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# Exploring Psychosocial Stress Among Hong Kong Medical Students During COVID-19: A Case-Control Study

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## ABSTRACT

The COVID-19 pandemic has led to substantial modifications in the undergraduate medical curriculum, with numerous in-person clinical sessions being replaced by online teaching methods. This study seeks to examine the relationship between medical students' stress levels during the pandemic and their performance in the final examinations. This cross-sectional study utilized a questionnaire-based approach to assess students' stress levels, measured using the COVID-19 Student Stress Questionnaire (CSSQ). The relationship between stress levels and students' performance in the final examinations was subsequently analyzed. A total of 110 out of 221 (49.8%) final-year medical students completed the questionnaire. Among them, 13 students failed the final examination (cases), while 97 students passed (controls). Baseline demographic characteristics were comparable between cases and controls, with a median age of 24 years in both groups. Cases reported higher stress levels across all domains, including concerns related to risk of infection, social isolation, relationships with family, peers, and faculty, academic life, and sexual life, compared to controls. Notably, academic-related stress was significantly greater among cases than controls ($p < 0.01$); all cases (100%) described their academic experience during the COVID-19 pandemic as "very" or "extremely" stressful, in contrast to 35.1% of controls. Elevated stress related to academics and studying during the COVID-19 pandemic was associated with poorer performance in the final examination. These findings highlight the need for enhanced academic support to address students' needs during such disruptive periods.

**Keywords:** Medical education, Psychosocial, COVID-19, Hong Kong

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## Introduction

The COVID-19 pandemic and the global implementation of social distancing measures have profoundly affected medical education worldwide. Infection control protocols have necessitated rapid adaptations in teaching strategies, with many institutions shifting partially or entirely to online instruction [1]. Consequently, the "COVID-19 generation" of medical students has had to transition from primarily practice-based education to distance learning, potentially missing essential hands-on experiences [2]. This disruption has placed considerable strain on students' psychological well-being, which may also impact their academic performance.

Multiple international studies have documented the adverse mental health effects of these sudden educational changes. Self-reported stress levels among medical students have increased, with some students experiencing clinically significant psychiatric symptoms. For example, a study in the United Kingdom reported that 54.5% of medical students experienced moderate to extreme stress, while in Western China, 82.3% of 361 surveyed students reported moderate to high stress levels [3].

Stress among medical students during the pandemic has been linked to various risk factors, including fear of contagion, social isolation, and disrupted interpersonal relationships. Concerns about personal health and the potential risk of transmitting infection to family members, particularly due to proximity to teaching hospitals, have contributed to psychosocial burdens [4, 5]. Social distancing and reduced in-person teaching have further

exacerbated isolation, leading to emotional detachment and decreased study engagement, as reported in studies from Saudi Arabia and China [6, 7].

Moreover, pandemic-related stress may influence academic performance, given the sudden shift in pedagogical methods. UK medical students reported higher stress associated with online learning and assessment formats [5]. Similarly, Hong Kong students demonstrated lower performance in problem-based learning tutorials conducted online compared to traditional face-to-face sessions [8]. Conversely, some studies, such as Syed *et al*., found no significant differences in final exam performance for first-year modules during the pandemic [9].

This study aims to investigate psychosocial stressors and stress levels among final-year undergraduate medical students in Hong Kong, where teaching was delivered online. While previous research indicates that online teaching can be implemented effectively without compromising academic outcomes [10], the impact of these changes on students' psychosocial well-being remains unclear.

## Materials and Methods

This prospective case-control study targeted final-year medical students, with a calculated sample size of over 109 considered sufficient to achieve 80% power at a 95% confidence level, assuming a 9–10% failure rate. The online questionnaire was emailed to all eligible students on 1st July 2021, four weeks after the final examination to reduce recall bias, and data collection continued until 110 responses were obtained.

Students in the 2021 cohort completed their final-year curriculum under strict COVID-19 restrictions. Access to hospital premises was prohibited during outbreaks, and most lectures and classes were conducted online, except for limited in-person sessions in small groups (8–10 students) for essential skills training.

The questionnaire comprised two sections. The first gathered baseline demographics, including age, gender, prior psychiatric history, and previous academic performance. The second assessed stress during the COVID-19 pandemic using the validated COVID-19 Student Stress Questionnaire (CSSQ) developed by Zurlo *et al*. [11], which includes seven items **(Figure 1)**. Participation was voluntary and uncompensated.

**PART 1 BASELINE PERSONAL INFORMATION**

Q1. What is your age?

Q2. What is your gender? (Male / Female / Others)

Q3. Do you have any known psychiatric illness requiring regular follow-up with psychologists / psychiatrists? (No / Yes)

Q4. Have you failed in previous examinations in medical school? (No / Yes)

Q5. Have you been awarded distinction in previous examinations in medical school? (No / Yes)

Q6. Did you experience any problem with internet connection for e-learning during COVID-19 pandemic? (No / Yes)

Q7. Did you experience any problem with computer hardware / software for learning e-learning during COVID-19 pandemic? (No / Yes)

Q8. Have you failed in any subjects in the final MBBS examination 2021? (No / Yes)

(a)

**PART 2 COVID-19 Students Stress Questionnaire**

*(Please answer in a Likert scale of 0 – 4, 0 = no stress at all, 4 = Extremely stressful)*

Q1. How do you perceive the risk of contagion during COVID-19 pandemic?

Q2. How do you perceive the condition of social isolation imposed during COVID-19 pandemic?

Q3. How do you perceive the relationships with your relatives during COVID-19 pandemic?

Q4. How do you perceive the relationships with your university colleagues during COVID-19 pandemic?

Q5. How do you perceive the relationships with your university professors during COVID-19 pandemic?

Q6. How do you perceive your academic studying experience during COVID-19 pandemic?

Q7. How do you perceive the changes in your sexual life due to the social isolation during this period of COVID-19 pandemic?

(b)

**Figure 1.** Questionnarie used in the study.

This study utilized a case-control design, categorizing students who did not pass the final medical school examination as the case group, and those who passed as the control group. The association between stress levels, as measured by the COVID-19 Student Stress Questionnaire (CSSQ), and examination outcomes was examined. Categorical variables were analyzed using the Chi-square or Fisher's exact test, while continuous variables were compared using the Student's t-test.

**Results and Discussion**

The online questionnaire remained open until 110 responses were received, which took approximately three weeks. Of the 221 final-year medical students invited, 110 (49.8%) participated. Among respondents, 13 students failed the final examination (case group), while 97 passed (control group). The median age of participants was 24 years (range: 23–27), with 56 males and 54 females. Six students (5.5%) reported a history of psychiatric conditions, such as depression or anxiety, requiring psychiatric follow-up. Sixteen students (14.5%) had previously failed examinations, and 11 students (10%) had achieved distinctions in prior assessments. Technical challenges during online learning
were reported by a minority, with 10 students (9.1%) experiencing internet connectivity issues and 7 students (6.4%) reporting hardware or software difficulties.
Baseline demographic characteristics were comparable between the case and control groups. The median age was 24 years in both groups (range: 24–26 in cases and 23–27 in controls). No significant differences were observed between groups regarding gender distribution, psychiatric history, prior examination failures or distinctions, or technical difficulties with online learning. A summary of the baseline characteristics is presented in **(Table 1)**.

**Table 1.** Baseline demographics between the two groups.

| Characteristic | Case (n = 13) | Control (n = 97) | P-value |
|---|---|---|---|
| Median age (years) | 24 (24–26) | 24 (23–27) | 1.000 |
| Gender (Male) | 9 | 47 | 0.239 |
| History of psychiatric illness | 1 | 5 | 0.539 |
| Previous exam failure | 4 | 12 | 0.472 |
| Previous exam distinction | 0 | 11 | 0.336 |
| Internet connectivity issues | 1 | 9 | 1.000 |
| Computer hardware/software issues | 1 | 6 | 1.000 |

Students in the case group reported higher stress levels across all measured domains compared to the control group, including concerns about risk of infection, social isolation, relationships with family, peers, and faculty, academic responsibilities, and sexual life **(Table 2)**. Of particular note, academic-related stress was significantly

greater among cases than controls ($p < 0.01$); all students in the case group (100%) described their academic experience during the COVID-19 pandemic as "very" or "extremely" stressful, whereas only 35.1% of control students reported similar levels of stres

**Table 2.** Frequency of Students Experiencing "Very" or "Extremely" Stressful Situations by Domain

| Question | Case N = 13 | Control N = 97 | P-value |
|---|---|---|---|
| Q1 (COVID-19 infection) | 2 (15.4%) | 3 (3.1%) | 0.1054 |
| Q2 (Social isolation) | 2 (15.4%) | 5 (5.1%) | 0.1926 |
| Q3 (Relationship with family) | 1 (7.7%) | 1 (1.0%) | 0.2234 |
| Q4 (Relationship with peers) | 3 (23.1%) | 7 (7.2%) | 0.0953 |
| Q5 (Relationship with teachers) | 2 (15.4%) | 3 (3.1%) | 0.1054 |
| Q6 (Stress from academic work) | 13 (100%) | 34 (35.1%) | <0.0001 |
| Q7 (Sexual relationship) | 2 (15.4%) | 6 (6.2%) | 0.2396 |

Among both cases and controls, additional sources of stress—ranked by frequency—were peer relationships (9.1%), sexual or romantic relationships (7.3%), social isolation (6.4%), risk of COVID-19 infection and interactions with teachers (each 4.5%), and family relationships (1.8%). These stressors did not differ significantly between the case and control groups.

Academic stress during the COVID-19 pandemic was associated with poorer performance in final examinations, with students reporting higher levels of academic stress exhibiting worse outcomes. In contrast, other stressors anticipated to negatively affect academic performance did not demonstrate a significant impact in this study cohort. While numerous studies have explored the effects of the pandemic on medical students' psychological well-being, the nature and perception of stressors may differ according to sociocultural contexts. This study offers specific insights into the experiences of medical students in Hong Kong, contributing to the broader understanding of COVID-19's unprecedented effects on medical education.

Academic stress was notably higher among students who failed the final examination compared to those who passed. Contributing factors may include rapid adaptations to medical curricula, such as shifts to online learning or modifications in clinical teaching. Exposure to clinical environments during the pandemic has been linked to increased anxiety due to concerns about infection risk [12]. Similarly, transitions to online learning and assessment formats have been shown to correlate with elevated stress levels [5]. Studies on Chinese medical students during COVID-19 reported that academic-related stressors—particularly concerns about examination performance—were more prominent than psychosocial or health-related stressors [3].

Elevated stress has been shown to negatively affect academic outcomes. Kötter *et al*. demonstrated that higher academic stress predicted poorer performance among undergraduate medical students [13], and Melaku *et al*. similarly reported a significant inverse relationship between stress and academic achievement in Ethiopian medical students [14]. Comparable findings have been reported in Pakistan [15], though some studies, such as Abdulghani *et al*., found no significant association [16]. Mechanistically, stress can impair memory, disrupt the encoding and retrieval of information, and trigger excessive cortisol secretion [17]. Stress has also been associated with lower motivation, emotional exhaustion, diminished sleep quality, and reduced self-esteem, all of which may compromise academic performance [15, 18].

Following academic stress, the most frequently reported stressors were peer relationships and relationships with teachers, collectively affecting 13.6% of students. The pandemic has broadly disrupted social networks, with international studies showing substantial reductions in student social interactions. For instance, 65.6% of medical students in Jordan reported worsened social relationships [19], and 86% of students in a U.S. study reported decreased social engagement [20]. These changes have been attributed to social distancing measures and the shift to online learning [21]. Prior research has linked robust social networks with better academic performance, as students with stronger interpersonal connections tend to achieve higher grades [22, 23]. Although these factors did not reach statistical significance in the current study, the observed trends suggest that interpersonal relationships may influence academic outcomes and warrant further investigation.

Relationships with family members were the least reported source of stress, with only 1.8% of respondents identifying it as a major stressor. This may reflect increased time spent at home during the pandemic, which has been noted as a positive outcome in studies from Saudi Arabia and Australia [24, 25]. However, other studies,

such as one conducted in the U.S., reported that living at home could increase distractions and exacerbate family tensions, negatively affecting academic productivity [20].

This study has several strengths, including the use of the validated COVID-19 Student Stress Questionnaire (CSSQ), which allowed for targeted assessment of multiple stress domains. Focusing on final-year medical students, who face imminent graduation, enabled the identification of potential interventions to alleviate stress and support academic performance, thereby preparing students for professional practice. The case-control design was appropriate given the relatively low prevalence of exam failures.

Nonetheless, limitations exist. The retrospective, self-reported design may introduce selection and response bias, as students with poorer performance might have been more or less likely to participate or to attribute outcomes to stress. Absence of pre-pandemic baseline measurements prevents definitive attribution of stress to pandemic-related curriculum changes. Confounding variables, such as socioeconomic factors, may also have influenced outcomes.

Findings indicate that academic stress is particularly elevated among students who fail subjects in the final examination, highlighting the need for targeted interventions. Academic support—both formal institutional programs and informal peer or family support—may help students adapt to changes in learning environments, such as the transition from in-person to online instruction [16]. Higher education institutions should proactively screen for students experiencing elevated stress and offer early interventions to prevent adverse academic consequences [13]. Integrating stress management programs into the formal curriculum may also be beneficial [26]. In the evolving educational landscape, where online and hybrid learning are likely to remain prevalent, innovative support strategies such as near-peer teaching, virtual wellness groups, and online counselling should be considered [26–28].

This study also addresses response bias concerns. The cohort's exam failure rate (10%) was consistent with previous years, suggesting that participation was not disproportionately influenced by academic performance.

To our knowledge, this is the first study to evaluate the impact of multiple stressors on medical students' academic outcomes using the CSSQ. While the tool is validated, it is inherently limited by its simplified design. Future research should include qualitative approaches to better understand students' perceptions of stress and its effects on academic performance. Prospective studies would minimize response bias and allow for clearer identification of causative stressors. Longitudinal studies could assess the lasting effects of COVID-19-related stress on medical education. Expanding sample sizes across multiple cohorts would enhance statistical power and allow for comparisons across different stages of medical training. Furthermore, evaluations of academic support and mental health interventions should be student-centered, with outcomes assessed based on student engagement and perceived usefulness [18].

## Conclusion

Academic stress during the COVID-19 pandemic is linked to poorer academic outcomes among undergraduate medical students in Hong Kong. By identifying stressors specific to this context and clarifying how they influence academic performance in future studies, targeted interventions can be designed to better support students' mental well-being and, in turn, enhance their academic achievement.

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