Feeling Refreshed by Sleep Can Predict Psychological Wellbeing Assessed Using the General Health Questionnaire in Male Workers: A 3-Year Follow-Up Study

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Prediction of psychological wellbeing based on several important predictors was conducted for ensuring maintenance of good mental health. A 3-year follow-up study to determine psychological well-being was conducted in 969 Japanese male workers. Age, body mass index, present history of medication and four lifestyle factors were used for the analysis. A logistic regression analysis revealed that the odds ratio (95% confidence interval) for obtaining a score of ≥4 in the General Health Questionnaire-12-item version, among the subjects who felt refreshed by sleep was 0.559 (0.415-0.753). None of the other factors showed any statistically significant association. Feeling refreshed by sleep was identified as a predictor of maintained psychological wellbeing in this 3-year follow-up study.

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Key Words Worker, the General Health Questionnaire 12-item version, Aging, Present history of medication, Alcohol intake, Smoking, Exercise, Refreshment by sleep, Follow-up study.

INTRODUCTION

Physical health is well known to be related to lifestyle factors, including smoking, drinking, exercise and sleeping,[1,2] however, psychological wellbeing has also come to be recognized to be related to lifestyle factors.[3]

A healthy lifestyle is important to maintain a good health status. In addition, if subjects have some health problems, maintaining a healthy lifestyle is difficult. The cause-effect relationship between good health practices and good health is sometimes complex. However, we considered that a follow-up study might yield important information on the cause-effect relationship.

The General Health Questionnaire, 12-item version, (GHQ 12) is a self-administered screening inventory to detect the level of psychological wellbeing.[4,5] As there is a lack of information on the cause-effect relationship between sleep quality and psychological wellbeing in the workplace, the authors tried to make clear the causality by adjusting some factors such as lifestyle habits and physical status. Furthermore, we wanted to identify whether the refreshment of sleep, the outcome of good sleep, would have an advantage as a predictive ability of psychological wellbeing. In the present study, a 3-year cohort study was conducted to identify risk factors for the lack of psychological wellbeing using several variables, including lifestyle factors, present history of medication, obesity and age, in the employees of a workplace.

METHODS

A total of 2,644 Japanese male workers of a car manufacturing company underwent annual health examinations in 2008. After 3 years, 971 subjects (36.7%) whose scores on the GHQ12 were <4 in 2011 were recruited for the next stage of the survey, while the remaining 1,673 subjects (63.3%) were excluded from the analysis because of the lack of psychological wellbeing. The subjects ranged in age from 34 to 61 years, and the mean (standard deviation) age was 44.7 (6.4) years.

The present history of medication was also determined by a self-administered questionnaire. Current histories of medications for hypertension (n=77), dyslipidemia (n=31), diabetes mellitus (n=16), hyperuricemia (n=9), liver disease (n=1), car-

diovascular and/or cerebrovascular disease (n=7) were included for the analysis. A total of 121 patients were under medical treatment for some comorbid diseases. After excluding two subjects with deficient GHQ12 data for 2011, 969 subjects were finally included in the analysis.

The authors obtained informed consent from each of the study participants, and the study protocol was approved by the ethics committee of the company in which the study was conducted.

Definitions of the four lifestyle-related variables and the body mass index

Lifestyle-related covariates in this analyses included binary data on the smoking status (1=never smoked or ex-smoker; 0=current smoker), alcohol use (1=never drinker or not everyday drinker; 0=everyday drinker), feeling refreshed by sleep (1=Yes; 0=No), and habitual exercise (1=not less than one- hour's exercise, including walking, everyday; 0=other). These criteria were modified from the report of Berkman and Breslow.[2] Body mass index (BMI) was calculated as follows: weight in kilograms divided by the square of height in meters.

Psychological wellbeing

The General Health Questionnaire (GHQ12), the 12-item version, was administered to the subjects. The original version of the GHQ12 was developed by Goldberg to measure psychological distress or to quantify the degree of psychological strain in an individual.[4] The GHQ12 is sensitive for detecting psychological strain and is an established and effective epidemiological approach for determining the prevalence of psychological disturbances in a normal population.[6] Ill-health indicators are assumed to represent relevant stress-related outcome variables; hence, the GHQ has been used in a variety of studies to evaluate the stress response. The rating scale is a behaviorally anchored scale consisting of four response options: "Better than usual", "Same as usual", "Worse than usual", and "Much worse than usual." In the present study, the author utilized the "GHQ-scoring" method, in which the first two anchors, "Better than usual" and "Same as usual", were scored as

zero and the last two anchors, "Worse than usual" and "Much worse than usual", were scored as one. Namely, the first two anchors represent non-manifestation of symptoms and are thus scored as zero, while the last two responses represent manifestation of symptoms and are therefore scored as one. The total score on the GHQ12 ranges from 0 to 12, and the author adopted GHQ12 ≥4 as the lack of psychological wellbeing in this study.[7,8]

Statistical analysis

Multiple logistic regression analysis was conducted to estimate the predictive ability of increase of the GHQ score using four lifestyle factors, namely, present history of medication, BMI and age, as covariates. SPSS 16.0 for Windows (SPSS Japan, Tokyo, Japan) was used for the statistical analysis. $p < 0.05$ was considered to denote statistical significance.

RESULTS

The mean (standard deviation) BMI, percentage of subjects on medication, and percentage of subjects adopting good health practices are presented, stratified by the state of psychological wellbeing, in Table 1. There was a significant difference in the percentage of subjects feeling refreshed by sleep between subjects with GHQ12 scores of <4 and ≥4, being higher in the former group. Other variables did not show any statistically significant associations with the GHQ12 score.

Multiple logistic regression analysis was conducted, and the odds ratios (95% confidence interval) of feeling refreshed by sleep for a high score on the GHQ12 (≥4) was 0.56 (0.42-0.75) (Table 2). However, no significant association of any of the other variables with the GHQ12 score was identified.

DISCUSSION

At the end of the three-year follow-up, 27.9% (270 out of 969) of the male workers showed GHQ12 ≥4. There was no significant difference in the prevalence of desirable lifestyles between the two groups, except for a higher percentage of sub-

Table 1. Characteristics of the subjects in 2008 stratified by the General Health Questionnaire, 12-item version, in 2011

	GHQ12 <4		GHQ12 ≥4		Significance
Age	N=699	44.9±6.5	N=270	44.3±6.1	ns
BMI	N=699	24.0±3.5	N=270	24.2±3.7	ns
Medication	12.2%	85/699	13.3%	36/270	ns
Not current smoking	49.4%	345/699	50.4%	136/270	ns
Not everyday drinking	57.7%	403/699	58.1%	157/270	ns
Habitual exercise	34.9%	242/694	35.8%	96/268	ns
Refreshment by sleep	72.0%	500/694	58.7%	158/269	p<0.001*

*there was a significant difference by Fisher's exact test. BMI: body mass index, ns: not significant, GHQ: The General Health Questionnaire

Table 2. Logistic regression analysis to determine the odds ratios and 95% confidence intervals of several factors to predict elevated GHQ12 (≥4)

Variables	Control	GHQ12≥4	
		OR (95%CI)	Significance
Age	1 year increase	0.98 (0.96, 1.01)	ns
Smoking	Current smoking	1.05 (0.79, 1.40)	ns
Drinking	Drink everyday	0.95 (0.71, 1.28)	ns
Sleep	Not refreshed	0.56 (0.42, 0.75)	p<0.001
Exercise	No habitual exercise	1.03 (0.76, 1.38)	ns
BMI	1 increase	1.01 (0.97, 1.05)	ns
Medication	No treatment	1.24 (0.79, 1.95)	ns

Each lifestyle factor was categorized binary. ns: not significant, GHQ: The General Health Questionnaire

jects feeling refreshed by sleep in the group with GHQ12 scores of <4. This significant association was detected by both univariable and multivariate logistic regression analysis, consistent with the results of a previous cross-sectional study.[3]

Previous studies have reported an association between desirable lifestyles and good mental health,[9,10] and that habitual exercise was associated with lower depressive symptoms.[11] There is also a report that the depressive state is not related to habitual exercise.[12] Although GHQ12 is not a tool to detect the depressive state, psychological wellbeing is strongly related to mental illness. Hamer et al.[13] reported that psychological distress, based on a score of ≥4 on the GHQ12, was evident in 3200 out of 19,824 participants. Furthermore, they reported that mental health benefits, as measured by GHQ12, were observed at a minimal level of physical activity of at least 20 min/week. In contrast, habitual exercise was not identified as a significant predictor of psychological wellbeing in this study.

There have been studies in the Japanese occupational field reporting a significant relationship between depression and obesity,[8,14,15] however, body mass index was not identified as a significant predictor of GHQ12 in this study. The follow-up period and the indicator of psychological health status used may have contributed to the outcome of this study. In addition, this survey dealt with workers at the endpoint, and there is a possibility of dropout of severe cases.

In our previous study, perceived health was not affected by a current history of medication in older subjects.[16] In concordance with this previous report, current history of medication did not significantly contribute to the lack of psychological wellbeing in the present study. In contrast, in a previous study perceived health in rural inhabitants was significantly associated with having disease in subjects aged 40 to 59 years old.[17] Current history of medication in this questionnaire survey was limited to conditions influencing the physical health, e.g., metabolic syndrome, and more comprehensive inclusion of dis-

eases, including mental illness, should be incorporated into the questionnaire.

As a positive finding, the risk of lack of psychological wellbeing was reduced by half in subjects who felt refreshed by sleep in this study. Lallukka et al.[18] reported that the single-item sleep measure in GHQ12 was not a substitute for sleep disturbances assessed using a sleep-specific questionnaire. They used the Jenkins Sleep Questionnaire, composed of one item relating to difficulty in falling sleep, two items related to maintenance of sleep, and one item related to non-restorative sleep. Non-restorative sleep corresponds to the sleep item evaluated in this study, however, sleep disturbance in the previous study was defined as being present in subjects complaining of at least one item out of the four at a frequency of 15 nights or more during the previous month. Feeling refreshed by sleep was an important factor associated with a lower score on the GHQ12 in this study, however, the contents of the sleep evaluation should be handled with caution.[19]

In summary, there was no significant association between psychological wellbeing and BMI, some medication status, smoking, drinking or exercise in this short follow-up study. There are many findings that obesity is significantly related to mental status such as depression, although causality is sometimes controversial. Exercise habit is also affected by mental status, and the patients sometimes become depressed by considering their health status in the future. Opposite to these findings, there was a lack of association on these variables in this study. The author speculates that the content of present medication is not related to acute or severe diseases including neoplasms, and the level of obesity is not extreme to affect or to be affected by mental status. In other consideration, refreshment by sleep is not merely a sleep parameter but it contains global factor to regulate general health status. That's why, the relative weakness of BMI, some medication status, smoking, drinking or exercise to affect psychological wellbeing might be observed in this study.

The author conducted this study on the employees of a car manufacturing company in Japan, and extrapolation of the results to other populations should be conducted with caution. There is a limitation in sample size, a local area of survey in Japan and short duration of follow-up period. To obtain definitive results for workers at this workplace, I intend to continue to follow-up this population. There is also the need for considering factors such as occupational position, mental health status, academic carrier and socioeconomic position, including income. Furthermore, GHQ12 contains one item on sleep, and there is a possibility to produce a significance effect of refreshment by sleep on psychological wellbeing. To avoid this problem, a new indicator of GHQ excluding one item on sleep is also used for the analysis. As there is no validation study on

this new indicator, the author plans to conduct this trial as a further study. However, this 3-year follow-up study for determining the risk of lack of psychological wellbeing at the workplace clarified that "good sleep" was a strong predictor of maintained psychological wellbeing.

Acknowledgments

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