

Association between Grit and depressive symptoms at the timing of job start among medical residents during the COVID-19 pandemic in Japan: a cross-sectional study

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ABSTRACT

Introduction: The COVID-19 pandemic had an additional negative impact on the mental health of healthcare workers, including residents. Previous studies revealed that grit, which is an individual trait to achieve long-term goals unrelated to intelligence quotient, is not only positively associated with academic achievement and career success but also negatively correlated with depression. This study aimed to examine the association between grit and depressive symptoms among residents at the time of job start during the coronavirus disease 2019 (COVID-19) pandemic in Japan.

Materials and methods: This cross-sectional study used data from all post-graduate year 1 residents from March 2020 to April 2022 at Tokyo Medical and Dental University, Tokyo, Japan. Grit was measured by the Japanese version of Grit-S. The resident's depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale. The association of interest was examined using logistic regression analysis.

Results: Among 221 residents, 28 (12.7%) have depressive symptoms. One unit increase in Grit-S score after adjusting for age, sex, graduated university, and sleeping hours was associated with lower odds of having depressive symptoms by 63% (odds ratio [OR]: 0.37; 95% confidence interval [CI]: 0.19–0.74). Further, the perseverance of effort subscale score was associated with lower odds of having depressive symptoms after covariate adjustment (OR: 0.43; 95% CI: 0.22–0.84).

Conclusions: Higher grit scores were associated with lower odds of having depressive symptoms among residents at the timing of job start during the COVID-19 pandemic. Regular mental health assessment is particularly important for residents with low grit scores at entry.

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Introduction

A systematic review and meta-analysis conducted before the coronavirus disease 2019 (COVID-19) pandemic showed that the prevalence of depression or depressive symptoms among residents ranges from 20.9% to 43.2% [1], which is higher than the rate among the general population [2,3]. The COVID-19 pandemic had an additional negative impact on the mental health of healthcare workers, including residents, because of concerns regarding lack of personal protective equipment, exposure risks, fear of carrying the virus to their family, isolation from loved ones, being redeployed to a new sector (e.g., non-ICU staff performs ICU-related tasks), concerns about access to up-to-date information, etc [4–7]. Previous studies reported that trainees (residents and clinical fellows) had more stress and burnout by COVID-19 exposure during the COVID-19 pandemic [8,9].

Residents with depression tend to make more medical errors than those without [10,11]; hence, resident program managers and departments need to address the issue by identifying the residents at risk of having depressive symptoms to provide preventive and timely support. Female sex, family history of depression, prior episodes of depression, chronic medical illness, and stressful life events are known risk factors in the general population [12–15]. Studies of residents revealed that job demands, such as concerns about patient care and some specialties (surgical/urgency residencies), were associated with burnout and stress [16,17].

Grit, which is an individual trait to achieve long-term goals unrelated to intelligence quotient [18] has received a lot of attention in recent years. Previous studies revealed that grit is not only positively associated with academic achievement in K-12 and higher education and career success but also negatively correlated with depression [19–22]. Furthermore, the

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possible positive effects of grit against stress were reported among healthcare workers during the COVID-19 pandemic [23,24]. Previous studies on grit in the field of medical education examined an association between a growth mindset and grit [25] and how the educational curriculum for surgical interns improved grit levels [26]. Interestingly, some studies revealed that higher grit was negatively associated with burnout in medical students in the United States of America and Singapore [27,28]. However, to the best of our knowledge, no study reported an association between grit and depressive symptoms among junior residents during the COVID-19 pandemic. Thus, this study aimed to examine the association between grit and depressive symptoms at the time of job start during the COVID-19 pandemic in Japan.

Methods

Study participants

This cross-sectional study was conducted using data from all post-graduate year 1 (PGY1) residents who joined the Tokyo Medical and Dental University (TMDU) resident program from March 2020 to April 2022. The online survey was performed approximately on the first day on the job. TMDU resident program consisted of 2-year training, in which all residents have to rotate through the main specialties at approved hospitals in Japan from 2004 [29]. Residents work at TMDU hospital, which is an academic medical center and tertiary emergency medical facility, for 1 year. Additionally, they work at another community-based hospital for one more year. Informed consent was obtained before answering the online survey. Those who did not answer the online survey or disagreed with participation were excluded from this study. Thus, 74 residents were excluded from all 295 residents, resulting in an analytic sample size of 221. Residents who participated in the study have no missing values in the data. The study protocol was reviewed and approved by the Institutional Review Board of TMDU.

Exposure, outcome, and variable definitions

Grit

Grit was measured by the Japanese version of Grit-S (Short grit scale) which was verified for factor structure, reliability, and validity among 1043 university students [30]. Grit-S consists of the following eight questions (1): I finish whatever I begin (2); I am a hard worker (3); I have difficulty maintaining my focus on projects that take more than a few months to complete (4); Setbacks don't discourage me (5);

I have been obsessed with a certain idea or project for a short time but later lost interest (6); I often set a goal but later choose to pursue a different one (7); I am diligent (8); New ideas and projects sometimes distract me from previous ones. Grit-S includes the subscales of perseverance of effort, which consists of questions (1), (2), (4), and (7), and consistency of interest, which consists of questions (3), (5), (6), and (8). Responses are obtained on a 5-point Likert scale and questions (3), (5), (6), and (8) are reversed items. Grit-S scores were added up for each question and divided by the number of questions, ranging from 1 to 5 with higher scores indicating a higher grit level. Scores for the perseverance of effort and consistency of interest have similar score ranges. A study on Grit-S validation revealed evidence for internal consistency, test-retest stability, and predictive validity of this scale [31]. Cronbach's alpha of our study was 0.77, 0.75, and 0.66 for Grit-S, perseverance of effort, and consistency of interest scores, respectively. The continuous Grit-S, perseverance of effort, and consistency of interest scores were used for the analysis.

Depressive symptoms

The Center for Epidemiologic Studies Depression Scale (CES-D) was used to assess the resident's depressive symptoms [32]. A CES-D score of ≥ 16 was defined as having depressive symptoms. The CES-D was used as a categorical variable in the analysis.

Covariate

We obtained information for variables, including age, sex, start year of training, and name of the graduated university, from the basic data at the start of the employment. The presence of a housemate, presence of family living together, average sleeping time on a weekday, smoking habits, drinking habits, frequency of eating breakfast, and frequency of exercise within the last month were obtained from the online survey. The name of the university from which they graduated was obtained to see if the training environment is familiar or unfamiliar to the residents. Residents who graduated from TMDU performed clinical clerkship at the TMDU hospital; thus, they are more familiar with the training environment than residents who graduated from other medical schools.

We asked the following questions about smoking habits: How many cigarettes, including heated cigarettes, and e-cigarettes, do you smoke per day? Response categories included: 'never,' 'I used to smoke but quit,' and 'I smoke.' Categories were collapsed: never, past smoker, and current smoker.

We asked the following questions to investigate drinking habits: How often do you drink alcohol? Response categories included 'never,' 'less than once

a month,' 'one to three times a month,' 'one to three times a week,' 'four to six times a week,' and 'every day.' Categories were collapsed: never, only a few times a month, and more than a few times a week.

We determined the frequency of eating breakfast as follows: How often do you eat breakfast? Response categories included: 'never,' 'less than once a week,' 'once a week,' 'two to three times a week,' 'four to six times a week,' and 'every day.' Categories were collapsed: less than a few times a week, more than several times a week, and every day.

Frequency of exercise within the last month was asked as follows: How many days did you exercise for health promotion, excluding commuting, and work on the job, for >10 min within the last month? Response categories included 'almost never,' 'several times a month,' 'one to two times a week,' 'three to four times a week,' 'five to six a week,' and 'every day.' Categories were collapsed: almost never, less than a few times a week, and more than several times a week.

Age and average sleeping time on a weekday were used as continuous variables. Sex, start year of training, name of the graduated university, presence of housemate, presence of family living together, smoking habit, drinking habit, frequency of eating breakfast, and frequency of exercise within the last month were used as categorical variables.

Statistical analysis

A *t*-test and the chi-square test were used to compare the proportion of each variable between participants in the non-depressed and depressed groups. Additionally, logistic regression analysis was performed to assess the association between grit level and depressive symptoms. All statistical analyses were conducted using Stata version 17.0 (Stata Corp LLC, College Station, TX, USA.) A *p*-value of <0.05 was considered statistically significant.

Results

This study included 295 PGY1 residents who joined the TMDU resident program from March 2020 to April 2022. Data from 221 (74.9%) residents were used for this study after excluding 74 participants due to non-response, missing data, and inconsistent responses (Figure 1).

Table 1 shows the characteristics of the study participants. Among 221 participants, 28 (12.7%) were classified into the depressed group. The mean age (25.4 in the depressed group and 25.0 in the non-depressed group, $P=0.386$) and the percentage of males in the two groups were similar (64.3% in the depressed group and 60.1% in the non-depressed group, $P=0.672$). More participants have drinking habits in the non-depressed group than in the depressed group while the mean weekday sleeping hours and the smoking habits of the two groups were similar. Participants in each group did not differ significantly regarding the frequency of eating breakfast and exercise within the last month. The Grit-S score in the depressed group was smaller than that of the non-depressed group (3.0 vs. 3.4; $P=0.005$). Regarding Grit-S subscales, the perseverance of effort score of the depressed group was significantly lower than that of the non-depressed group (3.2 vs. 3.7; $P=0.003$). The consistency of interest score in each group did not significantly differ (2.8 in the depressed group and 3.1 in the non-depressed group; $P=0.075$).

The unadjusted and adjusted odds ratios (ORs) derived from logistic regression analyses are shown in Table 2. Crude analysis revealed an association between one unit increase in Grit-S score with lower odds of having depressive symptoms by 61% (OR: 0.39; 95% confidence interval [CI]: 0.20–0.77). Similarly, after adjusting for age, sex, graduated university, and weekday sleeping hours [33], one unit increase in Grit-S score was associated with lower odds of having depressive symptoms by 63% (OR: 0.37; 95% CI: 0.19–0.74).

Table 3 shows the association of perseverance of effort and consistency of interest (i.e., Grit-S

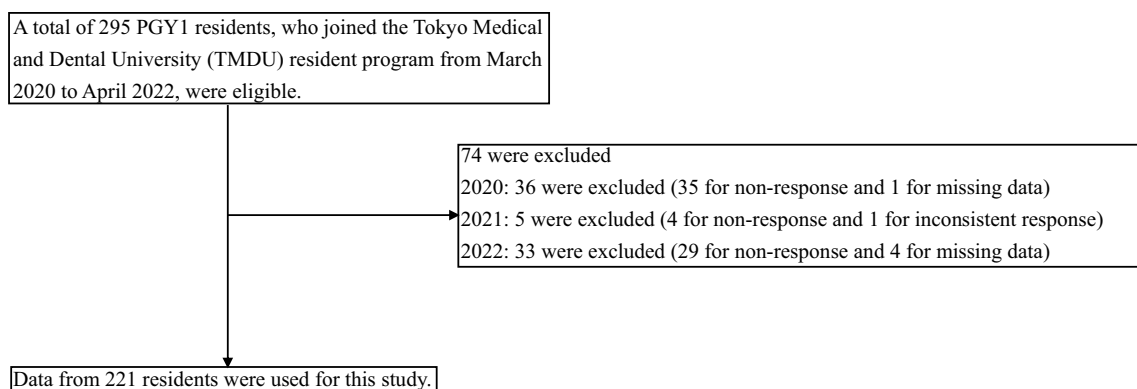


Figure 1. Study diagram.

Table 1. Characteristics of study participants.

Characteristics	Total (N = 221)	Depressed (N = 28)	Non-Depressed (N = 193)	p-value
Age (years), mean (SD)	25.1 (2.0)	25.4 (1.6)	25.0 (2.0)	.386
Male sex, n (%)	134 (60.6%)	18 (64.3%)	116 (60.1%)	.672
Start year of training, n (%)				.665
2020	70 (31.7%)	8 (28.6%)	62 (32.1%)	
2021	88 (39.8%)	10 (35.7%)	78 (40.4%)	
2022	63 (28.5%)	10 (35.7%)	53 (27.5%)	
Graduated university, n (%)				.888
TMDU	92 (41.6%)	12 (42.9%)	80 (41.5%)	
Others	129 (58.4%)	16 (57.1%)	113 (58.6%)	
Presence of family living together, n (%)	47 (21.3%)	5 (17.9%)	42 (21.8%)	.637
Presence of housemate, n (%)	4 (1.8%)	0 (.0%)	4 (2.1%)	.442
Weekday sleeping hours, mean (SD)	7.6 (1.0)	7.4 (1.2)	7.6 (1.0)	.426
Smoking habits, n (%)				.799
Never	204 (92.3%)	26 (92.9%)	178 (92.2%)	
Past smoker	12 (5.4%)	1 (3.6%)	11 (5.7%)	
Current smoker	5 (2.3%)	1 (3.6%)	4 (2.1%)	
Drinking habits, n (%)				.011
Never	31 (14.0%)	8 (28.6%)	23 (11.9%)	
Only a few times a month	112 (50.7%)	16 (57.1%)	96 (49.7%)	
More than a few times a week	78 (35.3%)	4 (14.3%)	74 (38.3%)	
Frequency of eating breakfast, n (%)				.702
Less than a few times a week	17 (7.7%)	3 (10.7%)	14 (7.3%)	
More than several times a week	67 (30.3%)	7 (25.0%)	60 (31.1%)	
Every day	137 (62.0%)	18 (64.3%)	119 (61.7%)	
Frequency of exercise within the last month, n (%)				.909
Almost never	51 (23.1%)	7 (25.0%)	44 (22.8%)	
Less than a few times a week	119 (53.9%)	14 (50.0%)	105 (54.4%)	
More than several times a week	51 (23.1%)	7 (25.0%)	44 (22.8%)	
Grit-S, mean (SD)	3.3 (0.6)	3.0 (.6)	3.4 (.6)	.005
Perseverance of Effort, mean (SD)	3.6 (0.7)	3.2 (.7)	3.7 (.7)	.003
Consistency of Interest, mean (SD)	3.0 (0.7)	2.8 (.8)	3.1 (.7)	.075

Bold indicates $p < 0.05$.

Table 2. Association between depressed state and Grit-S score.

	Crude		Adjusted	
	Odds Ratio	95% CI	Odds Ratio ^a	95% CI
Grit-S	0.39	0.20, 0.77	0.37	0.19, 0.74

^aAdjusted for age, sex, graduated university, and weekday sleeping hours.
Bold indicates $p < 0.05$.

Table 3. Association between depressed state and Grit-S score and Grit-s subscale scores (i.e., perseverance of effort and consistency of interest).

	Crude	Model 1 ^a	Model 2 ^b
	Odds Ratio (95%CI)	Odds Ratio (95%CI)	Odds Ratio (95%CI)
Perseverance of effort	0.42 (0.23–0.75)	0.39 (0.21–0.72)	0.43 (0.22–0.84)
Consistency of interest	0.61 (0.36–1.05)	0.60 (0.35–1.04)	0.84 (0.45–1.56)

^aAdjusted for age, sex, graduated university, and weekday sleeping hours.

^bScores for the perseverance of effort and consistency of interest were simultaneously put into the model and the model was adjusted for age, sex, graduated university, and weekday sleeping hours. Bold indicates $p < 0.05$.

subscale) scores with the odds of having depressive symptoms. In the crude and adjusted model (model 1), one unit increase in the perseverance of effort score was associated with lower odds of having depressive symptoms (OR: 0.42; 95% CI: 0.23–0.75 in crude and OR: 0.39; 95% CI = 0.21, 0.72 in model 1). However, the consistency of interest score was not significantly associated with the odds of having depressive symptoms in the crude model as well as the model adjusted for covariates (i.e., model 1) (OR: 0.61; 95% CI: 0.36–1.05 in crude and OR: 0.60; 95% CI: 0.35–1.04 in model 1). One unit increase in the perseverance of effort score was associated with lower odds of having depressive symptoms after adjusting

for age, sex, graduated university, and weekday sleeping hours in model 2 where perseverance of effort and consistency of interest scores were simultaneously placed (OR: 0.43; 95% CI: 0.22–0.84). However, the consistency of interest score was not significantly associated with the odds of having depressive symptoms in model 2 (OR: 0.84; 95% CI: 0.45–1.56).

Discussion

This study first revealed that higher grit score was associated with lower odds of having depressive symptoms among medical residents at the time of

job start during the COVID-19 pandemic. Additionally, higher perseverance of effort score, which is one of the Grit-S subscales, was negatively associated with the risk of depressive symptoms. A cross-sectional study before the COVID-19 pandemic revealed that higher grit was associated with lower levels of mental health outcomes, such as anxiety and depression, among university and college students in Thailand and China [21,34]. However, this study contributes to the literature by showing that higher Grit-S scores were also associated with lower odds of having depressive symptoms among medical residents because the association between higher grit levels and depressive symptoms among residents has been understudied to date.

A previous study revealed that highly stressful life events can offset the negative association between grit level and depressive symptoms among college students [35]. Our results showing the negative association between grit level and depressive symptoms confirm the importance of grit, although the students in our study were under high stress during the COVID-19 pandemic and at the start of employment.

A possible mechanism for grit's preventive effect on depressive symptoms is mindfulness which is defined as 'the state of being attentive to and aware of what is taking place in the present' [36]. Mindfulness mediates the association between grit and subject well-being [37]. Thus, higher grit may also be associated with higher levels of mindfulness, which may have been protective against depressive symptoms [38]. Future research should examine whether mindfulness mediates the association between grit and depressive symptoms among medical residents because mindfulness was not measured in this study.

Grit consists of two subscales (i.e., perseverance of effort and consistency of interest). We revealed that only perseverance of effort was negatively associated with depressive symptoms. A previous study in China reported that perseverance of effort and consistency of interest have different effects on mental health [39]. Perseverance of effort may be more associated with academic engagement and subjective well-being [40], while the consistency of interest may buffer psychological distress [41,42]. Additionally, the previous report showed that authentic pride mediates the association between perseverance of effort and depressive symptom [43]. This report supported our result that only perseverance of effort was negatively associated with the depressive symptoms, because the timing of this study, when they were transitioning from medical students to residents, is expected to give them pride. Thus, only the perseverance of effort score may have had a strong influence on the mental health of the participants.

Regarding the positive grit's characteristics, acquired growth of grit is expected. Angela Duckworth, who is a grit advocate, refers to grit development in her writings [44]. The growth factor keywords include 'Interest,' 'Practice,' 'Purpose,' and 'Hope' in her writing. Elucidating whether these factors grow grit requires further examination. However, non-cognitive skills, including grit, are known to grow in adolescence [45]. The authors of this study noted that 'work-based learning with its more varied types of learning experiences, including its hands-on learning in a real business environment with coworkers and customer interactions, plays an important role in the formation of non-cognitive skills.' (Hoeschler, Balestra, & Backes-Gellner, 2018, p.45). Additionally, continued academic study, such as degree completion, improved non-cognitive skills during early adulthood and adulthood [46]. Residents with lower grit levels may benefit from developing non-cognitive skills before or during the residency period. However, to our best knowledge, no previous study has examined this, thereby highlighting the need for further investigation.

Some limitations of this study need to be acknowledged. First, this study is a single-institution study. Future multi-center studies should confirm the findings. Second, this study is a cross-sectional study. Future longitudinal studies should examine whether a higher grit score at the start of employment is associated with a lower risk of subsequent depressive symptoms among medical residents. Third, one-quarter of residents did not participate in the online survey of this study. We have no information regarding their grit and depressive symptoms upon starting a job. Fourth, we did not diagnose the participant's depression because of a distinction between depressive symptoms assessed by CES-D and clinically diagnosed depression. Finally, this study potentially includes the social desirability bias. Some residents would try to make themselves look good, which resulted in higher grit and lower CES-D scores.

The results suggest that regular assessment of mental health is particularly important for medical residents with low grit scores at entry. Therefore, residency program administrators are recommended to measure grit score for medical residents at the start of employment. Close follow-up for residents with low grit score may lead to early detection of depressive symptoms, which could prevent depressive symptoms from getting worse and provide appropriate and timely intervention such as rest and periodic interviews.

Conclusion

In conclusion, higher grit scores were negatively associated with the odds of having depressive symptoms

among medical residents in high-stress environments at the start of employment. In particular, the higher perseverance of effort scores was negatively associated with the odds of having depressive symptoms. Future longitudinal studies should examine whether a higher grit and perseverance of effort scores at the start of employment is associated with a lower risk of subsequent depressive symptoms among medical residents. Furthermore, the association between grit score and depressive symptoms from medical school to residency during the pandemic should also be examined, because grit may affect mental health during medical school.

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Disclosure statement

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