Zung's Depression Scale as a Predictor of Death in Elderly People: a Cohort Study in Hokkaido, Japan

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The relation between each question in the Self-rating Depression Scale (SDS) of Zung and mortality in elderly people was investigated. Subjects were 2,166 inhabitants aged from 60 to 74 years in the Hidaka district of Hokkaido Prefecture, Japan, who were the same as in our previous prospective study concerning mental depression and mortality (J. Epidemiol. 1997). They were followed until February 1996. Among the original 20 questions of the SDS, 12 ones showed significant risk ratio for mortality (those whose score was 3 or 4 vs 1 or 2; P<0.01). The mortality of those whose average score of the 12 questions was more than 2.4 (severe depression) was 157.2 per 1,000, which was about 5.8 times as high as that of those who were not depressive (average score < 2.0). The 12 questions showed different risk ratios concerning the mortality of cancer, heart disease and cerebrovascular disease. The questions "Morning is when I feel the best" and "My heart beats faster than usual," e.g., showed a significant risk ratio only for the mortality of heart disease (3.96) and for that of cerebrovascular disease (16.49), respectively (P<0.01). Similar results were obtained from the subjects without respective diseases at the time of survey. Using these 12 questions, the risk for death and its cause can be estimated to a certain extent, and consequently, social supports can be given more effectively and more carefully. J Epidemiol, 1999; 9: 240-244.

depression, elderly people, SDS, Zung, death

Recently in Japan, the mortality from suicide in elderly people is higher than in any other age-group. In 1995, that in the age group older than 75 years was 41.1 (per 100,000), while that of the general population was 17.2 1). It is said that mental depression is related to physical health state 2,3) as well as to suicide. In an aging society like Japan's, therefore, it is important to know whether an aged person is depressed and to provide various types of support if so.

Previously we reported the relation between mental depression and mortality in a cohort of elderly people 4). To estimate the degree of depression, the Self-rating Depression Scale (SDS) of Zung 5), consisting of 20 questions, was employed. We classified the subjects into 3 groups depending on the average score, and compared the mortality. Those who were depressive showed a high mortality. But from a viewpoint of taking detailed countermeasures, it is not sufficient to know simply that a person in depressive state has a higher probability of death. More detailed information concerning the predictability of death and of its causes would be useful for, e.g., public health nurses who virtually care for elderly people.

The predictability of death of the questions in SDS may not be equal; i.e., some questions may be contributory, while others may not be so. In the present study we investigated the predictability for death of each of the 20 questions, employing the same subjects and the same methods 6).

SUBJECTS AND METHODS

1. Subjects

A total of 2,623 inhabitants aged from 60 to 74 years in the Hidaka district of Hokkaido Prefecture, Japan were systematically-randomly selected from the register of inhabitants in 1990.
This district, which is an area of primary industry, is located in the southwestern part of this prefecture (from 43°N, 143°E to 42°N, 142°E). The present subjects accounted for about 22% of the 12,038 inhabitants of this district aged from 60 to 74 years.

From December 1990 to January 1991, we sent the subjects a questionnaire, inquiring about their general health state, eating habits, human relationships, current diseases for which they were receiving treatment, the degree of mental depression, and so on.

2. Evaluation of mental depression

One of 4 scores is allotted to each answer for the 20 questions, depending on the degree of depression [1 (none), 2 (slight), 3 (intermediate), and 4 (severe)]. (Since some subjects did not answer all the questions, the numbers of subject reported below are smaller than the initial one.)

3. The number of current diseases

In the questionnaire we presented 9 categories of disease (diseases of the digestive system, high blood pressure, heart disease, liver disease, respiratory organ disease, diabetes mellitus, cerebrovascular disease, severe injury and others) and asked the subjects to mark the names of diseases for which they were receiving treatment at the time of survey.

4. Confirmation of being alive or dead

The subjects were followed up periodically until February 1996 to confirm whether they were still alive. If a subject had died, the exact cause of death was checked by reviewing the death certificate.

5. Statistical procedure

Chi-square test was employed for statistical analysis. The 95% confidence interval (CI) of mortality was calculated using F-distribution.

RESULTS

1. Risk ratio of each question concerning mortality

Table 1 shows the risk ratio of each question concerning mortality (the mortality of those whose score was 3 or 4 vs that of those whose score was 1 or 2). A total of 12 questions showed a significant risk ratio (P<0.01).

2. Mortality by the average score of the 12 questions

In our previous study, depending on the average score of the 20 questions, the subjects were classified into group A (not depressive; average <2.00), group B (slight-intermediate depression; 2.00-2.39), and group C (severe depression; >2.40). Table 2 shows the mortality by the average score of the 12 questions selected above. The mortality of group C was significantly higher than that of group A, and was 5.8 times as large as that of group A.

Table 1. Risk ratios (score 3 or 4 vs 1 or 2) of the 20 questions in Zung's self-rating depression scale concerning the mortality (descending order).

| Question                                | Risk ratio (95% CI/#)     |
|-----------------------------------------|---------------------------|
| I notice that I am losing weight.       | 5.52 (3.59-8.49)**        |
| My heart beats faster than usual.       | 4.12 (2.35-7.24)**        |
| I find it easy to do the things I used to. | 3.84 (2.68-5.52)**       |
| I have crying spells.                   | 3.28 (1.44-7.47)**        |
| I get tired for no reason.              | 2.75 (1.87-4.03)**        |
| My life is pretty full.                 | 2.39 (1.62-3.53)**        |
| I am more irritable than usual.         | 2.29 (1.30-4.04)**        |
| I find it easy to make decisions.       | 2.27 (1.57-3.29)**        |
| My mind is as clear as it used to be.   | 2.05 (1.42-2.96)**        |
| I feel down-hearted and blue.           | 2.02 (0.98-4.18)          |
| I eat as much as I used to.             | 1.99 (1.25-3.15)**        |
| I have trouble with constipation.       | 1.80 (1.20-2.70)**        |
| Morning is when I feel the best.        | 1.77 (1.21-2.58)**        |
| I still enjoy sex.                      | 1.74 (0.85-3.53)          |
| I feel hopeful about the future.        | 1.67 (1.12-2.50)          |
| I feel that others would be better off if I were dead. | 1.56 (0.60-4.07) |
| I feel that I am useful and needed.     | 1.44 (1.02-2.05)*         |
| I still enjoy the things I used to do.   | 1.35 (0.92-1.96)          |
| I am restless and can't keep still.     | 0.95 (0.57-1.57)          |
| I have trouble sleeping at night.       | 0.76 (0.25-2.34)          |

*P<0.05
**P<0.01
# reference 13

Table 2. Mortality (per 1,000) by the average score of the 12 questions (95% CI by F-distribution in parentheses).

| Group | A          | B          | C          |
|-------|------------|------------|------------|
| No. of subjects | 1257 (664/593) | 519 (208/311) | 388 (150/238) |
| Age at survey (mean±SD) | 65.8±3.92 | 66.124±21 | 66.6±4.09 |
| No. of deaths | 34 | 29 | 61 |
| Mortality | 27.0 (37.7-18.7) | 55.9** (78.3-37.9) | 157.2*** (192.8-125.2) |

Group A, SDS score <2.00 (not depressive);
Group B, 2.00-2.39 (slight-intermediate depression);
Group C, ≥2.40 (severe depression).

**P<0.01 (difference from Group A, chi-square test)
# expected value=388x(34/1257)=10.5
chi-square value=(61-10.5)²/10.5=242.9
3. Conditional logistic regression analysis

In our previous study, conditional logistic regression analysis was performed with regard to age, number of current disease, smoking state, gender, and the average score of the 20 questions. Age, gender, and the average remained significant. Table 3 shows the results of logistic regression analysis, employing the average score of the 12 questions and the same other factors as the previous report. The results were similar to those of our previous study, the average of the 12 questions being significant.

4. Risk ratios of the questions concerning the mortality of cancer, heart disease, and cerebrovascular disease

Table 4 shows the risk ratios for the mortality of cancer, heart disease (excluding heart failure) and cerebrovascular disease in each of the 12 questions (score 3 or 4 vs 1 or 2). Though the questions "I find it easy to do the things I used to" and "I get tired for no reason" revealed high risk ratios for the 3 diseases, the other questions showed different ratios. The questions "Morning is when I feel the best" and "My heart beats faster than usual," e.g., showed a significant risk ratio only for heart disease and for cerebrovascular disease, respectively.

The 3 questions that revealed a high risk ratio for cancer death concerned physical symptoms ("I notice that I am losing weight," "I get tired for no reason," and "I eat as much as I used to"). But another 2 significant questions, ("I find it easy to do the things I used to" and "My life is pretty full,"') were related to mental symptoms. The 2 questions that showed a significant risk ratio for heart disease (P<0.01; "I find it easy to do the things I used to" and "Morning is when I feel the best") concerned mental symptoms, too.

Similar results were obtained in the subjects without heart disease or cerebrovascular disease at the time of survey (Table 5). Since at present in Japan, it is not common that a doctor informs a patient that he has cancer, the results regarding this disease could not be obtained.

**DISCUSSION**

It is known that mental state has great influence on physical health. Severe stress may cause various diseases. Our previous study suggests that stress may promote the development of gastric cancer 6. Mental depression may cause various diseases and increase the mortality through suppression of the immunological system 710. Another study by us showed that health was one of the most influential factors for subjective happiness after retirement 12. To prevent various kinds of physical inconvenience caused by mental depression, it is important to detect depressive persons early and to give them

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Table 3. Logistic regression analysis with regard to age, number of current diseases, smoking state, gender and the average score of the 12 questions.

| Variable            | Coefficient | Standard error |
|---------------------|-------------|----------------|
| Age**               | 0.08694     | 0.02550        |
| No. of current diseases | 0.16136      | 0.14511        |
| Smoking state#     | 0.03937     | 0.08666        |
| Gender**           | -1.00737    | 0.21895        |
| Average score**    | 0.01420     | 0.00195        |

**P<0.01
# current, ex-, and non-smoker.

Table 4. Risk ratios (score 3 or 4 vs 1 or 2) of the 12 questions concerning the mortality of cancer, heart disease (excluding heart failure), and cerebrovascular disease.

| Question                              | Cancer | Heart disease | Cerebrovascular disease |
|---------------------------------------|--------|---------------|-------------------------|
| I notice that I am losing weight.     | 4.68** | 1.41          | 5.08*                   |
| My heart beats faster than usual.     | 1.73   | 2.18          | 16.49**                 |
| I find it easy to do the things I used to. | 2.45** | 4.14**        | 5.79**                  |
| I have crying spells.                 | 1.58   | 3.87          | 6.33                    |
| I get tired for no reason.            | 2.56** | 2.91*         | 7.35**                  |
| My life is pretty full.               | 2.81** | 2.55          | 1.18                    |
| I am more irritable than usual.       | 1.90   | 0             | 1.54                    |
| I find it easy to make decisions.     | 1.75   | 2.74*         | 2.24                    |
| My mind is as clear as it used to be. | 1.78   | 2.27          | 2.67                    |
| I eat as much as I used to.           | 2.69** | 3.26*         | 0                       |
| I have trouble with constipation.     | 1.29   | 1.84          | 3.21*                   |
| Morning is when I feel the best.      | 1.19   | 3.96**        | 1.41                    |

* P<0.05
**P<0.01
Table 5. Risk ratios (score 3 or 4 vs 1 or 2) of the 12 questions concerning the mortality of heart disease (excluding heart failure) and cerebrovascular disease in the subjects without respective diseases at the time of survey.

| Question                                      | Heart disease | Cerebrovascular disease |
|-----------------------------------------------|---------------|-------------------------|
| I notice that I am losing weight.             | 3.06          | 9.58**                  |
| My heart beats faster than usual.             | 0             | 92.95**                 |
| I find it easy to do the things I used to.    | 5.13**        | 11.08**                 |
| I have crying spells.                         | 0             | 11.69**                 |
| I get tired for no reason.                    | 1.82          | 10.57**                 |
| My life is pretty full.                       | 2.23          | 1.26                    |
| I am more irritable than usual.               | 0             | 2.44                    |
| I find it easy to make decisions.             | 2.03          | 2.54                    |
| My mind is as clear as it used to be.         | 1.94          | 2.25                    |
| I eat as much as I used to.                   | 3.72          | 0                       |
| I have trouble with constipation.             | 1.25          | 2.28                    |
| Morning is when I feel the best.              | 4.08*         | 2.25                    |

* P<0.05
** P<0.01

Thus, using the 12 questions that have different potential to predict the cause of death, the risk for death and its cause can be estimated to a certain extent, though there might be influence by symptoms of the diseases. Those whose answers show such potential risks should be given a careful support, irrespective of his having these diseases at the time of survey.

The Japanese society is rapidly aging and social support for mental aspect is becoming more important. However, time spent per person is becoming shorter, as the number of aged person is increasing. Under such circumstances, in order to give more effective and more careful social supports, a test which can be done during a short time with an easier questionnaire is desirable, since it decreases the burden for both answering and questioning.

REFERENCES

1. Health and Welfare Statistics Association. Death. J Health and Welfare Statistics (Kokumin Eisei No Doukou) 1997;44:48-61. (in Japanese)
2. Murphy, JM, Monson, RR, Olivier, DC, Sobol, AM, Leighton, AH. Affective disorders and mortality. Arch Gen Psychiatr 1987;44:473-480.
3. Shekelle, RB, Raynor, WJ, Ostfeld, AM, Garron, DC, Bielialiskas, LA, Liu, SC, Maliza, C, Paul, O. Psychological depression and 17-year risk of death from cancer. Psychosom Med 1981;43:117-125.
4. Takeida, K, Nishi, M, Miyake, H. Mental depression and death in elderly persons. J Epidemiol 1997;7:210-213.
5. Zung, WWK. A self-rating depression scale. Arch Gen Psychiatr 1965;12:63-70.
6. Watabe, K, Nishi, M, Miyake, H, Hirata, K. Life style and gastric cancer -- a case-control study. Oncol Rep 1998;5:1191-1194
7. Bartrop, RW, Lazarus, L, Luckherst, E. Depressed lymphocyte function after bereavement. Lancet 1977;1:834-836.
8. Laudeulager, ML, Ryan, SM. Coping and immuno-suppression: inescapable but not escapable shock suppresses lymphocyte proliferation. Science 1983;221:568-570.
9. Schleifer, SJ, Kellerk, SE, Siris, SG. Depression and immunity. Arch Gen Psychiatr 1985;42:129-133.
10. Irwin, M, Daniels, M, Bloom, ET, Smith, TL, Weiner, H. Life events, depressive symptoms, and immune function. Amer J Psychiatr 1987;144:437-441.
11. Levy, SM, Herberman, RB, Whiteside, T, Sanzo, K, Lee, J, Kirkwood, J. Perceived social support and tumor estrogen/progesterone receptor status as predictors of natural killer cell activity in breast cancer patients.
12. Nishi, M, Abe, M, Ikeda, K, Imai, M, Ooe, M, Kawaharada, M. Subjective happiness after retirement and related factors. Hokk J Publ Hlth 1994;8:34-37. (in Japanese)

13. Yamamoto A, Tsuda T. Statistical analysis of data. In: Aoyama H, ed. Today's Epidemiology, 1st ed. Igaku Shoin, Tokyo, 1996:76-97