research that stem from the findings of this research. Firstly, research into Zoom fatigue is new, and more research is needed to understand causes and consequences of Zoom fatigue for different groups (e.g. gender, culture, age groups) in different contexts. Secondly, since this research is in its infancy, there is limited understanding of the long-term effects of Zoom fatigue, as well as studies exploring the longitudinal aspects of Zoom fatigue. For example, Fauville et al. (2021a) suggest exploring how Zoom fatigue accumulates and dissipates over time over a week. Third, research with paramedicine students that incorporates additional significant aspects (e.g., culture, age group, personality type) should be included Finally, a focus on interventions and ways to reduce Zoom fatigue would seem a more proactive approach to Zoom fatigue research.

CONCLUSION

Higher education, including paramedicine education, is continually shaped by information technology and online learning, influencing the student's learning journey. Although video conferencing technology has been available for more than a decade, COVID-19 transitioned students over to this technology rapidly and normalized it in higher education. As such, Zoom meetings became essential rather than an add-on or optional tool for educators and continues to this day. This study contributes to the limited literature on understanding the life of the university student during the COVID-19 pandemic, providing empirical support for the existence of 'Zoom fatigue' and how Zoom fatigue increases with meeting frequency and is greater for female students. We believe that universities can only fully support their students when they understand in more detail the complexity of this type of fatigue. Identifying characteristics, as well as ways to reduce Zoom fatigue, can inform both teaching theory and practice, particularly about how video conference lessons are designed and evaluated.

REFERENCES

Asgari, S., Trajkovic, J., Rahmani, M., Zhang, W., Lo, R. C., & Sciortino, A. (2021). An observational study of engineering online education during the COVID-19 pandemic. *Public Library of Science One, 16*(4), 0250041–0250041. https://doi.org/10.1371/journal.pone.0250041

Bailenson, J. (2021). Nonverbal Overload: A theoretical argument for the causes of Zoom Fatigue. *Technology, Mind, and Behaviour, 2*(1), 1–6. https://doi.org/10.1037/tmb0000030

Bennett, A. A., Campion, E. D., Keeler, K. R., & Keener, S. K. (2021). Videoconference fatigue? Exploring changes in fatigue after videoconference meetings during COVID-19. *Journal of Applied Psychology, 106*(3), 330–344. https://doi.org/10.1037/apl0000906

Beyea, D., Lim, C., Lover, A., Foxman, M., Ratan, R., & Leith, A. (2025). Zoom fatigue in review: A meta-analytical examination of videoconferencing fatigue's antecedents. *Computers in Human Behavior Reports, 17*, 100571. https://doi.org/10.1016/j.chbr.2024.100571

Bolino, M. C., Hsiung, H.-H., Harvey, J., & LePine, J. A. (2015). Well, I'm tired of tryin'!" Organizational citizenship behavior and citizenship fatigue. *Journal of Applied Psychology, 100*(1), 56–74. https://doi.org/10.1037/a0037583

Clanton, N. (2021). Study: "Zoom fatigue" is worse for women: "Self-focused attention" produces negative emotions. *The Atlanta Journal-Constitution, 1*.

Dobson, S. (2021). Understanding "Zoom fatigue" and how to embrace the potential. *Canadian HR Reporter, 34*(5), 8–10.

Epstein, H.-A. B. (2020). Virtual Meeting Fatigue. *Journal of Hospital Librarianship, 20*(4), 356–360. https://doi.org/10.1080/15323269.2020.1819758

Fauville, G., Luo, M., Queiroz, A. C. M., Bailenson, J. N., & Hancock, J. (2021). Zoom Exhaustion & Fatigue Scale. *Computers in Human Behavior Reports, 4*, 100119. https://doi.org/10.1016/j.chbr.2021.100119

Fauville, G., Luo, M., Queiroz, A. C. M., Lee, A., Bailenson, J. N., & Hancock, J. (2023). Video-conferencing usage dynamics and nonverbal mechanisms exacerbate Zoom Fatigue, particularly for women. *Computers in Human Behavior Reports, 10*, 100271. https://doi.org/10.1016/j.chbr.2023.100271

Kaplan, S., & Berman, M. G. (2010). Directed Attention as a Common Resource for Executive Functioning and Self-Regulation. *Perspectives on Psychological Science, 5*(1), 43–57. https://doi.org/10.1177/1745691609356784

Massner, C. K. (2021). *Zooming in on Zoom fatigue: A case study of videoconferencing and Zoom fatigue in higher education*. ProQuest Dissertations Publishing.

McArthur, J. A. (2021). From classroom to Zoom room: Exploring instructor modifications of visual nonverbal behaviors in synchronous online classrooms. *Communication Teacher*, 1–12. https://doi.org/10.1080/17404622.2021.1981959

McConnon, A. (2021). Zoom fatigue: The differing impact on introverts and extroverts. Video tools take a toll on both kinds of personalities sometimes in surprising ways. *The Wall Street Journal*. https://www.wsj.com/articles/Zoom-fatigue-the-differing-impact-on-introverts-and-extroverts-11615291202

Nesher Shoshan, H., & Wehrt, W. (2022). Understanding "Zoom fatigue": A mixed-method approach. *Applied Psychology, 71*(3), 827–852. https://doi.org/10.1111/apps.12360

Oducado, R., Fajardo, M., Parreño-Lachica, G., Maniago, J., Villanueva, P., Dequilla, M., Montaño, H., & Robite, E. (2021). Predictors of Videoconference Fatigue: Results From Undergraduate Nursing Students in the Philippines. *Asian Journal for Public Opinion Research, 9*(4).

Ozainne, F., Rauss, L., & Stuby, L. (2023). Psychological State and Exam Performance among Paramedics' Students in Geneva during the COVID-19 Pandemic: A Mixed Methods Study. *International Journal of Environmental Research and Public Health, 20*(4), 3736. https://doi.org/10.3390/ijerph20043736

Peper, E., Wilson, V., Martin, M., Rosegard, E., & Harvey, R. (2021). Avoid Zoom fatigue: Be present and learn. *NeuroRegulation, 8*(1), 47–56. https://doi.org/10.15540/nr.8.1.47

Riedl, R., Kostoglou, K., Wriessnegger, S. C., & Müller-Putz, G. R. (2023). Videoconference fatigue from a neurophysiological perspective: Experimental evidence based on electroencephalography (EEG) and electrocardiography (ECG). *Scientific Reports, 13*(1), 18371. https://doi.org/10.1038/s41598-023-45374-y

Rouse, E. (2020). Zoom fatigue beginning to affect university students. *University Wire*.

Samara, O., & Monzon, A. (2021). Zoom burnout amidst a pandemic: Perspective from a medical student and learner. *Therapeutic Advances in Infectious Disease, 8*, 204993612110267. https://doi.org/10.1177/20499361211026717

Shockley, K. M., Gabriel, A. S., Robertson, D., Rosen, C. C., Chawla, N., Ganster, M. L., & Ezerins, M. E. (2021). The fatiguing effects of camera use in virtual meetings: A within-person field experiment. *Journal of Applied Psychology, 106*(8), 1137–1155. https://doi.org/10.1037/apl0000948

Simbula, S., Paganin, G., & Molino, M. (2024). Videoconference fatigue: Validation of the Italian translated Zoom Exhaustion and Fatigue Scale (ZEFS). *Fatigue: Biomedicine, Health & Behavior, 12*(1), 43–57. https://doi.org/10.1080/21641846.2023.2290137

Toney, S., Light, J., & Urbaczewski, A. (2021). Fighting Zoom fatigue: Keeping the Zoombies at bay. *Communications of the Association for Information Systems, 48*, 40–46. https://doi.org/10.17705/1CAIS.04806

Vandenbroucke, J. P., Von Elm, E., Altman, D. G., Gøtzsche, P. C., Mulrow, C. D., Pocock, S. J., Poole, C., Schlesselman, J. J., Egger, M., & for the STROBE Initiative. (2007). Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and Elaboration. *PLoS Medicine, 4*(10), e297. https://doi.org/10.1371/journal.pmed.0040297

Williams, B., King, C., & Ling, D. (2022). *Compassion and humanity for paramedicine students: An observational pilot study.*

EMS INDUSTRY DATA

The Hidden Cost of EMS Claim Denials

New data on how much revenue ambulance agencies lose to denials and why most of it is never recovered.

BY THE NUMBERS

$4.9B Estimated annual revenue lost to EMS claim denials nationwide

NAEMT / GAO analysis

15% Average denial rate for ambulance transport claims

CMS data

68% Of EMS denials are never appealed

HFMA / industry est.

$86 Average cost to manually rework a single denied claim

MGMA benchmark

42d Average days to resolve an EMS denial through appeal

Industry avg.

> For a mid-size agency running 20K transports per year, that's roughly $600K in recoverable revenue sitting untouched.