

Can We Predict Future Depression among Residents before the Start of Clinical Training?

Makoto Ito,¹ Emiko Seo,^{1,2} Ryoko Ogawa,² Masaru Sanuki,^{1,2} Takami Maeno,¹ & Tetsuhiro Maeno^{1,2}

¹Graduate School of Comprehensive Human Sciences, University of Tsukuba, Tsukuba, Ibaraki, Japan

²Center for Medical Education and Training, University of Tsukuba Hospital, Tsukuba, Ibaraki, Japan

Abstract

CONTEXT: Depression among medical residents is a very serious problem. It is, however, very difficult to detect signs of depression early, despite the severity and frequency of depression. Therefore we designed a nationwide longitudinal study to investigate whether the sense of coherence (SOC) scale, an indicator of stress-coping ability, could predict future depressive symptoms among medical residents.

METHODS: We distributed self-administered questionnaires to first-year residents in 251 postgraduate educational hospitals just before the start of their clinical training. The questionnaire contained the Center for Epidemiologic Studies Depression (CES-D) scale (a screening tool for depression), the SOC scale, and demographic factors. After three months, we again distributed questionnaires to the residents who responded to the first survey. The second questionnaire contained the CES-D scale, and their working conditions. We categorised the respondents into three groups according to their SOC score, and we analysed the relationship between the three SOC groups (low, middle, high)

and depressive symptoms at the follow-up survey.

RESULTS: In all, 1738 of 2935 residents (59.2%) responded to the first survey. Of these, 1245 residents (71.6%) also responded to the follow-up survey. A total of 189 residents were excluded because they screened positive for depressive symptoms at the first survey. At the follow-up survey, 238 residents (23.3%) had new-onset depressive symptoms, with 41.2% in the low SOC group, 22.3% in the middle group, and 11.3% in the high group ($p < 0.01$). The odds ratio of the low SOC group for new-onset depressive symptoms, adjusted for demographic factors, baseline CES-D score and mean working time, was 3.11 (95% confidence interval, 1.48-6.53), with the high SOC group as the reference.

CONCLUSIONS: The SOC score was significantly related to future depressive symptoms among medical residents. The SOC scale might be a useful and easy-to-use predictor of future depression.

INTRODUCTION

The medical residency period is important for creating skilful doctors; however it is stressful and burdensome, not only physically, but mentally¹. Residents face very high levels of stress;² furthermore, depression is one of the most important reactions to stress,³ and may lead to suicide which is an especially significant problem. As well as the stresses facing general physicians or consultants, such as patient-related factors and heavy workloads, the residents also face particular stresses, such as adjusting to relocation, inadequate coping skills, and the leap from being just a student to being a responsible resident.⁴⁻⁶ Goebert *et al.*⁷ reported suicidal ideation was present in nearly 6% of depressed residents. The suicide rate among male physicians is 40% higher than in the general male population and that of female physicians is 130% higher than in the general female population.⁸

Depression among residents is also harmful to patients. Fahrenkopf *et al.*⁹ reported that depressed residents made 6.2 times as many medical errors per month as residents who were not depressed. Thus depression of residents is related to medical error and medical error may lead to depression,⁹ making doctors 'the second victim'.¹⁰

The prevalence of depression among residents is variable, with reports ranging from 7%-35%¹¹⁻¹⁴ however most studies have found the rate of depression among residents to be higher than that of the general public (4%-5%).^{11,14,15} In fact, we have previously reported that 25.5% of first year residents, who had been without depressive symptoms before the start of training, had depressive symptoms two months after the start of clinical training.¹⁶

General preventive interventions for depression among residents include restriction of working time¹⁷, mental health services³, and sharing the information of residents'

mental health among directors and attending physicians.¹⁸ But using only these general interventions still makes it difficult to prevent depression among residents.

The early detection of depression and the provision of appropriate care are essential for creating a healthy clinical training environment; however, early detection of depression is difficult, despite the severity and frequency of the condition.⁸ This may be due to the poor recognition of depression among both resident colleagues and attending physicians.⁸ In addition, many residents do not know exactly how to get help for mental health problems or worry about disclosing the fact to colleagues or attending physicians.⁶ If a predictor for the group at high risk of depression can be identified, the program director and attending physician could monitor this high risk group. This may help the early detection of depression in residents and facilitate the provision of appropriate support before depression gets any worse.⁶

Previous studies have suggested some predictive factors for depressive symptoms in residents, such as self-criticism¹⁹, an unhappy childhood², and previous mental health problems.¹⁴ However these factors are intimate and sensitive and many residents may hesitate to answer questions about such personal issues, so, in practice, it might be hard to use predictive factors such as these to detect the high risk group for depression. A previous study has also suggested the sense of coherence (SOC) score has an association with the onset of depression among Japanese workers, where the risk ratio of a high SOC compared to a low SOC for depression was 0.18.²⁰ A SOC was one of the concepts stated by Antonovsky in 1979, indicating a stress-coping ability. Since then, the SOC scale has been used as a tool to measure stress-coping ability, and a number of previous studies have reported that people with high SOC scores can maintain good mental health.²¹ Haoka *et al.*²² also suggested a low SOC score in a group of residents indicated poorer

mental health, compared to a group of residents with a high SOC score, and it could influence the way job stress was perceived. That cross sectional study, however, could not demonstrate that the SOC score might predict future depression among residents.

So in the present longitudinal study, we investigated the possibility that the SOC score, when evaluated before the start of clinical training, is a predictor of future depressive symptoms among medical residents.

METHODS

Subjects and study design

We contacted 853 postgraduate educational hospitals across Japan using REIS (Residency Electronic Information System), which is the Japanese government database of hospitals providing clinical training. We asked them to participate in our study, and then mailed questionnaires to the hospitals which agreed to participate, and the clinical training program directors distributed the questionnaires to first-year residents, at the orientation session at the beginning of clinical training. The questionnaire contained the Center for Epidemiologic Studies Depression (CES-D) scale as an evaluating tool for depressive symptoms, the SOC scale and basic demographic information, such as age, sex and type of hospital (university hospital or other educational hospital). In addition, we allocated an ID number to each questionnaire, which was also used for the follow-up survey. The ID number was handled separately to protect personal information.

Three months after the start of their training, we conducted a follow-up survey of only those residents who had responded to the first survey. The follow-up questionnaire contained the CES-D scale, and questions about working conditions, such as mean working time on weekdays, mean working time on weekends, and monthly number of night duties. This series of surveys was conducted in 2011.

CES-D scale

We used the CES-D scale to evaluate depressive symptoms. The CES-D scale was developed as a case-finding tool to screen for depressive symptoms in the general population by the National Institute of Mental Health, and it is widely used as a self-report scale to measure symptoms associated with depression.²³ The CES-D tool

consists of 20 items that focus on depressive symptoms within the last week, and, on a scale from zero to three, respondents rate all 20 items, scoring from 0 to 60.²³ We used the Japanese version of the CES-D scale; the reliability and validity of this version have been confirmed, and using 16 points as a cut-off, its sensitivity is 88.2% and specificity is 84.8%.²⁴ A person with a score of more than 16 was defined as screening positive for depressive symptoms.²⁴

SOC scale

We used the Japanese version of the SOC questionnaire consisting of 13 items rated on 5-point scales, which has been previously tested for reliability and validity.²⁵ We classified residents into three groups based on their SOC score. Because there is no definitive cut-off point for the SOC scale, we used the mean and standard deviation (SD) of the total SOC score to define the groups, as in previous studies.^{22,26} Groups were as follows: low SOC score group, SOC score < mean - SD; high SOC score group, SOC score > mean + SD; middle SOC score group, SOC score \geq mean - SD but \leq mean + SD.

Mean working time

As in previous studies,^{22,27} we thought it might be difficult for residents to directly state their mean working time per week as most of them recognise their working time by the hours per day, so their mean weekly working time was calculated with the following equation using three components - mean working time on weekdays, mean working time on weekends, and monthly number of night duties: Mean weekly working time = $[5 \times (\text{mean working time on weekdays})] + [2 \times (\text{mean working time on weekends})] + [7 \times (\text{monthly number of night duties}/30) \times (24 - \text{mean working time on weekdays})]$.

That is, the mean weekly working time was defined as the sum of five times the mean daily working time on weekdays, plus two times the mean daily working time on weekends, plus the mean working time of night duties. The questionnaire included ‘monthly’ number of night duties, thus we re-calculated this value as the ‘weekly’ number of night duties. We calculated the working time of each night duty as ‘24 hours minus the mean daily working time on weekdays’.

Statistical strategy

We included the residents who answered both the first survey and follow-up survey. We excluded residents with missing data for SOC score, CES-D score, or demographic information. To evaluate how medical training influences their mental health as a stress factor, we also excluded the residents who had already screened positive for depressive symptoms at the first survey, before starting clinical training. Residents who did not screen positive for depressive symptoms at the first survey but screened positive for depressive symptoms at the follow-up survey were defined as residents with ‘new-onset depressive symptoms’.

To reveal any associations between new-onset depressive symptoms and the three SOC groups, baseline CES-D score, demographic factors, and working hours, we conducted chi-square tests or *t* tests for each variable, as univariate analyses. We also calculated the correlation between baseline SOC and CES-D scores. We conducted binomial logistic analysis for new-onset depressive symptoms to adjust for confounding factors, using demographic information and variables with p-values < 0.10 at the univariate analysis as independent variables. The significance level was set at $p < 0.05$. All statistical analyses were conducted by SPSS version 22.0.

Ethical consideration

The study was approved by the Ethics Committee of the Faculty of Medicine of the University of Tsukuba. The purpose of this study and provision of secure data management was stated on the first page of the questionnaire. At the same time we explained to them that their participation in the study was purely voluntary. Results were analysed separately from personal information, to allow for anonymity and confidentiality of personal information.

RESULTS

Subject characteristics

In all, 251 hospitals participated in our study, and we distributed questionnaires to 2935 residents. For the first survey, 1738 residents (59.2%) responded. Of these, 1245 residents (71.6%) responded to the follow-up survey. A total of 36 questionnaires had missing data so these respondents were excluded. Of the remaining 1209 residents, 189 residents (15.6%) screened positive for depressive symptoms at the time of the baseline survey, so they were also excluded from the study, leaving a final number of 1020 residents (82.0%) subject to analysis in this study. Of these, the number of male residents was 668 (65.5%). Their mean working time was 78.8 ± 13.6 hours per week and the percentage of residents working more than 80 hours per week was 45.7%. The demographic factors, mean SOC score and category, and mean working time of the residents are shown in Table 1.

SOC scores and grouping

The mean SOC score (\pm SD) of residents was 44.4 ± 6.0 ; the total SOC score ranged from 13 to 65. The correlation between SOC score and CES-D score at baseline was -0.488 ($p < 0.01$).

In all, 148 residents (14.5%) were categorised in the low SOC score group, 712 residents (69.8%) in the middle SOC score group, and 160 residents (15.7%) in the high SOC score group. Age was the only demographic factor significantly different between the three SOC score groups, with older residents having a higher SOC score than the younger residents.

New-onset depressive symptoms

At the follow-up survey, the number of residents with new-onset depressive symptoms was 238 (23.3%). The demographic factors, mean SOC score and category, and mean working time of the residents with and without new-onset depressive symptoms are shown in Table 2.

In a univariate analysis investigating the association of new-onset depressive symptoms with demographic factors, baseline CES-D score and working time, only the CES-D score at baseline (6.28 ± 3.8 vs. 8.95 ± 3.7 , for absence vs. presence of new-onset depressive symptoms, respectively; $p < 0.01$) and the mean number of working hours per week (77.5 ± 13.5 vs. 83.1 ± 13.9 , for absence vs. presence of new-onset depressive symptoms, respectively; $p < 0.01$) were significant. There were no significant differences between sexes (Table 2).

Relationship between new-onset depressive symptoms and SOC score

The mean SOC score was significantly lower in the residents with new-onset depressive symptoms at follow-up, compared to those residents without new-onset depressive symptoms (Table 2, $p < 0.01$). The percentage of residents with new-onset depressive symptoms in each SOC score group was as follows: low, 41.2%; middle, 22.3%; and high, 11.3% ($p < 0.01$; Figure 1).

Logistic regression analysis

The results of multivariate logistic regression analysis for new-onset depressive symptoms are shown in Table 3. The adjusted odds ratio of the low SOC score group for new-onset depressive symptoms was 3.11 (95% confidence interval [CI], 1.48-6.53; $p <$

0.01); the reference was the high SOC score group.

In addition, when we used the SOC score as a continuous variable in a logistic regression analysis, we confirmed that the SOC score was independently related to new-onset depressive symptoms, after adjustment for the baseline CES-D score (odds ratio, 0.93; 95% CI, 0.90-0.96; $p < 0.01$).

DISCUSSION

In the present longitudinal study, the SOC score had a significant independent association with new-onset depressive symptoms, even after adjustment for the CES-D score at baseline, with the adjusted odds ratio of the low SOC group being 3.11 (the reference was the high SOC group). This suggests that the residents categorized in the low SOC group had a threefold higher risk of future depressive symptoms than those in the high SOC group.

Sairenchi *et al*²⁰ reported that during a one year follow-up of depression in Japanese workers, the odds ratio of the high SOC group for future depression, compared to the low SOC group, was 0.18 (95% CI, 0.04-0.79), indicating that the high SOC group had a lower risk of future depression than the low SOC group. In our study, the reference was the high SOC group, hence when we re-calculated the odds ratio in Sairenchi's study using their high SOC group as the reference, the odds ratio of their low SOC group for future depression was 5.56, which is somewhat higher than that of our present study, however our results are still comparable to Sairenchi's study. In another previous study investigating the association between SOC scores and mental health among Japanese workers, the PSRs (Psychological Stress Response Scale) was used as a tool for evaluating mental health; to screen positive for PSRs means that the latent stress response is relatively high. In this study, the odds ratio for screening positive for PSRs was 6.35 in the low SOC group and 1.48 in the middle group (the reference being the high SOC group).²⁸ These results, while somewhat higher than our odds ratios, still have a similarity to our present results.

In univariate analysis for new-onset depressive symptoms, the mean weekly working time of residents with depressive symptoms was higher than those without

depressive symptoms (83.1 hours vs. 77.5 hours). The mean weekly working time also had a significant independent association with new-onset depressive symptoms, and its odds ratio was 1.04. Since a resident working more than 80 hours a week has a tendency for an increased risk of impaired mental health²⁹ or medical error,³⁰ the working hours of residents are restricted to less than 80 hours in the US¹¹ and Europe.²² In the present study, 45.7% of residents were working more than 80 hours per week, so it seems important to regulate the working time of residents to care for their mental health.

The job stress model of the National Institute of Occupational Safety and Health (NIOSH),³¹ which is one of the most widely used occupational stress models,²² may help explain a possible mechanism for how the SOC score may predict a group at high risk of depressive symptoms. This NIOSH model suggests that exposure to stressful working conditions (e.g. long working hours, complicated inter-personal relationships) can have a direct influence on worker safety and health, and can generate a stress reaction such as depression or burn-out.³² But individual factors (e.g. job position, relaxed and positive outlook) and other situational factors (e.g. support from colleagues or supervisors, work-home balance) can intervene to strengthen or weaken this influence. According to the NIOSH job stress model, when residents face the same stressful working conditions, but have different levels of stress-coping ability, which is thought to be an individual factor, the perceived level of influence on their mental state would be different. Therefore, since the SOC scale can measure this stress-coping ability, the SOC score may well predict future depression, as the NIOSH model shows that one of the important reactions to stress is depression.

Currently, general preventive interventions, such as restricting working time¹¹ and assistance services for residents,³ are being used to provide mental health care for

residents. However, even with these interventions, a significant number of residents still have depressive symptoms. Since the SOC scale may be able to predict the group at high risk of future depressive symptoms, this high risk group could be carefully monitored and early signs of depressive symptoms detected, and appropriate care provided before the symptoms worsen.⁶ The SOC scale is an easy-to-use tool and needs just a few minutes to administer, making it feasible for many educational hospitals. Furthermore, because the SOC score could be evaluated before the start of clinical training, there would be enough time to prepare support for the high risk group, such as frequent short-term counselling sessions,⁶ and sharing the issue with directors and attending physicians.³

Maintaining the stress-coping ability of residents is also an important issue. Antonovsky stated that a SOC is basically developed by around age 30, and can be maintained by positive, supportive, and meaningful life events.³³ Thus, in the case of residents, positive work situations or events, such as gratitude from patients, support from colleagues and job satisfaction, might influence the stress-coping ability of residents and would be helpful in maintaining their SOC.

While the SOC scale appears to be a useful tool, we should be careful in which situations it is used. In fact, while the odds ratio of the low SOC group for new-onset depressive symptoms was threefold higher than the high SOC group, 22.3% of residents had new-onset depressive symptoms in middle SOC group, 11.3% of residents had new-onset depressive symptoms in high SOC groups. Therefore, a general and comprehensive strategy for preventive interventions for depression is obviously needed for all residents, as depression can be influenced by many related factors.

This study has some limitations. First, we could only distribute questionnaires to residents who belonged to the limited number of hospitals that agreed to participate in this

study. In addition, we only included the residents who responded to both the first and follow-up surveys. It is possible that the residents who responded to our questionnaire were interested in issues such as working conditions, mental health, or depression. In contrast, it is possible that severely depressed residents could not respond to this survey. Therefore, we may have over-estimated or under-estimated the number of residents with new-onset depressive symptoms.

Second, only 251 of 853 hospitals (29.4%) participated in this study, which is a relatively small number. However, the hospitals that participated in the study were geographically spread across Japan. Moreover, of the residents who participated in this study, 39.7% belonged to university hospitals and 60.3% belonged to other educational hospitals, which might not represent the total distribution of residents in Japan (45.2% in university hospitals, 54.8% in other educational hospitals).³⁴ However there was no significant difference in new-onset depressive symptoms between residents belonging to university hospitals and other educational hospitals, so the results should not be influenced substantially.

Third, the follow-up survey was conducted only once, three months after the baseline survey; hence the present study could not clarify the prevalence of depression further in the future. A previous study, however, suggested that the prevalence of depression is highest after three months of clinical training among first year residents,³⁵ thus our follow-up survey was timed to find out the prevalence of new-onset depressive symptoms three months after the start of clinical training.

Finally, we used a self-administered questionnaire and defined residents who had a CES-D score of 16 or more as screening positive for depressive symptoms. Therefore, it should be noted that this may not always match a diagnosis of depression, or detect

residents who actually have depressive symptoms associated with depression. However in the present study, the prevalence of depressive symptoms was 15.6% at the baseline survey, which was similar to the 15.2% prevalence of depression in a study in which the CES-D score was translated into Japanese.²⁴ Moreover, including residents with depressive symptoms at baseline, 30.3% of residents had depressive symptoms at the follow-up survey. This is comparable to previous studies using the CES-D as a screening tool for depressive symptoms among medical residents which reported the prevalence of such symptoms as 29.2% to 34.2%.^{1,36} This confirms some amount of value and accuracy in the use of self-administered questionnaires.

CONCLUSIONS

The SOC scale, evaluated before the start of clinical training, could help identify medical residents at high risk of depressive symptoms, so they can be provided with effective support. It is of value to both residents and medical educators.

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We all have agreement to be accountable for all aspects of our work in ensuring that questions related to the accuracy or integrity of any part of our work are appropriately investigated and resolved. And all authors approved the final manuscript for publication.

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Conflicts of interest: None.

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Table 1. Participant characteristics, mean SOC score, SOC category, and mean working time (n = 1020)

Age , mean \pm SD, y	26.0 \pm 3.0
Sex	
Male, n (%)	668 (65.5%)
Female, n (%)	352 (34.5%)
SOC score	
SOC score, mean \pm SD	44.4 \pm 6.0
Low, n (%)	148 (14.5%)
Middle, n (%)	712 (69.8%)
High, n (%)	160 (15.7%)
Hospital type	
University hospital, n (%)	405 (39.7%)
Other educational hospital, n (%)	615 (60.3%)
Working time¹	
Mean \pm SD, hours/week	78.8 \pm 13.6
Residents working more than 80 hours/ week, n(%)	375(45.7%)

¹n = 820 as 200 residents returned the survey but did not provide an answer for working conditions.

Abbreviations: SOC, sense of coherence; SD, standard deviation.

Table 2. Association of new-onset depressive symptoms with demographic factors, SOC score, baseline CES-D score, and mean working time

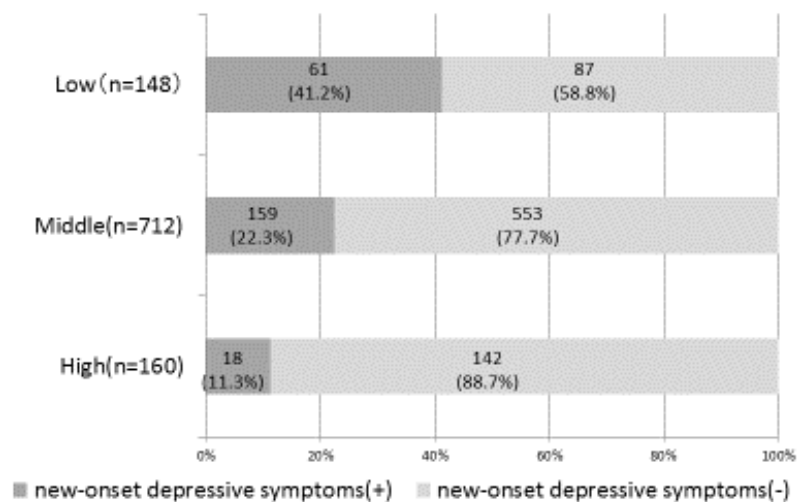
Variables	New-onset depressive symptoms (-) (n = 782)	New-onset depressive symptoms (+) (n = 238)	p-value
Age , mean \pm SD, y ¹	26.0 \pm 2.9	26.0 \pm 3.1	0.68
Sex , male (%) ²	519 (66.4%)	149 (62.6%)	0.31
SOC score , mean \pm SD ¹	45.6 \pm 7.2	40.0 \pm 7.3	< 0.01
CES-D score at baseline , mean \pm SD ¹	6.28 \pm 3.8	8.95 \pm 3.7	< 0.01
Hospital type			
University hospital, n (%) ²	312 (39.9%)	93 (39.1%)	0.88
Mean working time			
mean \pm SD, hours/week ¹	77.5 \pm 13.2	83.1 \pm 13.9	< 0.01

¹t test

²Chi-square test

Abbreviations: SOC, sense of coherence; SD, standard deviation; CES-D, Center for Epidemiologic Studies Depression.

Figure 1. The relationship between the number of residents with new-onset depressive symptoms and the three SOC score groups
n = 1020



Abbreviation: SOC, sense of coherence

Chi-square test $p < 0.01$

Prevalences of new-onset depressive symptoms in residents (n = 1020) grouped according to baseline scores on the Sense of Coherence Scale. Chi-squared test, $p < 0.01$

Table 3. Association between new-onset depressive symptoms and the SOC score
(n = 820)

	Odds ratio	95% CI	p-value
SOC score groups			
Low	3.11	1.48-6.53	< 0.01
Middle	1.72	0.92-3.24	0.09
High	1.00		
CES-D score at baseline	1.17	1.12-1.23	< 0.01
Age	1.05	0.99-1.12	0.11
Sex ^a	1.30	0.90-1.89	0.16
Hospital type ^b	0.87	0.61-1.25	0.45
Mean working time	1.04	1.02-1.05	< 0.01

The results of a binomial logistic regression analysis where the dependent variable is new-onset depressive symptoms and the independent variables are the three SOC groups, CES-D score at baseline, age, sex, hospital type, and mean working time.

^aCoded as: 0 = male; 1 = female.

^bCoded as: 0 = university hospital; 1 = other educational hospital.

Abbreviations: CI, confidence interval; SOC, sense of coherence; CES-D, Center for Epidemiologic Studies Depression.