

Mental health conditions in Korean atomic bomb survivors: a survey in Seoul

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More than 60 years have elapsed since the atomic bombings to Hiroshima and Nagasaki, and since all of the atomic bomb survivors have become old, the importance of caring their mental health has become increasing in Japan. Although approximately 70% of overseas atomic bomb survivors are living in Korea, there have been quite few studies on their mental health. The objectives of the present study were to elucidate whether the mental health conditions of atomic bomb survivors in Korea are similar to those in Japan. The subjects were 181 Korean atomic bomb survivors living in Korea (cases) and 209 outpatients of a hospital in Seoul who were not exposed to atomic bombs (controls). Interviewers administered them at the hospital a questionnaire with Impact of Event Scale-Revised, General Health Questionnaire 12 (GHQ-12), Korean version of short form Geriatric Depression Scale and the K scale of the Minnesota Multiphasic Personality Inventory. Excluding subjects with incomplete responses we analyzed 162 cases and 189 controls. The proportion of subjects with high score of GHQ-12 (≥ 4) was significantly higher in cases (78/162 or 48.1%) than in controls (42/189 or 22.2%) ($p < 0.0001$, Fisher's exact test). The present results, though preliminary, indicate that atomic bomb survivors in Korea have also mental health problems similar to those observed in Japanese atomic bomb survivors, indicating the necessity of a larger study.

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Introduction

Two atomic bombs (A-bombs) were dropped on Hiroshima on 6 and on Nagasaki on 9 August 1945, respectively. The bombs instantaneously destroyed almost all areas of the respective cities, resulting in a total of 194,000 deaths by the end of 1945 and about 158,000 injured people. As of the end of March 2007, there were approximately 240,000 atomic

bomb survivors in Japan. Hereafter, the atomic bomb survivor (A-bomb survivor) designates an individual who has officially been issued a so called A-bomb survivor's handbook. The A-bomb survivors are classified into 4 groups: Category 1-individuals exposed to the A-bombs in designated areas in Hiroshima or Nagasaki, who are called directly exposed; Category 2-individuals who had not been exposed to A-bombs but entered into the designated areas in either city

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within 2 weeks after the bombing; Category 3-individuals who were engaged in rescue and burial; and Category 4-individuals who were in utero of those in Categories 1-3.

In addition to these survivors, there are many so-called 'overseas atomic bomb survivors' who had been exposed to the A-bombs and immigrated to foreign countries or returned to their home country. As of the end of March 2007, there were approximately 4,300 overseas atomic bomb survivors. Of those survivors, about 2,930 were in the Republic of Korea (called hereafter Korean A-bomb survivors), 970 were in the United States, and 160 were in Brazil, so that 90% of overseas survivors were in these 3 countries.

As Japan is the unique country that has experienced atomic bombing, health effects of exposure to the A-bomb have been investigated extensively. The results of these studies have demonstrated that many survivors are still experiencing physical problems due to the effects of A-bomb radiation, 65 years after exposure. Known physical effects include an increased risk of leukemia and various other types of cancer, and many researches have been carried out to elucidate the role of radiation in developing these diseases.¹⁻³

Studies on overseas A-bomb survivors include a mail survey of the health status of 1,256 Korean A-bomb survivors,⁴ an investigation of the health status of 4,079 children of 1,115 Korean A-bomb survivors,⁵ and studies comparing Korean A-bomb survivors and controls with respect to the physical conditions using blood tests and other data.^{6,7} The study of Korean survivors' children⁵ demonstrated a relatively high frequency of mental retardation (0.18%) and congenital bone disorders (0.18%) among them. Jhun et al⁷ reported that blood pressure, white blood cell count, serum total cholesterol, and aspartate aminotransferase level were higher in Korean A-bomb survivors than in controls, while hemoglobin concentration, hematocrit, and red blood cell count were lower in the former than in the latter. Although the reports on physical illness in Korean A-bomb survivors are increasing, their number is still small compared to those on Japanese A-bomb survivors.

Though less compared to the study on physical conditions in Japanese A-bomb survivors, several researches have been carried out about their mental health conditions. The study by Okumura et al⁸ is the first one regarding the psychological impact on A-bomb survivors: they randomly selected 3 months after the Nagasaki atomic bombing 50 patients among 192 A-bomb survivors having been hospitalized at Omura Naval Hospital, examined them, reviewed their medical history, and diagnosed 3 patients psychogenic disorder. Nishikawa et al⁹ reported that they observed 533 neurosis cases among 7297 A-bomb survivors in Nagasaki who

underwent an extensive health examination and that the proportion of neurosis cases was higher by twofold or more in those with acute symptoms due to radiation exposure (9.7%) than in those without such symptoms (3.9%). Ohta et al¹⁰ reported that psychological distress measured half a century after exposure to the A-bomb on the basis of the GHQ-30, 30-item version of the original General Health Questionnaire (GHQ) consisting of 60 items,¹¹ was greater in the A-bomb survivors than in the controls. A study by Honda et al¹² on the mental health of Nagasaki A-bomb survivors revealed that 8.4% of them scored 4 points or higher in GHQ-12 (12-item version of the original GHQ),¹¹ suggesting that A-bomb survivors had mental health problems. The analysis¹³ of 35,035 responses to the mail survey which Nagasaki city administered to 49,867 A-bomb survivors in 2003 showed that 4,503 (28.2%) scored 25 points or higher on the Impact of Event Scale-Revised (IES-R).¹⁴ Furthermore, Yamada et al¹⁵ demonstrated that the proportion of A-bomb survivors showing anxiety disorder or somatoform disorder was significantly higher in those who had acute symptoms than in those who did not.

Since little is known about the mental health of overseas atomic bomb survivors, and since most of them living in areas other than Korean Peninsula are Japanese, we carried out the present study to elucidate the mental health conditions in Korean A-bomb survivors. The study was approved by the Nagasaki University School of Medicine Ethics Committee (08061978-2).

Subjects and Methods

Study subjects were Korean A-bomb survivors living in Seoul and outpatients of a hospital in Seoul not exposed to the A-bomb, who were included as controls.

Information on subjects was collected using anonymous self-administered questionnaire written in Korean with the help, if necessary, by Korean interviewers who were not healthcare professionals; however, they received, prior to commencement of the survey, one-day training enough to understand the content of the questionnaire. The questionnaire administered to controls included basic demographic items, e.g. gender and age, the GHQ-12,¹⁴ the Korean version of short-form Geriatric Depression Scale (K-SGDS),¹⁶ and the Minnesota Multiphasic Personality Inventory (MMPI),^{17,18} while the questionnaire administered to Korean A-bomb survivors included furthermore the I-ESR,¹⁸ the questions about circumstances due to the atomic bombing, e.g. injuries and deaths of family members, questions about the

experience of blast, heat and light from the bomb, and questions about official category as an A-bomb survivor.

The IES-R was used to assess the presence of posttraumatic stress disorder (PTSD) in A-bomb survivors. All items in the IES-R are scored on a 5-point scale (0, 1, 2, 3, 4) and the degree of PTSD is measured as the sum of all scores. The IES-R was assessed on the basis of the score distribution.

The GHQ-12 was used to assess the current mental health status. There are two methods for calculating the GHQ scores: the one method called the Likert scale method scores respective responses to each item by 4-point scale of (0, 1, 2, 3) and sums up all the scores to make up the total score, while the other method scores respective responses to each item by 4-point scale (0, 0, 1, 1) and sums up all the scores to make up the total score. The latter method was used in this study to calculate the GHQ score; the GHQ-12 score of 4 or higher was designated as a high GHQ-12 score, and those with a high GHQ-12 score are said to be more likely to have a non-psychotic mental illness.¹¹

The K-SGDS, the respective items being scored on a 2-point scale, was used to measure depression status. The total of the scores of all items was used for assessment, and subjects with total score of 8 or more were classified into a group of high scorers showing a tendency towards depression.

The MMPI K-scale (MMPIK), the respective items being scored on a 2-point scale, was used to assess respondent's demeanor during interviews related to attitudes towards personal problems. The total of the scores of all items was used for assessment, and subjects with total score of 20 or more were classified into a group of high scorers.

The frequency of subjects with high score was compared between A-bomb survivors and controls for GHQ-12, K-SGDS and MMPIK on the basis of Fisher's exact test. Similar comparison was also made in A-bomb survivors between those exposed within 2.5 km from the hypocenter and those exposed at further place. The effects of radiation exposure, gender, age and MMPIK score on the frequency of high GHQ-12 score was assessed by logistic regression analysis. The necessary calculations were performed using PROC FREQ and PROC LOGISTIC of the SAS system[®] version 9.1. The results were called (statistically) significant if the *p*-value was less than 0.05.

Results

The questionnaire was administered to 181 individuals

(66%) among 274 people who received health consultations for Korean A-bomb survivors in Seoul between June 23 and July 5, 2008; they provided written consent to participate in the present study. Of 181 participants, 19 people were excluded because they cancelled participation in the course of interview or because their responses were incomplete. A total of 162 A-bomb survivors (86 men and 76 women) remained for the analysis. A slightly different questionnaire was administered to 225 controls who provided written consent to participate in the present study. After excluding 36 participants who cancelled participation in the course of interview, whose responses were incomplete or who required hospitalization in the course of interview, 189 controls (89 men and 100 women) remained. Thus a total of 351 people (175 men and 176 women) remained for the analysis.

The male-female ratio was 1.13 in A-bomb survivors and 0.89 in controls, and no statistically significant difference was observed in the male-female ratio between A-bomb survivors and controls ($p = 0.29$, Fisher's exact test). The ages of A-bomb survivors ranged from 62 to 88 years with quartiles of 65, 68, and 73 years, while those of controls ranged from 59 to 89 years with quartiles of 66, 71, and 76 years. Though a statistically significant difference was observed in the median of age distribution between the two groups ($p = 0.0039$, Wilcoxon rank-sum test), the difference was rather small.

Among 162 A-bomb survivors, 148 (91.4%) were of Category 1, 3 (1.8%) were of Category 2, 7 (4.3%) were of Category 4, and categories in 4 (2.5%) were unknown. Regarding the A-bomb survivors' health conditions before the bombing, 118 (72.8%) responded good, 17 (10.5%) responded fair, 2 (1.2%) responded not good, and 25 (15.4%) responded nothing. Twenty-five A-bomb survivors (15.4%) had been treated after the bombing, while 129 (79.6%) did not, and 8 (4.9%) responded nothing. Approximately half of the A-bomb survivors (80 or 49.4%) lost their family members or relatives. Among 160 A-bomb survivors who responded to the questions about flash, blast and heat, 8 (5.0%) responded that they had not feel any of them, 42 (26.3%) responded that they had felt all, 63 (39.4%) responded that they remember any of them, 21 (13.1%) and 24 (15.0%) responded that they felt one and two, respectively, 2 (1.2%) responded that although they felt flash, they didn't remember other two.

The mean (standard deviation, SD) of IES-R score in A-bomb survivor was 19.9 (14.3), and the proportion of those with score of 25 or higher was 30.25%.

The proportion of subjects with high GHQ-12 score was

larger in A-bomb survivors (48.1% or 78/162) than in controls (22.2% or 42/189); the difference was statistically significant ($p < 0.0001$, Fisher's exact test) (Table 1). The mean (SD) of GHQ-12 score calculated by Likert scale method was 14.4 (6.4) in A-bomb survivors and 10.7 (4.3) in controls, respectively.

Table 1. Comparison of the A-bomb survivors and controls regarding the frequency of subjects with high scorers in the GHQ-12, K-SGDS, and MMPIK scales

Scale	Score	Group		P-value
		A-bomb survivors (n = 162)	Controls (n = 189)	
GHQ-12	≥ 4	78 (48.1%)	42 (22.2%)	< 0.0001
K-SGDS	≥ 8	56 (34.6%)	56 (29.6%)	0.3586
MMPIK	≥ 20	39 (24.1%)	24 (12.7%)	0.0077

GHQ-12: General Health Questionnaire (GHQ) is a self-administered screening instrument developed by Goldberg¹¹ to detect psychiatric disorders in community settings and non-psychiatric clinical settings such as primary care or general practice. The full version consists of 60 items. In the present study, we used a quick, reliable and short form consisting of 12 items named GHQ-12.

K-SGDS: The Korean version of SGDS, which is a short form of self-evaluating scale GDS (Geriatric Depression Scale) designed specifically to identify depression in the elderly. Although the full version of GDS consists of 30 items, the number of items in SGDS is decreased to 15 for not fatiguing elderly testee.

MMPIK: Abbreviation of The Minnesota Multiphasic Personality Inventory (MMPI) K scale. MMPI was developed in the late 1930's by psychologist S.R. Hathaway and psychiatrist J.C. McKinley at the University of Minnesota. The K scale of the MMPI was an attempt to assess more subtle distortion of response, particularly clinically defensive response.

The proportion of subjects with high K-SGDS score was larger in A-bomb survivors (34.6% or 56/162) than in controls (29.6% or 56/189); the difference, however, was not statistically significant ($p = 0.3586$, Fisher's exact test) (Table 1). The mean (SD) of K-SGDS score was 5.8 (4.5) in A-bomb survivors and 5.0 (4.2) in controls, respectively.

The proportion of subjects with high MMPIK score was larger in A-bomb survivors (24.1% or 39/162) than in controls (12.7% or 24/189); the difference was statistically significant ($p < 0.0077$, Fisher's exact test) (Table 1).

Table 2 presents the results of the logistic regression analysis regarding the frequency of subjects with high GHQ-12 score; we see from this Table, for example, that the odds of the frequency of subjects with high GHQ-12 score in A-bomb survivors will be about 3.3 times higher than those in controls after adjustment for gender, age and MMPI K scale score.

Table 3 summarizes the comparison of 69 A-bomb survivors

Table 2. The results of the logistic regression analysis regarding the frequency of subjects with high GHQ-12 score

Factor	Comparison	Estimated odds ratio (95% CI)
Exposure to A-bombing	Yes vs No	3.3 (2.09-5.50)
Gender	Female vs Male	1.8 (1.14-2.97)
Age	≥ 70 years vs < 70 years	1.2 (0.78-2.03)
MMPI K scale score	≥ 20 vs < 20	1.8 (1.04-3.35)

Table 3. Comparison of the A-bomb survivors exposed within 2.5 km from the hypocenter and those exposed at 2.5 km or further from the hypocenter regarding the frequency of subjects with high scorers in the IES-R, GHQ-12, K-SGDS, and MMPIK scales

Scale	Score	Distance of the exposed place from the hypocenter		P-value
		< 2.5 km (n = 69)	≥ 2.5 km (n = 58)	
IES-R	≥ 24	24 (34.8%)	25 (43.1%)	0.8523
GHQ-12	≥ 4	34 (49.3%)	25 (43.1%)	0.5924
K-SGDS	≥ 8	21 (30.4%)	21 (36.2%)	0.5711
MMPIK	≥ 20	14 (20.3%)	16 (27.6%)	0.4032

IES-R: Abbreviation of The Impact of Event Scale-Revised developed by Weiss and his colleagues, which is a self-administered 22-item questionnaire based on three clusters of symptoms identified in the Diagnostic and Statistical Manual of Mental Disorders, third edition (DSM-III), as indicators of posttraumatic stress disorder (PTSD).

See the footnote of Table 1 for other scales.

directly exposed within 2.5 km from the hypocenter and 58 those directly exposed at 2.5 km or further from the hypocenter with respect to the frequency of subjects with high IES-R, GHQ-12, K-SGDS, and MMPIK scorers. No statistically significant difference was indicated between the two groups of A-bomb survivors regarding these three scales. No adjustment for circumstances in A-bomb survivors was made because they correlate with the distance of the exposed place from the hypocenter.

Discussion

In the present study carried out in 2008, over 60 years after the atomic bombings, 30.25% of Korean A-bomb survivors scored 25 or more in IES-R with the mean (SD) of 19.9 (14.3).

The following results have been reported for studies related to PTSD in Koreans using the IES-R. In a survey on Koreans conducted by Yoon et al¹⁹, the mean (SD) of IES-R score among 65 individuals diagnosed with PTSD was 40.6 (16.9).

Studies by Bahk et al²⁰ and Kim et al²¹ reported the mean (SD) of IES-R score as 53.1 (13.0), and 49.8 (11.9), respectively, for individuals diagnosed with PTSD. These studies are subject to people got the PTSD was evaluated immediately after exposure to stress reactions (1 month). The IES-R levels of the precedent studies were higher than that of our study. We guess the reason as follows: the subjects of survey being patients given a diagnosis of PTSD, and the evaluation time was one month later exposed to severe stress in the precedent studies.

IES-R questionnaires given to survivors of the Nagasaki atomic bombing¹² showed that 28.2% were high scorers (25 points or higher). This study results, though preliminary, indicate that A-bomb survivors in Korea have also mental health problems similar to those observed in Japanese A-bomb survivors,

The study by Honda et al¹² reported that 8.4% of Nagasaki survivors were in the GHQ high scoring group (4 points or higher). In the present study, 48.1% of Korean survivors were in the GHQ-12 high scoring group (4 points or higher). These percentages are higher than those of Japanese survivors, suggesting that Korean survivors have some mental health problems.

Surveys conducted in Korea related to the GHQ-12 scale revealed the mean (SD) of GHQ-12 score calculated by Likert scale method as 17.7 (5.5) in subjects who showed a tendency towards depression.²² A Korean study conducted by Han et al²³ on patients with depression or anxiety disorder who were receiving primary care reported mean GHQ-12 scores calculated by Likert scale method of 13.8 for those with depression and 15.3 for those with panic disorder. In the present study, the mean (SD) of GHQ-12 score calculated by Likert scale method in Korean survivors was 14.1 (6.0), which is roughly equal to the score in the above study. This study results were similar to the group that any psychiatric problems.

When we calculated odds ratios to test the influence of various factors on GHQ-12 score, we found that gender and age had little effect on the rise of GHQ-12 scores, but the effect from presence/absence of A-bomb exposure was large. As a result, it was suggested that a being bombed experience adversely affected the mental health of the A-bomb survivors.

Research conducted by Bae et al²⁴ on K-SGDS of older Korean psychiatric outpatients revealed the mean (SD) of the score as 10.82 (3.00) in those with major depression and 5.71 for those without depression. The mean (SD) of K-SGDS score found in this study was 5.8 (4.5). However, in other study,²⁵ the mean (SD) of K-SGDS score in patients with early dementia was 5.5 (4.0). Therefore, it

cannot be said that a mean of K-SGDS in results of this study is low unconditionally. The percentage of high scorers in the K-SGDS questionnaire with scores of 8 points or higher was 34.6% (56 people) for survivors. From the above, the percentage of depression among Korean A-bomb survivors was high.

In the MMPI K scale as well, the percentage of high scorers in the MMPI K questionnaire with scores of 20 points or higher was 34.1% (39 people) for survivors of Korean survivors were high scorers. High MMPI K scorers are said to be defensive towards the investigation, while low scorers are said to be frank and self-critical.^{16,17} The fact that scores for this scale were high in Korean survivors suggests that they may be leading their lives without being aware of their own psychological confusion.

When we tested the difference between those within or outside of a 2.5 km perimeter from the hypocenter during exposure, we did not find any significant differences in any items of the GHQ-12, K-SGDS, or MMPI scales, suggesting that distance from the hypocenter did not affect psychiatric health. Other studies related to the mental health of survivors^{10,13,15} have reveal the influence of distance from the hypocenter on psychiatric health of survivors. In those studies, survivors who were within 2.0 km of the hypocenter when exposed to the A-bomb presented with acute symptoms due to radiation from exposure. Following exposure, they felt anxiety regarding their own health, as well as anxiety from such experiences as deaths in their family and destruction of their home. Such anxiety is considered to be a factor that leads to poorer mental health. 51.2% of subjects of this study were 5 years old or younger at the time of A-bomb exposure. Therefore, memory at being bombed is vague, and the possibility that affected the anxiety about the being bombed is inferred. We think that more detailed examination will be necessary about the association between being bombed distance and mental health.

The present study has several limitations, including the probable biases stemming from that the Korean A-bomb survivors participated in the study were only those who participated in consultation program, and the smallness in the sample size. Addressing these issues in further research is important for increasing our understanding of psychiatric health problems in Korean survivors.

The above-mentioned results, in the present that passed from atom bomb being bombed more than 60 years, it was found that the A-bomb survivors residing in Korea had a problem in mental health associated with a being bombed experience.

Conclusion

This study is the first to focus on psychiatric health problems in Korean A-bomb survivors. The results demonstrated the poor psychiatric health of Korean survivors, and suggested that atomic bomb exposure may be a major causal factor. Further studies are needed to provide detailed examinations of mental health problems among Korean survivors.

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