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Medical Students' Zoom Fatigue in a Thai Medical School During the COVID-19 Pandemic

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ABSTRACT

Public concern about an emerging phenomenon of exhaustion during online studies, known as "Zoom fatigue," is growing. This study evaluated Zoom fatigue and undergraduate medical students' perceptions of online lectures. This cross-sectional study was conducted at a medical school in southern Thailand from September to October 2022 and included voluntarily participating first- to third-year medical students. The perception of Zoom fatigue was evaluated using the Zoom Exhaustion and Fatigue (ZEF) Scale on a five-point Likert scale. One hundred twenty-five students responded to the questionnaire. Most participants experienced moderate Zooming Fatigue, with a mean composite ZEF score of 2.82. The women were associated with high Zoom fatigue (odds ratio 2.87; 95% confidence interval; 1.29–6.37, $p = 0.01$). The median concentration time for online lectures was 60 minutes. It was found that 81.6% ($n=102$) of students disagreed that Zoom lectures provided more interaction with their teachers than traditional lectures. Almost all students (93.6%, $n=117$) preferred to turn off their cameras during class. Nearly half of them (49.6%, $n=62$) disagreed that online lectures were better than traditional ones, whereas 28.8% ($n=36$) were unsure. Most students had neutral or negative perceptions of online lectures. Therefore, strategic interventions are necessary to prevent or mitigate fatigue during online lectures.

Keywords: *Fatigue, Zoom, Medical students, COVID-19, Online*

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INTRODUCTION

The COVID-19 pandemic has caused significant changes in the education sector, especially in higher education. Many universities had closed, and students had to study online. Consequently, distance-based and online education is important. Thailand was the first country to report an outbreak of COVID-19 outside of mainland China (1). At the time of our research initiation (2022), COVID-19 remained a widespread contagious disease that needed to be monitored.

Medical students are affected, as are students worldwide (2). Teaching, especially pre-clinical medical education, primarily consists of didactic classroom-based learning, which lends itself to online delivery. However, clinical studies involve hands-on patient interactions and practical experiences that are challenging to replicate online. The examinations were also performed online. Clinical studies are limited to experiential practices. (3). Popular applications such as Zoom, Microsoft Teams, and Google Meet are used as platforms for online learning. According to reports, Zoom users rose from 10 million in 2019 to 300 million in 2020 (4).

Students must be prepared for various media, such as computers or mobile phones, have Internet signals, and be in a learning environment to study online. Students should concentrate on screens during online classes or meetings. This causes negative effects on the body, such as fatigue, exhaustion, eye irritation, and psychological effects, such as stress and irritability. Fatigue caused by online learning or meetings is known as Zoom fatigue (5). Researchers have developed an online learning scale called the Zoom Exhaustion and Fatigue (ZEF) scale to assess the prevalence of this problem (6). In the healthcare setting, ZEF scales were used to evaluate online conference fatigue among medical and nursing students (7, 8).

Medical students at the Prince of Songkla University used an online learning system using the Zoom application, strictly following the COVID-19 prevention policy of the government. We were interested in determining the prevalence of online fatigue and the risk factors for this condition among pre-clinical medical students, for whom almost 100% of online classes are required. The primary objective of this study was to explore the level of Zoom fatigue among pre-clinical medical students. The secondary objectives were to study the factors affecting fatigue levels due to online learning and to survey the attitudes of medical students towards online lectures.

METHODS

Study Design and Setting

This cross-sectional study was conducted at the Faculty of Medicine, Prince of Songkhla University, Thailand. The medical program follows a comprehensive 6-year course structure comprising pre-clinical and clinical years. The pre-clinical phase spans the first to third years, whereas the clinical phase encompasses the fourth to sixth years. Formal lectures and interactive sessions incorporate diverse teaching methods during the pre-clinical years. These methods include didactic lectures, small group discussions, case-based learning, and problem-solving exercises. At the time of the survey, all lectures were delivered via an online platform, with approximately 70% being synchronous live online classes. Undergraduate pre-clinical-year medical students were invited to participate in the online survey. As participation was voluntary, only medical students who consented to voluntary participation were included. This study was approved by the Research Ethics Committee of the Faculty of Medicine, Prince of

Songkhla University (REC 65-326-14-1). The survey started on September 1, 2022, and concluded on October 31, 2022.

Survey Questionnaire and Data Collection

The questionnaire comprised three parts. Part one included baseline characteristics such as age, gender, academic year, online study, exercise, and sleep time. Part two was the Zoom fatigue score. The ZEF scale developed by Fauville et al. (6) was used for this study. The tool developer granted permission to use the ZEF scale. The ZEF scale includes 15 items in five domains: general, visual, social, motivational, and emotional. Sample items on the ZEF scale are: "How irritated do your eyes feel after video conferencing?" and "How emotionally drained do you feel after video conferencing?" All items were answerable on a five-point Likert scale (1 = "Not at all," 2 = "Slightly," 3 = "Moderately," 4 = "Very," 5 = "Extremely"). The levels of Zoom fatigue were categorized as very low (1.00–1.50), low (1.51–2.50), moderate (2.51–3.50), high (3.51–4.50), and very high (4.51–5.00) in the composite score and each of the five domains. We categorized ZEF on a scale of 0–2.50 as low and 2.51–5.00 as high Zoom fatigue. The English version of the ZEF scale, available online, was used in this study because the Thai version has not yet been validated. Part three included attitudes toward online Zoom lectures. The content validity was approved by three experts. The researchers conducted a pilot study with 33 fourth-year medical students to check reliability. The Cronbach's alpha coefficient of the ZEF scale and attitude items was 0.861.

Statistical Analysis

Data were exported from Google Forms to Microsoft Excel. Stata version 16.0 (StataCorp, College Station, Texas, USA) was used for statistical analysis. Continuous variables are presented as mean \pm standard deviation (SD) or median with an interquartile range. Categorical variables are presented as numbers (percentages). Continuous variable differences were compared using the Wilcoxon rank-sum and F-tests (ANOVA). Differences in categorical variables were compared using Pearson's chi-square test. Factors associated with high ZEF scores were analyzed using logistic regression. P values < 0.05 were considered statistically significant.

RESULTS

One hundred twenty-five medical students responded to the survey (response rate: 52%). The median age of the participants was 20 years. Most participants were women (71.2%) and first-year students (44%). They reported a daily median sleep duration of six hours and a regular exercise rate of 38.4%. The median concentration was 60 minutes. Most students (93.6%) preferred turning off the camera during Zoom. Table 1 lists the location, device, Wi-Fi, and duration of the online study.

With a mean composite score of 2.82 (SD = 0.79) on the ZEF scale, most participants reported moderate levels of Zoom fatigue. Medical students scored the highest on the general tiredness subscale (M = 3.04, SD = 0.89) out of the five ZEF domains, with 40.8% (n=51) and 29.6% (n=37) expressing moderate and high general fatigue, respectively. Social fatigue (M = 2.82, SD = 1.00) and motivational fatigue (M = 2.78, SD = 1.01) were the next two factors, with 37.6%

(n=47) and 30.4% (n=38) of respondents indicating moderate social and low motivational fatigue, respectively (Table 2).

We found no significantly different scores on the composite ZEF scale according to gender, academic year, GPA (≥ 3.50 or less), sleeping hours (≥ 6 or less), regular exercise, exercise hours (≥ 3 days/week or less), or concentration time (≥ 60 min or less). When the composite ZEF scale was categorized into low (0–2.50) and high (2.51–5.00) Zoom fatigue, nearly two-thirds (62%) of the medical students had high zoom fatigue. Female students reported significantly higher Zoom fatigue than male students (Table 3).

Univariate logistic regression found that women were independently associated with high composite Zoom fatigue (odds ratio [OR] = 2.87; 95% confidence interval [CI]:1.29–6.37) and all domains of the ZEF subscale. The highest association level was found for social Zoom fatigue (OR = 3.21; 95% CI: 1.43–7.19) (Table 4).

Students' attitudes towards Zoom lectures were also investigated. Over one-third of the medical students (37.6%, n=47) were unsure whether Zoom encouraged them to pay attention to studying and feel confident about learning (35.2%, n=44). Additionally, 81.6% (n=102) of the students disagreed that Zoom lectures provided more interaction with their teachers than traditional lectures. Nearly half (48.8%, n=61) of the students agreed that Zoom lectures facilitated time administration. Moreover, 83.2% (n=104) of the students agreed with the Zoom recording. Most students (78.4%, n=98) showed neutral or negative perceptions of online lectures compared to traditional lectures (Table 5).

Table 1: Baseline characteristics and online learning behaviors (n=125)

Parameters	Value
Gender, n (%)	
- Male	36 (28.8)
- Female	89 (71.2)
Age (years), median (IQR)	20 (19–21)
Academic year levels, n (%)	
- First	55 (44.0)
- Second	26 (20.8)
- Third	44 (35.2)
GPA, median (IQR)	3.60 (3.49–3.87)
Sleeping hours (hours/day), median (IQR)	6 (5–7)
Exercise at least three days/week, n (%)	48 (38.4)
Exercise hours (days/weeks), median (IQR)	1 (1–3)
Concentration span (min), median (IQR)	60 (40–90)
Favor turning off the camera, n (%)	117 (93.6)
Location of online study, n (%)	
Home	50 (40.0)
Dormitory	75 (60.0)

Parameters	Value
Libraries	44 (35.2)
Others, café	30 (24.0)
Devices, n (%)	
Notebook	111 (88.8)
Tablet	119 (95.2)
Mobile phone	59 (47.2)
Types of Wi-Fi, n (%)	
University	85 (68.0)
Home	56 (44.8)
Sim card	70 (56.0)
Online study maximum duration (min), median (IQR)	180 (180–180)
Online study (hours/day), median (IQR)	4 (3–6)

Abbreviations: GPA, grade point average; Wi-Fi, wireless fidelity; IQR, interquartile range

Table 2: Level of Zoom fatigue among medical students (n=125)

Level of Zoom fatigue	General		Visual		Social		Motivational		Emotional		Composite	
	n	%	n	%	n	%	n	%	n	%	n	%
Very low	5	4.0	12	9.6	18	14.4	16	12.8	23	18.4	9	7.2
Low	27	21.6	35	28.0	24	19.2	38	30.4	33	26.4	38	30.4
Moderate	51	40.8	48	38.4	47	37.6	36	28.8	41	32.8	54	43.2
High	37	29.6	25	20.0	32	25.6	31	24.8	25	20.0	23	18.4
Very high	5	4.0	5	4.0	4	3.2	4	3.2	3	2.4	1	0.8

Note:

1. Levels of Zoom fatigue in each domain are presented as mean (standard deviation).
2. Level of Zoom fatigue: Very low (1.00–1.50), Low (1.51–2.50), Moderate (2.51–3.50), High (3.51–4.50), Very High (4.51–5.00)

Table 3: Comparison characteristics between high (ZEF score 2.51–5.00) and low (ZEF score 0–2.50) composite Zoom fatigue (n=125)

	High Zoom fatigue (n = 78)	Low Zoom fatigue (n = 47)	P value
Gender, n (%)			0.008
Male	16 (20.5)	20 (42.6)	
Female	62 (79.5)	27 (57.4)	
Academic year, n (%)			0.688
1	32 (41.0)	23 (48.9)	
2	17 (21.8)	9 (19.1)	
3	29 (37.2)	15 (32.0)	
GPA, median (IQR)	3.60 (3.40–3.80)	3.71 (3.50–3.88)	0.264
Zoom online (hours/day), median (IQR)	4 (3–6)	4 (3–6)	0.681
Exercise (days/week), median (IQR)	3 (1–3)	2 (2–4)	0.970
Sleep (hours/day), median (IQR)	6 (6–7)	6 (5–7)	0.430

Abbreviations: GPA, grade point average; IQR, interquartile range; ZEF, Zoom Exhaustion and Fatigue

Table 4: Association between females and high Zoom fatigue in the composite and each of the five domains (n=125)

Domains	OR	95% CI	P value
Composite	2.87	1.29–6.37	0.010
General	3.02	1.29–7.06	0.010
Visual	2.87	1.29–6.37	0.010
Social	3.21	1.43–7.19	0.005
Motivational	2.80	1.26–6.21	0.011
Emotional	2.54	1.15–5.63	0.021

Abbreviations: OR, odds ratio; CI, confidence interval

Table 5: Medical Students' attitudes

Items	1 Strongly disagree	2 Disagree	3 Not sure	4 Agree	5 Strongly agree
Zoom lectures encourage you to pay attention when studying.	20 (16.0)	45 (36.0)	47 (37.6)	10 (8.0)	3 (2.4)
Zoom lectures make you feel confident about learning.	12 (9.6)	39 (31.2)	44 (35.2)	27 (21.6)	3 (2.4)
Zoom lectures assist you in remembering important learning material.	18 (14.4)	36 (28.8)	39 (31.2)	27 (21.6)	5 (4.0)
Zoom lectures make for a better learning environment.	28 (22.4)	44 (35.2)	40 (32.0)	10 (8.0)	3 (2.4)
Zoom lectures provide more interaction with your teachers.	47 (37.6)	55 (44.0)	12 (9.6)	8 (6.4)	3 (2.4)
Zoom lectures facilitate time administration.	12 (9.6)	17 (13.6)	35 (28.0)	37 (29.6)	24 (19.2)
Zoom recording is useful.	3 (2.4)	6 (4.8)	12 (9.6)	22 (17.6)	82 (65.6)
Overall, Zoom lectures are better than traditional lectures.	25 (20.0)	37 (29.6)	36 (28.8)	22 (17.6)	5 (4.0)

Note: Data are presented as n (%)

DISCUSSION

Zoom fatigue is a widespread phenomenon that significantly impacts students globally, affecting their well-being, cognitive abilities, and academic performance (6). This study demonstrated that Zoom fatigue was a prevalent and real phenomenon during the COVID-19 pandemic. The composite mean ZEF score was 2.82, which was lower than those of Stanford University students ($M = 2.99$) (6) and nursing students in the Philippines ($M=3.82$) (8).

Among the five domains of the ZEF scale, medical students had the highest level of fatigue on the general fatigue subscale, followed by social and motivational factors. This is similar to the nursing students surveyed in the Philippines (8).

Women medical students had the most gender trends in Thailand and the US (9). Regarding demographic variables, women were associated with Zoom fatigue, similar to previous studies (8, 10). We caution against this interpretation because most participants were women. Researchers have explained that women experience more mirror anxiety, are more self-focused, experience more negative affect (10), and report higher emotional reactions than men (11). The impact of mirror anxiety on social physique (12) would be related to social Zoom fatigue, which had the strongest association with women in our findings.

Our students had a median Zoom study duration of six hours, close to that of medical students in the UK (13). Notably, only 22% favored lectures via Zoom over on-site lectures. This finding is similar to that of medical students in India, who reported that online studying was less effective

than on-site studying because of a more distracting environment (14). Our students had a maximum concentration span of 60 minutes compared to 30 minutes in a study in Brazil (7). In Brazil, medical students reported significantly more Zoom fatigue with hybrid teaching (problem-based learning [PBL] combined with traditional teaching) than with PBL alone. One potential explanation is that hybrid teaching requires more time daily in online conferences than PBL teaching (7). The teaching method and variances across teachers account for most variations in student attentiveness (15). Online courses fail to retain students 10–20% more frequently than traditional classroom settings (16). Between 40% and 80% of online students leave their courses (17).

Most students did not need to turn on the cameras during the lectures. This study did not explore why the students wanted to turn off their cameras. In Castelli and Sarvary's report (18), the reasons were concerns about personal appearance, other people, the physical location is seen in the background, and having a weak Internet connection. Based on previous studies and our results, we proposed strategies to mitigate Zoom fatigue. These strategies include ensuring that online lectures are conducted for a maximum of 60 minutes per period, implementing regular breaks during online sessions, promoting a supportive learning environment, and setting clear expectations of camera usage (18).

To our knowledge, this is the first study to examine the impact of COVID-19 on Zoom fatigue among Thai medical students. However, this study has some limitations. First, our sample included only students from the Prince of Songkhla University during the COVID-19 pandemic. Given the unique online curriculum design and the demographics of medical students, generalizations cannot be made. Second, the response rate was low as this was a questionnaire-based study. Some items were intentionally left blank, and the misinterpretation of certain questions could not be ignored. Third, some aspects of this survey depended on the participants' memory, perhaps influencing their reporting and introducing elements of recall bias. The survey did not include all factors associated with Zoom fatigue and focused only on online lectures, such as socioeconomic status, COVID-19, and other medical problems (8, 19). Notably, our survey was conducted during the third wave of COVID-19; hence, students might have been acquainted with online learning, and the faculty corrected problems with online platforms. Further studies are required to confirm and validate the results. Future research should investigate the long-term effects of Zoom fatigue, explore interventions or techniques to minimize its impact and examine the effectiveness of different teaching approaches in reducing Zoom fatigue and other factors influencing Zoom fatigue among medical students.

CONCLUSION

Our undergraduate medical students reported moderate Zoom fatigue, particularly women. The majority did not appreciate online lectures. Strategies to improve the quality of online lectures should be implemented for a maximum of 60 min per period, implementing regular breaks, promoting a supportive learning environment, and setting clear expectations for camera usage. Further studies are required for external validation, the long-term effects of Zoom fatigue, and interventions to mitigate it.

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ETHICAL APPROVAL

This research was approved by the Research Ethics Committee of the Faculty of Medicine, Prince of Songkla University (REC 65-326-14-1) on September 13, 2022.

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