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Abstract: Development of Japanese Version of the Checklist Individual Strength Questionnaire in a Working Population: Yutaka Aratake, et al. Department of Occupational Mental Health, Graduate School of Medical Sciences, Kitasato University—The aims of the present study were to develop and validate the Japanese version of the checklist individual strength questionnaire (CIS) which is used to measure prolonged fatigue not only in the general population but also in the working population. We obtained permission to use CIS from its author and translated the questionnaire into Japanese. Then, the Japanese version of the questionnaire was translated back into English by a bilingual person. The author of the original version agreed that the back-translated version was conceptually and linguistically equivalent to the original CIS. To validate CIS, 399 workers (66.7% were men) from different companies answered the Japanese version of the CIS (CIS-J), Maslach burnout inventory-general survey (MBI-GS), Beck Depression Inventory-II (BDI-II), visual analogue scale (VAS) questionnaires for subjective fatigue, number of overtime hours and number of hours of sleep. Cronbach’s α for the total CIS-J score was 0.91. The test-retest reliability assessed with an intra-class correlation coefficient was 0.82. Although confirmatory factor analysis did not show an ideal model fit, the correlation coefficients between the total CIS score and the MBI-GS exhaustion score, the BDI-II score and the VAS score were 0.58 (p<0.01), 0.66 (p<0.01) and 0.63 (p<0.01), respectively. The less workers slept and the longer they worked, the higher their total CIS score became. CIS-J showed good reliability and acceptable validity in the working population. Thus, it could be useful for studying fatigue among Japanese working populations.

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Key words: Fatigue, CIS, Questionnaire, Reliability, Validity, Working population, Overtime hours, Sleep time

Fatigue is a common complaint and an important problem because it affects quality of life. However, fatigue is difficult to define and measure. Fatigue can be classified in terms of length, that is, acute and prolonged fatigue. Acute fatigue is a normal phenomenon that is task-specific and tends to disappear after a period of rest when tasks are switched or when particular compensation strategies are used (e.g., working at a slower pace). Prolonged fatigue is assumed to be the result of a cumulative process and can occur if an individual is continuously exposed to one or more stressors during which there is no or inadequate opportunity to recover. Prolonged fatigue is not task-specific and compensation mechanisms are ineffective at reversing it within a short time. Prolonged fatigue refers to a debilitating state that could have negative effects on quality of life.

Fatigue is considered to be a predictor of diseases. Appels et al. showed that there are strong associations between fatigue and morbidity and mortality in longitudinal studies. In a study by de Croon et al., the need for recovery was found to be predictive of future long-term sick leave (>14 d).

No gold standard exists for measuring fatigue. Objective fatigue is measured with a focus on physiological processes or performance such as reaction time or the number of errors. Subjective methods of assessing fatigue include diary studies, interviews and the use of questionnaires. Often, questionnaires are used in large-scale studies for convenience. There are several questionnaires for assessing fatigue among...
The Checklist Individual Strength questionnaire (CIS) is a questionnaire used most frequently worldwide. It is a fatigue questionnaire used to measure prolonged fatigue. CIS consists of twelve statements for which the person has to choose an answer from a five-point Likert scale. The statements refer to aspects of fatigue experienced during the past two weeks. CIS is divided into four dimensions: subjective fatigue (four items), reduction in concentration (five items), reduction in activity (three items), and reduction in motivation (four items). The subscales for subjective fatigue, concentration, activity, and motivation have five, five, three, and four items, respectively. The reliability and validity of CIS were confirmed through statistical analysis.

To translate CIS into Japanese, two individuals translated the questionnaire into Japanese independently. They then met and discussed the translations with a third person, finally agreeing on a consensus version. Later, this consensus version was translated back into English by a bilingual person. The author agreed that the back-translated version was conceptually and linguistically equivalent to the original CIS. CIS-J is shown in the Appendix.

Participants

The participants were recruited from various industries. Workers from different companies and organizations such as manufacturing industries, information technology companies, hospitals, and public offices participated in this study. The survey was conducted at the periodic physical examination of each industry. When the employees attended their physical examination, they were requested to cooperate in the research. Written or oral informed consent was obtained from all the participants before they filled out the questionnaire.

Reliability of CIS

The internal consistencies of the scales used were assessed using Cronbach’s α. After obtaining informed consent, test-retest reliability was examined using 35 participants. They had completed CIS on two occasions at an interval of 3 d. Test-retest reliability was assessed using the intra-class correlation coefficient (ICC).

Validity of CIS

Confirmatory factor analysis was carried out to corroborate the factor structure of CIS-J was the same as that of the subscales of CIS. Subsequently, model fitness was assessed using the following indices of fit: goodness of fit index (GFI), adjusted goodness of fit index (AGFI), root mean square error of approximation (RMSEA) and the comparative fit index (CFI). We consider that that GFI>0.90, AGFI>0.80, RMSEA<0.10 and CFI>0.90 are desirable for the indices of fit for structural equation modeling as Byrne described.

The concurrent validity of CIS was assessed using correlations with the Maslach burnout inventory-general survey (MBI-GS) exhaustion score, the Beck Depression Inventory-II (BDI-II) score, and the visual analogue scale (VAS) score for subjective fatigue using the Pearson correlation coefficient.

MBI-GS was developed on the basis of MBI. MBI was originally developed to measure burnout in human service providers. More recently, MBI-GS, which can also be used for other occupations, has been developed. The MBI-GS has three subscales that parallel those of MBI: exhaustion, cynicism, and professional efficacy. The exhaustion items are generic, without MBI’s emphasis on emotions and without direct references to service providers.

Methods

Development of CIS-J

We obtained permission to use CIS from its author and translated the questionnaire into Japanese using a recommended procedure. First, two individuals translated CIS into Japanese independently. They then met and discussed the translations with a third person, finally agreeing on a consensus version. Later, this consensus version was translated back into English by a bilingual person. The author agreed that the back-translated version was conceptually and linguistically equivalent to the original CIS. CIS-J is shown in the Appendix.

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recipients. The items include references to both emotional and physical fatigue. The items of the subscale cynicism reflect indifference or a distant attitude toward work itself. High degrees of exhaustion and cynicism, and a low degree of professional efficacy are indicative of burnout\textsuperscript{18}. The reliability and validity of a Japanese research version of MBI-GS have been examined\textsuperscript{21}. We received the author’s permission to use the Japanese version of MBI-GS. Cronbach’s $\alpha$ of MBI-GS exhaustion score in this study was 0.88.

The BDI questionnaire, a 21-item self-report questionnaire for measuring the severity of depression in adults, was developed to assess symptoms corresponding to criteria for diagnosing depressive disorders on the basis of the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV). In the present study, an updated version was used (BDI-II)\textsuperscript{20}. The BDI-II questionnaire takes about 10 min to complete and has a two-week time frame including the day it is filled out. Items are rated using a four-point scale ranging from 0 to 3, with higher scores reflecting more severe depression. The total score is obtained by adding up the scores for each of the 21 items. A cut-off score of 20 was used. The validity of BDI-II in Japan has been confirmed\textsuperscript{21}. Cronbach’s $\alpha$ of the BDI-II score in this study was 0.90.

To measure fatigue using a unidimensional visual analogue scale (VAS), the participants were asked to rate their perceived fatigue in the previous 2 wk, ranging from never (0 mm) to very often (100 mm).

To assess the discriminant validity of CIS, we examined the difference in scores between groups in terms of the numbers of hours of sleep and overtime. The number of hours of sleep was the average of the number of hours of sleep for the past two weeks, and the number of overtime hours was the sum of the number of overtime hours worked in the past month. The numbers of hours of sleep and overtime were obtained from self-assessment information. We divided the participants into 3 groups in terms of the numbers of hours of sleep (i.e., a group receiving more than 6 h, a group receiving 5–6 h and a group receiving 5 h of sleep or less). The comparisons between these groups were performed using the Tukey multiple comparisons test. We also divided the participants into 2 groups in terms of the numbers of overtime hours worked in the past month (i.e., a group working 40 h of overtime or less and a group working more than 40 h of overtime).

All statistical analyses were carried out with SPSS version 12.0 and confirmatory factor analyses were performed using Amos 5.

**Results**

Three hundred and ninety-nine of 424 (94%) volunteers participated, of which 267 were men and 132 were women. The participants worked as office workers, engineers, sales staff, nurses, and so on. Table 1 shows the demographics of the participants.

The means ± SD of total CIS score, MBI-GS exhaustion (MBI-EE) score, BDI-II score and VAS score were 73.4 ± 20.5, 2.8 ± 1.4, 12.3 ± 8.3 and 57.0 ± 25.6, respectively. One hundred and seventy-nine participants (44.9%) were determined to have chronic fatigue using a cut-off score of 76, as proposed by Bultmann et al\textsuperscript{22}. Two hundred and fifty participants (62.7%) were determined to be in the minimal range for depression using a cut-off score of 13 as proposed by Beck et al\textsuperscript{20}.

**Reliability of CIS**

The reliability of CIS was evaluated in terms of internal consistency reliability and test-retest reliability. Internal consistency reliability, as assessed using Cronbach’s $\alpha$, was 0.91. Test-retest reliability was determined using a subgroup (N=35) of the participants. The subgroup had completed CIS on two occasions at an interval of 3 d. The test-retest reliability assessed with ICC was 0.82.

**Validity of CIS**

The result of confirmatory factor analysis of CIS-J, the factor structure of which is assumed to be the same as that of the original CIS, is shown in Fig. 1. The fit indices of the model are as follows: GFI=0.79, AGFI=0.73, RMSEA=0.10 and CFI=0.82. The path coefficients from subscale 3 (motivation) to item 15 (I am full of energy) to item 7 (I do quite a lot within a day) were not high. However, the whole path coefficients from each subscale to its items were high, including those of subscales 3 and 4.

The correlation coefficients between total CIS score and MBI-EE score, BDI-II score and VAS score were 0.58 ($p<0.01$), 0.66 ($p<0.01$) and 0.63 ($p<0.01$), respectively.

The total CIS score (mean ± SD (95% CI)) of the group
receiving more than 6 h of sleep was 67.6 ± 19.3 (64.5–
70.8). The total CIS score of the group receiving 5–6 h
of sleep was 73.4 ± 21.2 (70.0–76.8). The total CIS score
of the group receiving 5 h of sleep or less was 81.7 ±
18.3 (78.1–85.3). The total CIS scores of the three groups
differed significantly. The less working people slept, the
more they indicated fatigue. The total CIS score of the
group receiving 5–6 h of sleep was 73.4 ± 21.2 (70.0–76.8). The total CIS score of the group receiving 5 h of sleep or less was 81.7 ± 18.3 (78.1–85.3). The total CIS scores of the three groups differed significantly. The less working people slept, the more they indicated fatigue. The total CIS score of the group receiving 5–6 h of sleep was 73.4 ± 21.2 (70.0–76.8). The total CIS score of the group receiving 5 h of sleep or less was 81.7 ± 18.3 (78.1–85.3). The total CIS scores of the three groups differed significantly. The less working people slept, the more they indicated fatigue.

Discussion

We translated CIS, which is used to measure prolonged
fatigue not only in the general population but also in the
working population, into Japanese. Then, the Japanese
version of the questionnaire was translated back into
English by a bilingual person. The author of the original
version agreed that the back-translated version was
equivalent to the original CIS. To validate CIS, 399
workers (66.7% were men) from different companies
answered CIS-J, MBI-GS, BDI-II, VAS, questionnaires
for subjective fatigue, number of overtime hours and
number of hours of sleep. Cronbach’s \( \alpha \) for the total CIS-
J score was 0.91. The test-retest reliability was also substantially high. However, the test-retest interval was short for CIS and study of a longer test-retest interval is required.

Confirmatory factor analysis was carried out to
determine whether the factor structure of CIS-J can be
considered to be almost the same as that of the original
CIS, which Vercoulen et al. developed\(^9\). Toyoda
suggested that RMSEA is least affected by degree of
freedom and the most reliable among the fit indices, and
that structural equation modeling is acceptable if RMSEA
is not larger than 0.10 regardless of the other fit indices\(^23\).
Although not all of the fit indices of CIS-J were sufficient
in this study, the RMSEA was within the tolerance level.
The reason a good model fit was not obtained might be
that the sample was not uniform because the participants
were recruited from various industries that have different
employment conditions and the number of participants
was relatively small. Also, the model, which was
confirmed in overseas studies, might not be suitable for
Japanese workers. Further studies are needed to clarify
the reason why a good model fitting was not obtained.
The concurrent validity of the total CIS score was
assessed by correlation with MBI-EE score. Burnout is a
pathological syndrome in which emotional depletion and
maladaptive detachment develop in response to prolonged
occupational stress. Fatigue is different from burnout.
However, they have many similarities. Therefore, the
concurrent validity of the total CIS score was assessed

![Fig. 1. Confirmatory factor analysis of Japanese version of CIS. S1–S4 indicate the subgroups of
CIS (S1: subjective feeling of fatigue, S2: concentration, S3: motivation, S4: physical
activity). Each number in the square corresponds to the item in CIS.](image-url)
by evaluating the score’s correlation with the MBI-EE score. The corresponding correlation coefficient between the total CIS score and the MBI-EE score was high (0.62) in the group of employees with mental fatigue. BDI-II score was also used to assess the concurrent validity of the total CIS score. In general, the more severe the fatigue and the larger the number of associated somatic (and unexplained) complaints, the greater the disability and the greater the likelihood of a diagnosis of depression. Each of the corresponding correlation coefficients among the total CIS score and MBI-EE score, BDI-II score and perceived fatigue score (VAS) was in the expected direction and high, which shows sufficient concurrent validity.

The less employees slept, the more they had fatigue and the group that worked more were more fatigued. When healthy adults receive an average of less than 5 h of sleep per night, the homeostatic drive to sleep increases sharply, as shown by an increased propensity to sleep and cognitive performance begins to decline. Thus, sleepiness and fatigue are the results of fundamental biological processes. Iwasaki et al. reported that a significant relationship exists between the numbers of working hours and fatigue complaints. Our two results on the numbers of hours of sleep and overtime showed high discriminant validity.

There were some issues regarding the examined in this study. The participants were recruited from various industries. However, they were not completely representative of the Japanese workforce. In particular, we were not able to recruit participants from primary industries in this study. In addition, 25 workers who attended physical examination at the time of our survey refused to participate in this study and we obtained no information about these workers. This might have had some effect on the results of this study, even though the number of these workers was very small. Further study of the workers of various types of business including primary industries is desired to confirm the reliability and validity of CIS-J.

Using only questionnaires may have affected the significance of the relationship as a result of self-report bias resulting from issues such as the common variance of methods, cognitive consistency, social desirability, and overlapping between dependent and independent variables. Therefore, fatigue should be evaluated not only using CIS, but also by considering other methods such as those evaluating the number of hours of sleep and overtime hours.

To assess the prevalence of fatigue in workers, a cut-off point for fatigue for use in the working population was developed by Bultmann et al. Using this cut-off point, workers with a total CIS score higher than 76 for total CIS score are considered as probable fatigue cases, with a fatigue level that can be indicated as putting the employee at risk for sick leave or work disability. Bultmann et al. showed that the prevalence of fatigue in the working population is 21.9%. According to the cut-off scores of BDI-II, Koijima et al. reported that 80.7% of the participants scored in the minimal range (0–13) for depression in the working population. The prevalences of fatigue and depression in the present study were higher than those of the two aforementioned studies. Although the large amount of stress at work in Japan might be the cause of the higher prevalences of fatigue and depression in the present study, future studies are needed to compare the prevalence of fatigue in Japan with that in other countries.

The need for recovery is a measure of acute-work-related fatigue. Under conditions of prolonged exposure to work-related stressors and insufficient recovery, acute fatigue is assumed to lead to cumulative health deterioration and sick leave. Janssen et al. reported that fatigue as measured with CIS can be used as a screening instrument to assess the likelihood of sick leave in the short term. Therefore, by using CIS as a screening tool and then intervening with those whose fatigue could affect their health, we may be able to prevent diseases. Many methods of intervention have been considered such as advising those experiencing fatigue to get more sleep and decrease their overtime work.

Questions such as CIS are desired not only to check the presence or absence of symptoms but also to determine the cause of symptoms. Occupational health staff members are recommended to utilize such questionnaires to clarify the association between symptoms and risk factors in the work place and improve the circumstance in cooperation with the relevant departments.

Acknowledgment: Gratitude is expressed to Kitaoka-Higashiguchi K. for assistance with use of the Japanese version of MBI-GS.

References
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Appendix

Checklist Individual Strength

Instruction:
You find 20 statements. With these statements we wish to get an impression of how you have felt during the past two weeks. For example:

I feel relaxed
If you feel that this statement is true, place a cross in the right box; like this:
I feel relaxed
   yes, that is true  X
   no, that is not true

If you feel that this statement is not true at all, place a cross in the box that is most in accordance with how you have felt.

For example, if you feel relaxed, but not very relaxed, place a cross in one of the boxes close to “yes, that is true”: like this:
I feel relaxed
   yes, that is true  X
   no, that is not true

Do not skip any statement and place only one cross for each statement.

1. I feel tired
   yes, that is true  X
   no, that is not true
2. I feel very active
   yes, that is true  no, that is not true
3. Thinking requires effort
   yes, that is true  no, that is not true
4. Physically I feel exhausted
   yes, that is true  no, that is not true
5. I feel like doing all kinds of nice things
   yes, that is true  no, that is not true
6. I feel fit
   yes, that is true  no, that is not true
7. I do quite a lot within a day
   yes, that is true  no, that is not true
8. When I am doing something, I can concentrate quite well
   yes, that is true  no, that is not true
9. I feel weak
   yes, that is true  no, that is not true
10. I don’t do much during the day
    yes, that is true  no, that is not true
11. I can concentrate well
    yes, that is true  no, that is not true
12. I feel rested
    yes, that is true  no, that is not true
13. I have trouble concentrating
    yes, that is true  no, that is not true
14. Physically I feel I am in a bad condition
    yes, that is true  no, that is not true
15. I am full of plans
    yes, that is true  no, that is not true
16. I get tired very quickly
    yes, that is true  no, that is not true
17. I have a low output
    yes, that is true  no, that is not true
18. I feel no desire to do anything
    yes, that is true  no, that is not true
19. My thoughts easily wander
    yes, that is true  no, that is not true
20. Physically I feel in a good shape
    yes, that is true  no, that is not true
Checklist Individual Strength 日本語版

下記のそれぞれの問について、最近2週間の当てはまるところに○をしてください。

例：とても疲れている場合

<table>
<thead>
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少し疲れている場合

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<tr>
<th>（1）疲れている</th>
<th>○</th>
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</thead>
</table>

(1) 疲れている
(2) とても活動的だ
(3) 考えるのがめんどうだ
(4) 身がへとへとだ
(5) やりたいことは何でもしたい
(6) 健康的だ
(7) 一日にたくさんのことをしている
(8) 何かをする時、十分集中できる
(9) 怠っている
(10) 途中で立たせることができない
(11) 集中力がある
(12) 身体が休まっている
(13) 集中するのが面倒だ
(14) 身体の具合が悪い
(15) やりたいことがいっぱいある
(16) すぐに疲れてしまう
(17) 一日にやれることは多くない
(18) 何もする気になれないので
(19) すぐに気が散る
(20) 体調がよい