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# Factors Influencing Social Isolation and Loneliness Among Lung Cancer Patients: A Cross-sectional Study

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**Abstract.** *Background/Aim: Previous reviews of Social determinants of health in lung cancer patients have not examined essential factors such as social isolation and loneliness. This study aimed to explore the factors affecting social isolation and loneliness among lung cancer patients. Patients and Methods: A cross-sectional study was conducted. Social isolation, loneliness, and the presence of dementia were measured using Japanese adaptations of the Lubben Social Network Scale, UCLA Loneliness Scale, and Life Function Evaluation for Care Provision, respectively. Results: From March 2019 to March 2020, 264 patients were included. Social isolation was significantly higher for patients receiving welfare (adjusted OR=5.28, 95% CI=2.24-12.4). Loneliness was significantly higher for patients receiving welfare (beta coefficient=0.52, 95% CI=0.13-0.90) with symptoms of dementia (beta coefficient=0.28, 95% CI=0.03-0.54). Conclusion: Results showed that receiving welfare was associated with experiencing social isolation. Receiving welfare and symptoms of dementia were associated with experiencing loneliness.*

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*Key Words:* Lung cancer, social determinants of health, social isolation, loneliness, dementia.

Social determinants of health (SDH) are social and economic factors that affect human health (1). These factors include income, social status, education, living conditions, social support, and access to health services (2). Social isolation and loneliness are also crucial factors of SDH (3). Individuals who experience social isolation and loneliness have an increased risk of cardiovascular disease and all-cause mortality (3). Addressing SDH is essential for improving health and reducing longstanding disparities in health and healthcare service provision (4). The World Health Organization (WHO) further highlights the importance of addressing SDH (5).

To date, few studies on SDH have been conducted among patients with cancer (6). Moreover, a previous systematic review on SDH among lung cancer patients failed to examine essential factors, such as social isolation and loneliness (7). Thus, the present study aimed to explore the factors affecting social isolation and loneliness at the time of diagnosis among lung cancer patients in Japan. Our research

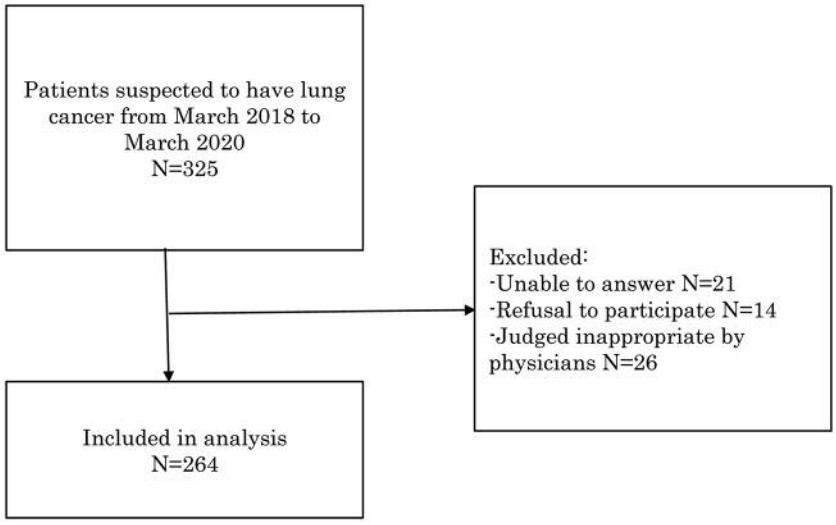


Figure 1. *Patient flow chart*.

question (RQ) was as follows: RQ: What factors influence social isolation and loneliness in SDH among lung cancer patients?

## Patients and Methods

*Protocol*. This study was developed and reported according to the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement (see supplemental table). The study protocol has been published (8).

*Design and setting*. This study was conducted among lung cancer patients at a single tertiary care facility, Hyogo Prefectural Amagasaki Medical Center, from March 2018 to March 2020. We employed a cross-sectional research design.

*Participants*. Inclusion criteria were patients with a pathological or clinical diagnosis of lung cancer, unsuitability for curative surgery, and were previously untreated or within two months of commencing treatment. Exclusion criteria was the inability to complete the study questionnaire.

*Measures*. Social isolation was measured using the Japanese abridged version of the Lubben Social Network Scale (LSNS-6) (9). It has no cut-off level. We thus used the cut-off level for the English version, which was 12 out of 30 points (9). Loneliness was evaluated using the Japanese version of the UCLA Loneliness Scale (3-12 points) (10). To reduce patient response times, we adapted the UCLA Loneliness Scale into a 3-question version, following a previous study (11). Since the condensed version had no defined cut-off values, we used quartiles to categorize the participants (low to high loneliness). The presence of dementia was assessed using questions extracted from the Life Function Evaluation for Care Provision (12). These instruments were utilized at the time of enrolment in the study.

*Statistical analysis*. Statistical analysis was conducted using the EZR software (version 1.33) (Saitama Medical Center, Jichi Medical University, Japan) (13). Descriptive statistics were performed using summary statistics. Multivariate analysis was performed using logistic and multiple regression models. The statistical significance was set at $p$=0.001. A complete-case analysis was conducted.

*Ethical considerations*. This study was approved by the Institutional Review Board of Hyogo Prefectural Amagasaki General Medical Center (No 29-164). Written informed consent was obtained from each participant.

## Results

Between March 2019 and March 2020, 206 males and 58 females were recruited to participate in the study (Figure 1). The median age was 72, and ages ranged from 34 to 90 years. Clinical characteristics are summarized in Table I. Among the participants, 89 (34%) experienced social isolation. The number of patients in the first (≥8), second (=7), third (>3, ≤6), and fourth (≤3) quartiles were 41 (16%), 39 (14%), 109 (41%), and 70 (27%), respectively.

Univariate analysis showed that there were more socially isolated patients receiving welfare [odds ratio (OR)=5.15, 95% confidence interval (CI)=2.31-11.50]. Additionally, multivariate analysis indicated that there were more socially isolated patients in stage 3B of cancer (adjusted OR=2.64, 95% CI=1.21-5.78) and receiving welfare (adjusted OR=5.28, 95% CI=2.24-12.4) (Table II).

Univariate analysis indicated that there were more patients with a history of smoking (beta coefficient=0.42, 95% CI=0.03-0.81), receiving welfare (beta coefficient=0.48, 95% CI=0.13-0.83), and presenting with symptoms of dementia

Table I. *Clinical characteristics of included patients*.

| Clinical characteristics | All patients (N=264) |
|---|---|
| Median age (range, in years) | 71.76 (34-90) |
| Number of patients (N) | |
| Age | |
| ≥75 | 110 (42%) |
| <75 | 154 (58%) |
| Gender | |
| Male | 206 (78%) |
| Female | 58 (22%) |
| Performance Status | |
| ≥2 | 67 (25%) |
| ≤1 | 197 (75%) |
| Stage | |
| ≥3B | 192 (73%) |
| ≤3A | 69 (26%) |
| Missing | 3 (1%) |
| Dementia | |
| Present | 131 (50%) |
| Absent | 132 (50%) |
| Unknown | 1 (<1%) |
| Insurance | |
| Welfare | 37 (14%) |
| Other | 227 (86%) |
| Final education level | |
| University or higher | 53 (20%) |
| High school or lower | 208 (79%) |
| Unknown | 3 (1%) |
| Job | |
| Employed | 74 (28%) |
| Unemployed | 188 (71%) |
| Unknown | 2(1%) |
| Internet | |
| Using | 62 (24%) |
| Not using | 201 (76%) |
| Unknown | 1 (<1%) |
| Smart phone | |
| Using | 88 (33%) |
| Not using | 175 (66%) |
| Unknown | 1 (<1%) |
| Smoking history | |
| Current/Ex | 235 (89%) |
| Never | 29 (11%) |
| Social isolation | |
| Present (<12) | 89 (34%) |
| Absent (≥12) | 167 (63%) |
| Missing | 8 (3%) |
| Loneliness | |
| First quartile (≥8) | 41 (16%) |
| Second quartile (7) | 39 (14%) |
| Third quartile (>3, ≤6) | 109 (41%) |
| Fourth quartile (≤3) | 70 (27%) |
| Unknown | 5 (2%) |

Table II. *Univariate and multivariate analysis of social isolation*.

| | Univariate analysis | | Multivariate analysis | |
|---|---|---|---|---|
| | Odds ratio | 95% Confidence interval | Odds ratio | 95% Confidence interval |
| Age | | | | |
| <75 years | Reference | | Reference | |
| ≥75 years | 0.6 | 0.33-1.08 | 0.79 | 0.38-1.63 |
| Gender | | | | |
| Female | Reference | | Reference | |
| Male | 1.99 | 0.96-4.15 | 1.72 | 0.73-4.04 |
| Performance status | | | | |
| ≤1 | Reference | | Reference | |
| ≥2 | 1.56 | 0.49-4.92 | 1.45 | 0.72-2.94 |
| Stage | | | | |
| ≤IIIA | Reference | | Reference | |
| ≥IIIB | 2.66 | 0.49-14.40 | 2.64 | 1.21-5.78 |
| Dementia | | | | |
| Absent | Reference | | Reference | |
| Present | 1.55 | 0.87-2.75 | 1.41 | 0.78-2.58 |
| Insurance | | | | |
| Other | Reference | | Reference | |
| Welfare | 5.15 | 2.31-11.50 | 5.28 | 2.24-12.40 |
| Education level | | | | |
| High school or lower | Reference | | Reference | |
| University or higher | 1.32 | 0.64-2.72 | 1.17 | 0.52-2.62 |
| Job | | | | |
| Unemployed | Reference | | Reference | |
| Employed | 0.95 | 0.50-1.80 | 1.01 | 0.50-2.04 |
| Internet | | | | |
| Not using | Reference | | Reference | |
| Using | 1.86 | 0.85-4.09 | 1.21 | 0.49-2.98 |
| Smart phone | | | | |
| Not using | Reference | | Reference | |
| Using | 1.1 | 0.55-2.19 | 1.1 | 0.52-2.37 |
| Smoking history | | | | |
| Never | Reference | | Reference | |
| Current/Ex | 1.57 | 0.59-4.20 | 2.01 | 0.49-8.30 |

Univariate and multivariate analyses were performed using logistic regression models.

(beta coefficient=0.29, 95% CI=0.04-0.53). Multivariate analysis showed that there were more patients experiencing loneliness who were receiving welfare (beta coefficient=0.52, 95% CI=0.13-0.90), and had symptoms of dementia (beta coefficient=0.28, 95% CI=0.03-0.54) (Table III).

## Discussion

This study aimed to explore the factors affecting loneliness and social isolation among lung cancer patients in Japan. Our results indicated that receiving welfare was associated with experiencing social isolation. Furthermore, receiving welfare and having symptoms of dementia were related to experiencing loneliness.

Our results are consistent with existing research. For example, a previous study indicated that welfare recipients

Table III. *Univariate and multivariate analysis of loneliness.*

| | Univariate analysis | | Multivariate analysis | |
|---|---|---|---|---|
| | Regression coefficient estimate | 95% Confidence interval | Regression coefficient estimate | 95% Confidence interval |
| Age | | | | |
| <75 years | Reference | | Reference | |
| ≥75 years | –0.17 | –0.42-0.08 | –0.14 | –0.46-0.17 |
| Gender | | | | |
| Female | Reference | | Reference | |
| Male | 0.25 | –0.04-0.55 | 0.22 | –0.14-0.57 |
| PS | | | | |
| ≤1 | Reference | | Reference | |
| ≥2 | 0.08 | –0.21-0.36 | 0.11 | –0.20-0.41 |
| Stage | | | | |
| ≤IIIA | Reference | | Reference | |
| ≥IIIB | –0.04 | –0.04-0.25 | –0.12 | –0.43-0.19 |
| Dementia | | | | |
| Absent | Reference | | Reference | |
| Present | 0.29 | 0.04-0.53 | 0.28 | 0.03-0.54 |
| Insurance | | | | |
| Other | Reference | | Reference | |
| Welfare | 0.48 | 0.13-0.83 | 0.52 | 0.13-0.90 |
| Education level | | | | |
| High school or lower | Reference | | Reference | |
| University or higher | –0.13 | –0.44-0.18 | –0.12 | –0.47-0.22 |
| Job | | | | |
| Unemployed | Reference | | Reference | |
| Employed | 0.09 | –0.19-0.36 | 0.07 | –0.23-0.37 |
| Internet | | | | |
| Not using | Reference | | Reference | |
| Using | –0.11 | –0.40-0.19 | –0.1 | –0.48-0.29 |
| Smart phone | | | | |
| Not using | Reference | | Reference | |
| Using | –0.04 | –0.30-0.22 | –0.04 | –0.36-0.29 |
| Smoking history | | | | |
| Never | Reference | | Reference | |
| Current/Ex | 0.42 | 0.03-0.81 | 0.23 | –0.26-0.72 |

Univariate and multivariate analyses were performed using multiple regression models.

are more likely to feel hopeless and demoralized, and exhibit suicidal behavior (14). Moreover, previous studies have shown that unemployment among lung cancer patients was two to three times higher than in patients without cancer, or with other types of cancer (15). In addition, lung cancer patients experienced a drastic reduction in earnings compared to patients with other types of cancer (15). This suggests that lung cancer patients may frequently be the recipients of welfare benefits. Furthermore, lung cancer patients receiving welfare benefits may experience higher levels of social isolation and loneliness. To this end, social prescribing has gained popularity in recent years. Social prescribing is carried out by healthcare institutions and involves identifying patients who are vulnerable to social risk factors. The healthcare institution then links such patients with agencies that refer them to welfare organizations and other social services (16). Further studies are therefore needed to investigate the effectiveness of social prescribing among lung cancer patients.

Additionally, our results indicated that a relationship exists between dementia and loneliness among lung cancer patients. In the present study, over half of the patient population was older than 75 years. This is consistent with a previous cohort study, which found that loneliness was associated with a 40% increased risk of dementia in elderly people (17). Furthermore, previous studies have suggested that self-efficacy improves after cognitive stimulation therapy (CST) in patients with dementia. Improvements in quality of life are also associated with decreased loneliness and increased self-efficacy after CST (18). Thus, including treatments for dementia symptoms in the care of lung cancer patients may decrease patients' experiences of loneliness.

Our study has several limitations. First, reverse causality may have occurred, since the present study has a cross-sectional design. Therefore, the temporal context is unknown. Future cohort studies are needed to address this issue. Second, this is a single-center study, and generalizability may be limited. Further research which includes a variety of patients from multiple hospitals is necessary.

In conclusion, this study showed that loneliness and social isolation may be more severe among lung cancer patients who are welfare recipients and experience symptoms of dementia. Future large cohort studies are necessary to confirm our results.

## Conflicts of Interest

Katsuya Hirano has received lecture fees from AstraZeneca; Chugai Pharmaceutical, Eli Lilly; Nippon Boehringer Ingelheim, Ono Pharmaceutical, Pfizer; Taiho Pharmaceutical and Novartis. Junichi Nikaido has received lecture fees from Eli Lilly. MS has received lecture fees from MSD and Eli Lilly. Takahiro Matsumoto has received lecture fees from Ono Pharmaceutical and AstraZeneca.

## Authors' Contributions

Nanami Ashi had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Concept and design: All authors. Acquisition, analysis, or interpretation of data: All authors.

Drafting of the manuscript: Nanami Ashi. Critical revision of the manuscript for important intellectual content: All authors. Supervision: Yuki Kataoka.

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