Associated Factors of Resilience among Medical Students

Warisa Leethanakul[1], Cherdsak Iramaneerat[2], Yodying Dangprapai[3]

[1] *Department of Anatomy, Faculty of Medicine Siriraj Hospital, Mahidol University*
[2] *Department of Surgery, Faculty of Medicine Siriraj Hospital, Mahidol University*
[3] *Department of Physiology, Faculty of Medicine Siriraj Hospital, Mahidol University*

ABSTRACT

Objective: This study aimed to explore factors associated with resilience among medical students.

Materials and Methods: The correlational research was conducted in 1735 students who were studied in 1st – 6th year of MD program at Faculty of Medicine Siriraj Hospital in academic year 2022. Participants responded to online questionnaire which consisted of 5 sections: basic characteristics (gender, age, year in medical school, GPA, physical activity, and leisure activity), the Connor-Davidson resilience scale 10 (CD-RISC 10), the mindset assessment scale, the revised Thai multi-dimensional scale of perceived social support (MSPSS), and the perceived teacher's support scale. The univariate analysis of each dependent variable and the CD-RISC score was analysed to identify potential predictors of the CD-RISC score. Subsequently, the multiple linear regression was performed to determine the predictors of resilience scores.

Results: The response rate was 38% (n = 652). The univariate analysis found that gender (r = 0.09, p = 0.02), physical activity (r = 0.18, p < 0.001), growth mindset (r = 0.55, p < 0.001), fixed mindset (r = -0.10, p = 0.01), perceived social support (r = 0.35, p < 0.001), and perceived teacher's support (r = 0.28, p < 0.001) were correlated with resilience. The multiple linear regression revealed that growth mindset (ß = 0.77, p < 0.001), fixed mindset (ß = -0.13, p = 0.01), perceived social support (ß = 0.08, p < 0.001), and perceived teacher's support (ß = 0.02, p = 0.04) were significant predictors of resilience. The multiple linear regression model provided significant predictive ability with coefficient of determination (R^2) of 0.35.

Discussion and Conclusion: Gender, physical activity, growth mindset, fixed mindset, perceived social support, and perceived teacher's support were significantly associated with resilience among medical students. A medical school should focus on improving these factors in order to enhance resilience in medical students.

Keyword: Resilience, Medical students, Growth mindset, Social support, Teacher's support

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INTRODUCTION

During training, medical students faced with multiple stressors and challenges such as congested curriculum, changes in personal lives and environment, psychological and physical demands, and stressful clinical events.[1-5] These sufferings may explain the reported decline of medical students' mental health after entering medical schools. The stressors may also lead to poor outcomes such as depression[6], burnout[7], declined empathy[8], poor cognitive performance[9], serious thoughts of quitting medical schools, and suicidal ideation.[10, 11] In addition, medical students reported a greater incidence of negative psychological states and burnout than their age-matched peers did.[12-15]

Resilience is a characteristic that promotes positive adaptation in the face of adversity. It contains an ability to bounce back, and even thrive after challenges.[16-20] The concept of resilience has evolved from a constant trait to a process that can be learned. Thus, later trend believes that resilience is flexible, adaptive, and can be promoted.[3, 19, 21, 22] Individuals with high resilience had higher life satisfaction[23, 24], better psychological well-being[25, 26], and better quality of life.[3, 22, 27] In addition, resilience is a protective factor against distress and negative psychological states such as burnout, depression, and anxiety.[7, 28] Therefore, attention should be focused on how to cultivate resilience in medical students to maintain their healthy mental status and functions during training and in their future professions.[2, 29, 30]

Reported factors were associated with and could predict resilience. These factors were categorized into individual factors, environmental factors, and challenging circumstances.[31-33] Identifying these factors would be beneficial for faculty members to decide on strategies and areas to promote resilience in their students.[33, 34]

The conceptual framework of this study was adapted from the coping reservoir model[35], which explained internal and external factors affecting medical student well-being. This study examined potential associated factors of resilience for which there was limited quantitative evidence in the context of medical students. Previous qualitative studies in medical students and physicians mentioned mentorship[36, 37] and leisure activity[38, 39] as factors that affected resilience. Growth mindset[40, 41], perceived social support[7, 42], and physical activity[43, 44] had significantly positive association with resilience in other population, but these factors had limited quantitative studies in medical students. Furthermore, this study investigated demographic characteristics, such as gender, age, year in medical school, and academic achievement, for which prior studies found inconclusive results.[2, 45-48] According to the coping reservoir model, the external structures addressed in this study were perceived social support, physical activity, leisure activity, and mentorship. The internal structures recorded in this study were growth mindset, gender, year in medical school, and academic achievement.

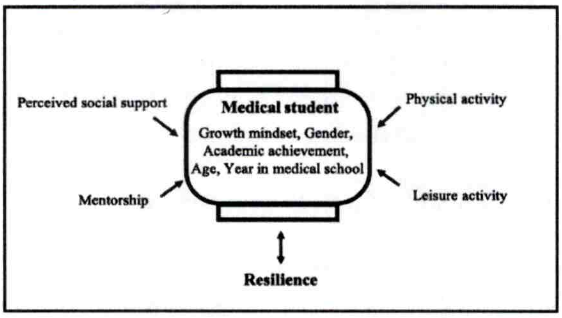

Figure 1 Diagram illustrating conceptual framework of this study

There were limited studies on resilience and psychological well-being in Thai medical and health science students. [49-52] Moreover, different societies possessed different values and cultures. Since resilience was influenced by both personal and environmental factors, different societies that hold different values might affect how these factors interacted with resilience. [5] Therefore, a greater understanding of these factors would be advantageous for future interventions intended to enhance resilience in this context.

The purpose of this study is to identify associated factors of resilience in medical students. Identifying these factors is essential for recognizing students at risk of low resilience, and performing interventions to modify these factors to improve resilience of medical students. [34] Fostering resilience in medical students will lead to better students' mental health, better tolerance against burnout, and better quality of patient care. [8]

MATERIALS AND METHODS

The cross-sectional correlational research based on survey data was conducted in the 1st – 6th year medical students at Faculty of Medicine Siriraj hospital, Mahidol university in academic year 2022. All 1735 medical students were invited to participate in the study during December 2022 to January 2023. The participants were provided information sheet and decided to join the study voluntarily. The study was approved by the Siriraj Institutional Review Board, Faculty of Medicine Siriraj Hospital, Mahidol University. (COA no. Si 844/2022)

The sample size calculation utilized the rule of thumb for regression analysis, which required 20 samples per a predictor. [53-55] This study included 15 predictors, thus the sample size of 300 was required. In previous literature, there was wide range of reported response rates of online survey. The response rates varied between 20% and 83%.[56-63] The most conservative estimate was used in order to mitigate underpowering of the study, thus the sample size was inflated to 1500. To avoid selection bias, all 1735 medical students at the institute was invited to join this study.

Instruments

The online survey, administered in this study via Google form, consisted of 5 sections: First, the demographic data including year in medical school, age, gender, GPA, physical activity, and leisure activity.

Second, the Connor-Davidson Resilience Scale (CD-RISC 10) is a self-rated 10-item questionnaire with a 5-point Likert scale ranging from 0 to 4. [64] The validated Thai version of CD-RISC 10 was used in this study. The Thai version had good internal consistency with Cronbach's alpha of 0.85. [65] The total score of CD-RISC 10 ranged from 0 to 40. There was no cutoff point for the resilience score. The higher CD-RISC 10 score meant higher resilience. [64, 65]

Third, the Mindset Assessment Scale is a self-rated 8-item questionnaire with a 6-point Likert scale ranging from 1 to 6. [66, 67] The scale was developed in Thai. The factor analysis yielded 2 dimensions with 4 items represented growth mindset and the other 4 items represented fixed mindset. The content validity and construct validity of the scale were studied. It had good reliability with composite reliability of 0.90. [67] The growth mindset score and the fixed mindset score were separately reported. The total scores of the growth mindset items and the fixed mindset items were both ranged from 4 to 24. The higher growth mindset score meant greater growth mindset. And the higher fixed mindset score meant greater fixed mindset.

Forth, the revised Thai Multi-Dimension Scale of Perceived Social Support (MSPSS) is a self-rated 12-item questionnaire with a 7-point Likert scale ranging from 1 to 7. [68] The MSPSS measured the perception of social support from 3 sources: significant others, family, and friends. [69] The validated Thai version of MSPSS had good reliability with Cronbach's alpha of 0.92. [68] The total score ranged from 12 to 84. The higher MSPSS score meant greater perceived social support.

Fifth, the Perceived Teacher's Support Scale, which was newly developed in this study, measured medical students' perception of having mentors during medical school. The researchers reviewed literature about mentorship in medical education context and generated an item pool. The content validity of the scale was tested via the index of item objective congruence (IOC). There were 3 content experts evaluated the scale. Items with IOC below 0.5 were revised or removed. After 2 rounds of IOC, the scale yielded 20 items with passed IOC scores. Subsequently, the reliability of the scale was examined. It was piloted in a group of 33 medical student graduates at Faculty of Medicine Siriraj Hospital in academic year 2021. The Cronbach's alpha of piloted responses was 0.94. The Perceived Teacher's Support Scale is a self-rated 20-item questionnaire with a 5-point Likert scale ranging from 1 to 5. The total score ranged from 20 to 100. The higher score meant greater perceived teacher's support.

Statistical analysis

The Statistical Package for the Social Sciences Version 28.0 for MacOs was used for data analysis. The reliability of all the instruments was assessed via Cronbach's alpha. Cronbach's alpha of at least 0.7 indicated acceptable internal consistency. The statistical significance level was defined at p-value < 0.05.

For descriptive statistic, categorical data were reported as frequency. Continuous data were analyzed and reported in mean and standard deviation (SD) or median and interquartile range (IQR), depending on the normality of the data. The physical activity was categorized into adequate and inadequate physical activity according to Centers for Disease Control and Prevention (CDC) recommendation. [70] The adequate physical activity was defined as at least 150 minutes a week of moderate-intensity physical activity or 75 minutes a week of vigorous-intensity physical activity.

For inferential statistic, univariate analysis of each independent variable and CD-RISC 10 score was performed. Different methods, including Pearson's r correlation, Spearman's rho correlation, and point-biserial correlation, were used to measure correlation based on types of data. Independent variables which demonstrated potentially significant correlation with resilience score (p-value of 0.10 or less) were included in multiple linear regression to create a predicting equation for resilience score. Prior to multiple linear regression analysis, its basic assumptions were tested.

RESULTS

652 of 1735 medical students voluntarily completed the online questionnaire, resulted in the response rate of 38%. The number of participants from first-year, second-year, third-year, forth-year, fifth-year, and sixth-year were 101 (16%), 113 (17%), 116 (18%), 80 (12%), 50 (8%), and 192 (29%), respectively. There were 279 females (43%). The mean (SD) age of the participants was 21.36 (2.08) years old. Due to the different curriculum, only students in the 3rd – 6th year had reported GPA. The first and the second-year medical students were graded in pass/fail system, thus GPA in these students were considered missing data. After removed 6 outliers, there were 432 GPAs available for analysis. The mean (SD) of GPA was 3.51 (0.30). There were 264 participants (41%)

who had adequate physical activities. Majority of participants had leisure activities 1 - 2 day/week (50%) and 3 -5 day/week (32%).

Table 1 reported descriptive statistics of independent and dependent variables in this study and reliabilities of the scales. The scales in this study had acceptable reliability, except the fixed mindset scale that had fair reliability, with Cronbach's alpha of 0.67. The mean (SD) of resilience was 28.23 (6.09).

Table 1 Descriptive statistics of independent and dependent variables

Variables (score range)	Mean scores (SD)	Cronbach's alpha
Resilience (0-40)	28.23 (6.09)	0.87
Mindset (8-48)		
Growth mindset (4-24)	16.78 (3.54)	0.78
Fixed mindset (4-24)	14.03 (4.18)	0.67
Perceived social support (12-84)	68 (18)†	0.92
Family	24 (7)†	0.92
Friend	23 (7)†	0.91
Significant other	22 (8)†	0.92
Perceived teacher's support (20-100)	58.51 (18.57)	0.97
Professional (10-50)	29.65 (9.19)	0.94
Personal (10-50)	28.86 (10.00)	0.95

† Median (IQR)

The univariate analysis of each independent variables and resilience was performed. The independent variables that were significantly correlated with resilience were gender, physical activity, growth mindset, fixed mindset, perceived social support and perceived teacher's support. For gender, male (28.73 (6.22)) had higher resilience level than female (27.57 (5.87)). The correlation coefficients and *p*-values were reported in Table 2. Additionally, analysis of variance showed that there was no significant difference of resilience scores between participants from each year in medical school. ($F(5,646) = 0.81$, $p = 0.54$).

Table 2 Univariate analysis between independent variables and resilience score

Independent variables (n = 652)	**Correlation coefficients**	***p*-value**
Year in medical school	0.05[b]	0.23
Age	0.02[c]	0.53
Gender	0.09[a]	0.02*
Physical activity	0.18[a]	<0.001*
Leisure activity	0.02[b]	0.66
GPA (n=432)	0.001[c]	0.98
Growth mindset	0.55[c]	<0.001*
Fixed mindset	-0.10[c]	0.01*
Perceived social support	0.35[b]	<0.001*
Perceived teacher's support	0.28[c]	<0.001*

* $p < 0.05$; significant correlation, [a] Point biserial correlation,
[b] Spearman's rho correlation, [c] Pearson's r correlation

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According to the univariate analysis, potential predictors were gender, physical activity, growth mindset, fixed mindset, perceived social support, and perceived teacher's support. The basic assumptions of multiple linear regression, which included linearity, normality of residuals, homoscedasticity, and no multicollinearity, were satisfied. The multiple linear regression analysis found that growth mindset, fixed mindset, perceived social support, and perceived teacher's support were significant predictors of resilience. The regression model R^2 was 0.35. The regression coefficients were reported in Table 3. The multiple linear regression yielded a predicting equation as follows:

Resilience score = 10 + 0.77 growth mindset score - 0.13 fixed mindset score
+ 0.08 perceived social support score
+ 0.02 perceived teacher's support score
+ 0.53 gender + 0.51 physical activity

Table 3 Regression result table

	Unstandardized coefficients	**Standard error**	**Standardized coefficients**	**t**	***p*-value**	**Tolerance**	**Variance inflation factor**
Constant	10.00	1.35		7.40	<0.001*		
Gender	0.53	0.41	0.04	1.28	0.20	0.90	1.12
Physical activity	0.51	0.42	0.04	1.22	0.22	0.90	1.12
Growth mindset	0.77	0.06	0.45	12.48	<0.001*	0.78	1.28
Fixed mindset	-0.13	0.05	-0.09	-2.74	0.01*	0.99	1.01
Perceived social support	0.08	0.02	0.18	4.97	<0.001*	0.81	1.24
Perceived teacher's support	0.02	0.01	0.07	2.03	0.04*	0.84	1.20

R^2 0.35

F = 58.09

n = 652

* $p < 0.05$; significant predictor

DISCUSSION

This study aimed to explore factors associated with resilience among medical students. The result revealed that gender, physical activity, growth mindset, fixed mindset, perceived social support, and perceived teacher's support were associated with resilience among medical students.

On the other hand, age, year in medical school, academic achievement, and leisure activity were not associated with resilience.

In this study, male medical students were more resilient than females. The finding was similar to previous studies in Thai[71], Canada[45, 46], US[2], and China[47]. Various factors might account for males' greater resilience than females. First, despite similar academic performance, female medical students reported lower levels of self-confidence than male students. [72] This might suggest that female students had a poor opinion of their own competency which affected resilience. [46] Second, it was believed that females were more sensitive to difficulties under high stress settings[73] and so more likely to employ maladaptive coping mechanisms. [74]

Physical activity was significantly correlated with resilience in the univariate analysis. This was consistent with previous studies. [43, 44, 75, 76] Physical activity was associated with resilience through both physiological and psychological mechanisms. [77] By strengthening specific brain regions, physical activity can help improve emotional regulation. [78] According to a research of Chinese college students, participation in physical exercise fulfilled three domains of basic psychological needs: competence, autonomy, and relatedness. [77] Consequently, satisfied psychological needs lead to greater resilience. In addition, another study also mentioned role of physical activity in stimulating optimism, hope, autonomy, and social support, which were sources of resilience. [79]

According to the study result, growth mindset showed significantly positive correlation with resilience, while fixed mindset had significantly negative correlation with resilience. The result of this study was congruent with those of prior research conducted on Australian physiotherapy students[41] and Chinese elementary and middle school children. [80] The mechanism explaining growth mindset and resilience relationship was proposed. [40, 80, 81] The mindset determined how individuals viewed obstacles and hence influenced how they responded to setbacks. [40] A longitudinal study of 7th and 8th grade students in the United States revealed that students with a growth mindset focused more on learning goals than performance goals, believed in the utility of effort over its futility, made low-effort, mastery-oriented attributions of failure rather than low-ability helpless attributions, and demonstrated mastery-oriented strategies instead of helpless strategies toward disappointments. [40, 81] This study contributed another quantitative evidence that reassured the positive association between growth mindset and resilience among medical students.

In this study, perceived social support was significantly correlated with resilience. The result was consistent with numerous previous research. [7, 34, 42, 48] Friend, family, and significant other support provided interpersonal resources that mitigate the effects of medical school stress. [7] Students who felt comfortable addressing medical errors, stress, and burnout with colleagues displayed a higher level of resilience, according to a study examining the association between resilience and response to a difficult clinical event among U.S. medical students. [2] Additionally, in the midst of adversity, persons with a strong perception of their social network would turn out better than those who perceive themselves to be alone. [42]

According to this study, perceived teacher's support exhibited positive significant correlation with resilience. No prior study that we are aware of directly examined the relationship between mentoring and resilience. However, there were few studies that investigated relationship of mentorship and burnout. [36, 82] According to literatures that described roles of mentorship, the mentor-mentee relationship was usually focused on fostering mentee's development, both professionally and personally. [83-85] Considering mentor functions, having a mentor who understood the medical students' context and had greater experience in the field would simplify the process for medical students to overcome challenges during medical school. In terms of professional guidance, the mentor would

provide students with precise feedback on their strengths and weaknesses, as well as strategies for improvement. [85, 86] Regarding students' personal development, the mentor would provide emotional support and facilitate self-reflection. [86, 87] Moreover, having good relationship with mentor would help reduce stress and gain support through difficulty. These functions of the mentor may explain the positive correlation between mentoring and resilience. The outcome of the current study offered additional quantitative support for the mentorship-resilience relationship among medical students.

According to the study findings, neither age nor year in medical school exhibited significant correlation with resilience. This was consistent with findings among Canadian[46] and American medical students[2] and the American general population. [88] However, the finding was countered by those of Thai undergraduates[71] and operating room nurses[89]. As individuals aged, they accumulated more personal, social, and professional experiences. As a result, one's ability to manage complex situations may improve. [90] Prior longitudinal national survey in the United States discovered U-shaped quadratic association between the amount of lifetime adversities and mental health outcomes. Specifically, individuals with some, as opposed to none, history of lifetime hardship had better mental health outcomes. Consequently, overcoming adversity may contribute to future resilience. [91] Nonetheless, some studies reported negative correlation of age and resilience. [23] As students aged, they were more likely to face stress from more sources, which caused more stress. Therefore, the reason for insignificant association between age and resilience or year in medical school and resilience were as following. Due to the narrow age range of the participants in this study, it was probable that they had not accumulated enough life experiences to indicate varying levels of resilience with age. Another plausible explanation was that there were contradictory effects of aging. Some students may encounter obstacles that promote resilience, while others confronted an excessive number of setbacks that have led to deteriorating mental health. Consequently, these mixed effects were not apparent through linear association in the total samples.

The current study demonstrated no significant correlation of GPA and resilience. The result was supported by former studies in Thai undergraduate students[71], and Mexican medical students. [92] However, there were studies that reported weakly positive correlation of GPA and resilience. [5, 93, 94] It was hypothesized that GPA was associated to resilience via self-efficacy. [5] Students with a higher GPA had greater academic satisfaction and self-efficacy. [95, 96] Moreover, greater self-efficacy correlates with greater resilience. [97] Due to the transition from a numerical grading system to a pass/fail system, the 1st and 2nd year medical students in this study did not report GPAs. This might result in under power of the study because there were missing data in one third of the study samples. In addition, the past studies were from various programs in various nations, which may have varied GPA formulations.

Leisure activity and resilience did not significantly correlate, according to the study's finding. There was no previous study that measured leisure activity. This factor was based on qualitative studies in physicians, who reported that they engaged in leisure activities such as music, literature, or art, as a method for relieving stress. [32, 38] The study's lack of statistical significance could be attributed to the instrument used to quantify leisure activity. In this study, the frequency of leisure activities in a week was gauged by a single question. A more precise scale may be required for a future study to evaluate leisure activities and its objectives.

The regression model in this study had R^2 of 0.35. This indicated that approximately 35% of the variance in resilience was explained by growth mindset, fixed mindset, perceived social support, perceived mentorship, gender, and physical activity. The remaining 65% could be explained by other factors not included in this study, such as coping styles[29, 48, 98, 99], personality[99-101], self-efficacy[31, 97, 102, 103] and self-esteem. [104, 105]

This research had several limitations. First, because this study is cross-sectional, it is not possible to infer a causal relationship between the independent variables and resilience. Second, social desirability may have caused a response bias on the result. Since the survey asked for participants' e-mail addresses, they might not have answered all the questions truthfully. Third, this study was conducted at a single center which might limit its generalizability. Future research should focus on determining whether there is a causal relationship between these predictors and resilience using longitudinal or experimental study design. In order to acquire detailed information for enhancing faculty's mentorship program, it is also necessary to perform a qualitative study on how medical students perceive and need mentorship.

CONCLUSION

The current study reported that gender, physical activity, growth mindset, fixed mindset, perceived social support, and perceived teacher's support were significantly correlated with resilience among medical students. Multiple linear regression analysis found that growth mindset, fixed mindset, perceived social support, and perceived teacher's support were significant predictors of resilience. Consequently, the medical school should pay attention on improving these predictors to enhance medical students' resilience.

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