

Original

Life in company dormitories and a career change are associated with anxiety over lack of privacy among radiation decontamination workers in Fukushima Prefecture, Japan

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Abstract: Objectives: The purpose of the present study was to obtain knowledge for improvement of the housing and life among radiation decontamination workers by examining the effect of housing type on anxiety over lack of privacy. **Methods:** This cross-sectional study comprised 544 male radiation decontamination workers in Fukushima Prefecture who anonymously answered self-administered questionnaires in 2013, including measurement of privacy anxiety, housing type, career change, social support, and sociodemographics. Chi-square tests and binary logistic regression analysis were used to evaluate the associations between these factors and anxiety over lack of privacy. **Results:** The number of workers who had anxiety over lack of privacy was 93 (17.1%), and the number of workers who were living in owner-occupied housing, rental housing, company dormitories, and hotels was 165 (30.3%), 177 (32.5%), 168 (30.9%), and 34 (6.3%), respectively. The presence of anxiety was significantly associated with housing type ($p < 0.001$), a career change ($p = 0.005$), and the location of the worker's previous residence ($p < 0.001$). Binary logistic regression analysis revealed that life in a company dormitory and a career change were separately associated with anxiety over lack of privacy ($p < 0.001$ and $p < 0.027$, respectively). **Conclusions:** We found that anxiety among radiation decontamination workers over lack of privacy increased if they lived in company dormitories or had changed careers to become a radiation decontamination worker. These findings demonstrate the need to improve occupational mental health management,

with an intensive focus on the residential environment. (J Occup Health 2018; 60: 361-368)
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Key words: Anxiety, Company dormitory, Lack of privacy, Occupational mental health management, Radiation decontamination

Introduction

Following the Fukushima Daiichi Nuclear Power Plant accident in 2011, radioactive materials were released into the surrounding environment¹. The Japanese government designated three areas based on radiation dose: “difficult-to-return zones,” “no-residence zones,” and “zones being prepared for lifting of evacuation order”. Radiation decontamination work was started in 2012 as part of a government strategy to clean up the contaminated sites, including the “no-residence zones” and the “zones being prepared for lifting of evacuation order”².

Housing for radiation decontamination workers in Fukushima Prefecture, Japan, has become a topic of occupational health management. It is widely agreed that sufficient privacy in housing contributes to resident well-being. In contrast, it is also known that lack of privacy leads to problems^{7,8}. Previous studies have indicated that anxiety over lack of privacy disrupts supportive relationships among neighbors and the individual life of the resident⁹, and has a direct influence on psychological and

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physiological stress¹⁰. Conversely, increased private space contributes to the improvement of privacy and decreases in antisocial behavior¹¹.

In fact, poor privacy has posed more serious problems among radiation decontamination workers. In 2015, there was a murder case where a radiation decontamination worker killed his roommate in the company dormitory due to a conflict caused by lifestyle differences and poor privacy⁶. Company dormitories are common in Japan as part of employee benefit programs²³, and according to past studies many people have moved to Fukushima Prefecture from other prefectures to begin work as radiation decontamination workers^{3,4}. Thus, there is a high probability that company dormitories are widely used for these workers' residences.

However, the association between anxiety over lack of privacy and the specific type of worker housing, such as company dormitories, has yet to be clarified. Company dormitories have never been studied as a factor related to health, although past studies examining the relationship between housing type and mental health have investigated the ownership status of the house (tenure housing or not)¹²⁻¹⁴, the building type (high-rise or low-rise accommodations)^{15,16}, the form of housing (detached house or apartment)^{17,18}, the size of the residence (small, medium, or large)¹⁹, or property ownership (public housing or private housing)²⁰ as factors affecting mental health. Therefore, it is essential to add new information regarding the association between different housing types, such as company dormitories, and anxiety over lack of privacy.

Previous surveys have revealed that the living conditions of people living in company dormitories are often substandard and/or dissatisfactory. For example, the average floor space per person in a company dormitory is 16.6 m²⁹, much less than the 25 m² defined by the government as the minimum floor space for a single-person household²¹. Moreover, it is reported that many company dormitories are over 30 years old and need to be remodeled²². Furthermore, a greater number of residents living in company dormitories have complaints regarding air conditioning, sunshine, and noise than those living in other types of housing²³. In addition, previous studies reported social problems specific to company dormitories, such as living under corporate rules and pressure all day²⁴, or living while monitoring others or being monitored by others²⁵. In light of these studies, it stands to reason that living in company dormitories can invade privacy and harm the mental health of the residents.

We hypothesized that a higher proportion of decontamination workers living in company dormitories would have anxiety over privacy than those living in another type of housing. We suspected that life in company dormitories results in workers developing a fear of always being watched or listened to by their colleagues, and thus feeling that their privacy is not well-protected.

The purpose of the present study was to obtain knowledge for improvement of the housing and life among radiation decontamination workers by examining the effect of housing type on anxiety over lack of privacy. Radiation decontamination work will be expanded to the "difficult-to-return zones" from FY 2017²⁶, and therefore occupational health management for decontamination workers is of continued importance. In particular, better understanding of occupational mental health may decrease conflict among decontamination workers and improve the work environment. Therefore, the study of anxiety over the lack of privacy among decontamination workers is as important as the study of their physical health.

Subjects and Methods

Study Participants

The study subjects were the same male radiation decontamination workers used in our previous studies^{10,11}. In total, 1505 workers were recruited from companies involved in radiation decontamination work in Fukushima Prefecture, and attended a training program held by the Fukushima Occupational Health Promotion Center in 2013 to help prevent radiation exposure. Self-administered questionnaires were sent to the workers' companies, to be distributed among all 1505 workers. Six hundred and fifty-one workers (628 men and 23 women) returned the questionnaires anonymously by mail. Because nearly all respondents were male, we included the 544 responding males in the final analysis as the subjects of the present study. The response rate was 43.3%, and the effective rate was 36.1%.

Measures

Anxiety over privacy: The presence of anxiety over lack of privacy was assessed by the question "Do you have anxiety about the assurance of privacy in your daily life?"

Housing type and career change: These issues were addressed by questions regarding "current housing type" ("owner-occupied housing", "rental housing", "company dormitory", or "hotel"); and "Have you experienced a career change from another business field to become a radiation decontamination worker?" ("yes" or "no"); and "location of previous residence before starting your current job" ("Fukushima Prefecture" or "other").

Social support: The question regarding the presence of social support was "Are close persons available to confide in?" ("present" or "absent"). Our previous study indicated that the presence of close persons to confide in may ease anxiety over radiation exposure¹¹, and we then assumed that the presence of a close person to confide in may also be associated with anxiety over lack of privacy. Thus, this

Table 1. Characteristics of study subjects (n=544).

Characteristic	Number of workers (%)
Age	Mean 47.0 (SD: 13.4)
≤30	78 (14.3)
31-40	100 (18.4)
41-50	121 (22.2)
51-60	153 (28.1)
≥61	92 (16.9)
Duration of employment (months)	Mean 7.5 (SD: 5.9)
Anxiety over lack of privacy	
Have	93 (17.1)
Not have	451 (82.9)
Current housing type	
Owner-occupied housing	165 (30.3)
Rental housing	177 (32.5)
Company dormitory	168 (30.9)
Hotel	34 (6.3)
Career change ^a	
Yes	256 (47.1)
No	288 (52.9)
Previous residence location	
Fukushima Pref.	354 (65.1)
Others	190 (34.9)
Persons to confide in ^b	
Present	411 (75.6)
Absent	133 (24.4)

a: Changed careers to become a radiation decontamination worker.

b: Close persons available to confide in.

question was included in the questionnaire.

Sociodemographics: Sociodemographic characteristics included age, gender, and duration of employment in radiation decontamination work (months). In addition, age was classified into five groups: ≤ 30, 31-40, 41-50, 51-60, and ≥61 years.

Statistical Analysis

We verified the missing data before conducting the analysis since the response rate was low and there were many responses with missing data. Of these, the most common missing data was “Current housing type” (39.2%), and the second was “Persons to confide in” (32.4%). The total proportion of other missing data was less than 8%.

Statistical analyses were performed using SPSS Statistics Version 23 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to examine the characteristics of the participants. The relationships between the presence of anxiety over lack of privacy and the other fac-

tors in the questionnaire were analyzed using chi-square tests, and the statistical significance of cells in the tables was then examined using residual analysis. The cells were considered to have significantly more workers than expected when the adjusted standardized residual values were greater than 1.96, and to have significantly fewer people than expected when the values were lower than -1.96.

We used binary logistic regression analysis to examine whether housing type, career change, social support, or sociodemographic characteristics were predictors of anxiety over lack of privacy. A stepwise forward selection method (likelihood ratio) was employed because it was not clear which covariates would have statistically significant effects on anxiety over a lack of privacy. The housing types were reclassified into two categories (“living in company dormitories” or “not living in company dormitories”), and then used for the analysis. Anxiety over a lack of privacy was used as the dependent variable, and all other covariates, including age, duration of engagement in decontamination work, housing type, career change, previous residence location, and the presence of persons to confide in were selected as independent variables by a stepwise procedure after verification of multicollinearity.

The Variance Inflation Factor (VIF) was used to test multicollinearity. The VIF values for age, duration of engagement in the decontamination work, housing type, a career change, previous residence location, and presence of persons to confide in were 1.033, 1.030, 1.512, 1.054, 1.492, and 1.048, respectively. None of the VIF values reached 10, and the mean VIF of the model was less than 6. Thus, there was no collinearity.

P values below 0.05 were regarded as statistically significant. The odds ratio and 95% confidence intervals were calculated for covariates identified as statistically significant by regression analysis.

Ethics

This study was approved by the Research Ethics Committee of the Japanese Labour Health and Welfare Organization (Announcement No. 3) and the Ethics Committee of Fukushima Medical University (Application No. 1728).

Results

The characteristics of the included subjects are shown in Table 1. The mean age of participants (n=544, all male) was 47.0 years (SD: 13.4, range: 18-77), and the number of participants in the ≤ 30, 31-40, 41-50, 51-60, and ≥61 age groups was 78 (14.3%), 100 (18.4%), 121 (22.2%), 153 (28.1%), and 92 (16.9%), respectively. The number of subjects with anxiety over lack of privacy was 93 (17.1%), and the number of subjects who had changed

Table 2. Association of factors with anxiety over lack of privacy.

	Presence of anxiety over lack of privacy (%)		<i>p</i> -value
	Present	Absent	
Age			0.090
≤30	7 (9.0)	71 (91.0)	
31-40	13 (13.0)	87 (87.0)	
41-50	21 (17.4)	100 (82.6)	
51-60	31 (20.3)	122 (79.7)	
≥61	21 (22.8)	71 (77.2)	
Current housing type			<0.001*
Owner-occupied housing	10 (6.1) †	155 (93.9) ‡	
Rental housing	17 (9.6) †	160 (90.4) ‡	
Company dormitory	58 (34.5) ‡	110 (65.5) †	
Hotel	8 (23.5)	26 (76.5)	
Career change ^a			0.005*
Yes	56 (21.9) ‡	200 (78.1) †	
No	37 (12.8) †	251 (87.2) ‡	
Previous residence location			<0.001*
Fukushima Pref.	42 (11.9) †	312 (88.1) ‡	
Other	51 (26.8) ‡	139 (73.2) †	
Persons to confide in ^b			0.054
Present	63 (15.3)	348 (84.7)	
Absent	30 (22.6)	103 (77.4)	

* indicates significant chi-square test;

† indicates adjusted standardized residual <−1.96;

‡ indicates adjusted standardized residual >1.96;

a: Changed careers to become a radiation decontamination worker.

b: Close persons available to confide in.

careers to become a decontamination worker was 256 (47.1%). Slightly more than one third of the subjects were from prefectures other than Fukushima (190, 34.9%). The number of subjects living in “owner-occupied housing”, “rental housing”, “company dormitories”, and “hotels” was 165 (30.3%), 177 (32.5%), 168 (30.9%), and 34 (6.3%), respectively.

The association of age and other factors with anxiety over lack of privacy is shown in Table 2. Chi-square tests revealed that housing type, a career change, and previous residence location were all associated with anxiety over lack of privacy ($p < 0.001$, $p = 0.005$, and $p < 0.001$, respectively). Residual analysis revealed that a significantly high number of subjects with anxiety over lack of privacy lived in company dormitories, had experienced a career change, or came from prefectures other than Fukushima. Age and the presence of close persons available to confide in were not associated with anxiety over lack of privacy ($p = 0.090$ and $p = 0.054$, respectively).

The association of age and other factors with the current housing type is shown in Table 3. The chi-square test revealed that the previous residence location was signifi-

cantly associated with the current housing type ($p < 0.001$). Residual analysis revealed that a significantly high number of subjects from Fukushima Prefecture lived in owner-occupied housing or rental housing, whereas a significantly high number of the subjects from other prefectures lived in company dormitories or hotels. Age and career change were not significantly associated with the current housing type ($p = 0.092$ and $p = 0.155$, respectively).

The associations of age and previous residence location with a career change are shown in Table 4. A chi-square test revealed that previous residence location was significantly associated with a career change ($p = 0.023$), whereas age was not associated ($p = 0.065$). A significantly higher number of subjects from prefectures other than Fukushima had undergone a career change to become radiation decontamination workers.

Binary logistic regression models for the association between anxiety over lack of privacy and each of the covariates are shown in Table 5. The coefficient of anxiety over lack of privacy was higher if the subjects were living in company dormitories (OR = 4.948; 95% CI = 3.080,

Table 3. The association of different factors with current housing type.

	Current housing type (%)				<i>p</i> -value
	Owner-occupied housing	Rented housing	Company dormitory	Hotel	
Age					0.092
≤30	27 (34.6)	31 (39.7)	18 (23.1)	2 (2.6)	
31-40	32 (32.0)	42 (42.0)	21 (21.0)	5 (5.0)	
41-50	34 (28.1)	39 (32.2)	39 (32.2)	9 (7.4)	
51-60	42 (45.7)	40 (43.5)	59 (64.1)	12 (13.0)	
≥61	30 (32.6)	25 (27.2)	31 (33.7)	6 (6.5)	
Location of previous residence					<0.001*
Fukushima Pref.	158 (44.6) ‡	145 (41.0) ‡	41 (11.6) †	10 (2.8) †	
Other	7 (3.7) †	32 (16.8) †	127 (66.8) ‡	24 (12.6) ‡	
Career change ^a					0.155
Yes	70 (27.3)	79 (30.9)	91 (35.5)	16 (6.3)	
No	95 (33.0)	98 (34.0)	77 (26.7)	18 (6.3)	

* indicates significant chi-square test result;

† indicates adjusted standardized residual <−1.96;

‡ indicates adjusted standardized residual >1.96;

a: Changed careers to become a radiation decontamination worker.

Table 4. The association of age and previous residence location with career change.

	Career change experience (%)		<i>p</i> -value
	Changed careers	No change	
Age			0.065
≤30	34 (56.4)	44 (56.4)	
31-40	37 (37.0)	63 (63.0)	
41-50	60 (49.6)	61 (50.4)	
51-60	72 (47.1)	81 (52.9)	
≥61	53 (57.6)	39 (42.4)	
Previous residence location			0.023*
Fukushima Pref.	154 (43.5) †	200 (56.5) ‡	
Other	102 (53.7) ‡	88 (46.3) †	

* indicates significant chi-square test;

† indicates adjusted standardized residual <−1.96;

‡ indicates adjusted standardized residual >1.96;

7.951; $p < 0.001$), or had experienced a career change to become a decontamination worker (OR = 1.711; 95% CI = 1.062, 2.756; $p = 0.027$). Other covariates, including age, the duration of employment, the presence of persons to confide in, and previous residence location were not significantly associated with anxiety over lack of privacy.

Discussion

This study shows that living in company dormitories is significantly associated with anxiety over lack of privacy

compared to living in other housing types. Experiencing a career change to become decontamination worker also had a negative effect on anxiety over lack of privacy. The results of the current study also show that many of the radiation decontamination workers were from places other than Fukushima Prefecture, and therefore some of them might be considered as migrant workers. While few studies have investigated the association between life in company dormitories and mental health, this study provides evidence for such an association.

The characteristics of decontamination workers are

Table 5. Logistic regression models for the association between anxiety over lack of privacy and covariates.

Variables	Coefficient (95% CI)	SE	p-value
Living in company dormitory	4.948 (3.080, 7.951)	0.242	<0.001
Career change ^a	1.711 (1.062, 2.756)	0.243	0.027
Age	N/A	N/A	0.072
Duration of engagement	N/A	N/A	0.590
Persons to confide in ^b	N/A	N/A	0.625
Previous residence location	N/A	N/A	0.746

N/A indicates “not applicable”, because no statistical significance was seen for the variable using the stepwise method.

a: Changed careers to become a radiation decontamination worker.

b: Close persons available to confide in.

shown in Table 1. Slightly more than one third of the workers were from prefectures other than Fukushima Prefecture, and approximately half of the workers had experienced a career change. We found that approximately 30% of decontamination workers lived in company dormitories, whereas a previous report estimated that only 10.3% of all Japanese workers live in company dormitories⁹). This suggests that decontamination workers may be working and living in poorer conditions than general workers.

Anxiety over privacy was significantly associated with workers living in company dormitories, having experienced a career change, and/or having moved from prefectures other than Fukushima (Table 2). Moreover, significantly high numbers of workers from prefectures other than Fukushima were living in company dormitories or hotels (Table 3), and had experienced a career change (Table 4). Importantly, we found that living in company dormitories was significantly associated with the presence of anxiety, whereas living in hotels was not. Although company dormitories and hotels fall into the same category of temporary housing, they had different effects on anxiety. Life in company dormitories may contribute to the development of anxiety over lack of privacy because workers tended to have more frequent interactions with their colleagues, even in private settings, than the workers living in hotels.

Binary logistic analysis revealed that living in company dormitories and experiencing a career change are both significantly associated with the presence of anxiety over lack of privacy (Table 5). The former finding is in line with our hypothesis. We hypothesized that the frequent interaction with colleagues, even in a private setting, has a negative effect on the anxiety over lack of privacy; while a past study found that the increased communication could contribute to the improvement of psychosocial risk and productivity among workers²⁷). The frequency of communication in a private setting may determine whether communication has a positive effect or negative

effect on mental health, as overly frequent communication could intrude on workers' privacy.

Our results indicated that many of the decontamination workers who had experienced a career change were from places other than Fukushima Prefecture. Therefore, these decontamination workers might be considered migrant workers, and it is reasonable that past studies regarding migrant workers may be applicable to this population. Past studies have indicated that migrant workers are at risk of job burnout²⁸), mental health problems such as depression²⁹⁻³²), and inadequate self-health management caused by lack of access to mental health services^{33,34}). These studies also suggested that migrant workers are vulnerable to mental health problems, and our study indicates that anxiety over lack of privacy could be included in such problems. A previous study argued that the government and policy makers should take a multidisciplinary approach utilizing public health, housing, environmental science, urban planning, transportation, and other disciplines to prevent and resolve problems related to the effects of housing on citizens' health³⁵). Additionally, several countries have conducted assessments to gauge the health effects of political interventions in housing³⁶⁻³⁹). We conclude that such interventions and studies would also be beneficial for radiation decontamination workers in Japan.

A limitation of this study was that the number of roommates was not considered. The number of roommates may affect the workers' anxiety over lack of privacy in all types of housing. Therefore, a significant increase in anxiety over lack of privacy may be present in housing types other than company dormitories. Future studies are needed in order to more fully understand the relationships between housing type and mental health among decontamination workers, including the number of roommates as a factor. Moreover, we cannot rule out the possibility that the missing data may have an effect on the outcome of our analysis, since the frequency and proportion of missing data for “Current housing type” was relatively

high (40 and 39.2%, respectively). Although logistic regression analysis indicated that the association between current housing type and anxiety over lack of privacy was robust, we may need to conduct a study with a larger sample size in order to add supporting evidence.

In conclusion, we revealed that anxiety over lack of privacy among radiation decontamination workers was increased if they lived in company dormitories or had experienced a career change to become a radiation decontamination worker. These findings can help improve the work and home environment of radiation decontamination workers, and show the necessity of occupational mental health management and considering the residential environment.

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Conflicts of interest: None declared.

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