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# The association between mental status, personality traits, and discrepancy in social isolation and perceived loneliness among community dwellers

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## Abstract

**Background** Social isolation and loneliness can co-occur; however, they are distinct concepts. There is discrepancy as some people feel lonely in social isolation, while others do not. This study sought to enhance our understanding of this discrepancy between social isolation and loneliness by investigating its related factors, with a specific focus on mental status and personality traits.

**Methods** This study adopted a cross-sectional study design and utilized data from the 2016 and 2018 waves of the University of Michigan Health and Retirement Study. The participants were community dwellers aged 50 years and older. The outcome measurement was defined as the discrepancy between social isolation, based on six criteria, and loneliness, assessed using the three-item version of the Revised UCLA Loneliness Scale. Multinomial logistic regression models were conducted to examine the factors associated with the discrepancy.

**Results** Participants with fewer depressive symptoms and higher extraversion were associated with the only social isolation group and the only loneliness group rather than the group consisting of those who felt lonely with social isolation. In addition, lower neuroticism was associated with the only social isolation group. Participants with fewer depressive symptoms, lower neuroticism, and higher extraversion were more likely not to feel lonely even with social isolation, compared to feeling lonely even in the absence of isolation.

**Conclusions** Mental status and personality traits may be closely related to the discrepancy between social isolation and loneliness. This study suggests that incorporating social, mental, and psychological factors may be essential for interventions in social isolation and loneliness.

**Keywords** Social isolation, Loneliness, Personality traits, Depressive symptoms

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## Introduction

Social isolation is a serious public concern. The National Health and Aging Trends Study found that 7.7 million older adults living in the community (24%) were socially isolated in the United States [1]. With the rise in the number of people experiencing social isolation and loneliness during the COVID-19 pandemic, there is growing concern about their long-term effects on physical and mental health [2, 3].

Previous studies reported the association between social isolation or loneliness and several health outcomes, such as depression and anxiety [4, 5], mortality [6, 7], and the onset of dementia [8, 9]. Despite there being a variety of definitions and measurements for social isolation and loneliness, social isolation often refers to objective isolation, which is a limited social relationship in structural (social networks) or functional (social support) facets [8, 9]. On the other hand, loneliness is generally perceived as subjective isolation and refers to situations in which an individual feels uncomfortable or has an unacceptable lack of social connectivity [10]. Although social isolation and loneliness can co-occur, they are distinct concepts. Some people may not feel lonely even during social isolation or may feel lonely in the absence of social isolation.

There is a paucity of studies on the discrepancy between social isolation and loneliness. Victor et al. classified social groups into four types of combination of social isolation and loneliness using data from the 1950–1960s [11]. However, the characteristics and factors associated with the classification of discrepancy have not been discussed. Other prior studies have reported relationships between different discrepancy types and health outcomes. A study using the Irish Longitudinal Study on Ageing (TILDA) and the English Longitudinal Study of Aging (ELSA) categorized the discrepancy between social isolation and loneliness into “Concordantly Lonely & Isolated,” “Discordant: Robust to Loneliness,” and “Discordant: Susceptible to Loneliness” [12]. The second categorization, which is the group that feels less lonely in the face of social isolation, outperformed the third group in all cognitive function tests. Moreover, a study from the ELSA grouped social isolation and loneliness into six types based on a living arrangement, loneliness, and social isolation using cluster analysis [13]. Groups with either social isolation or loneliness were associated with a high risk of health outcomes, including activities of daily living, subjective health status, chronic illness, and mental health, compared to the group with no social isolation or loneliness. Another study using data from the Canadian Longitudinal Study of Aging clarified the four categories of combinations of social isolation and loneliness and found relationships with social support and psychological stress [14].

Summarily, some prior studies suggested that the discrepancy types between social isolation and loneliness, as well as social isolation and loneliness individually, may be key factors for various health risks. Although there is still limited literature on the discrepancy between social isolation and loneliness, more evidence is required to develop an intervention for social isolation and loneliness. Specifically, understanding the factors associated with the discrepancy between social isolation and loneliness has clinical usefulness because they possibly have some effect on the efficacy of interventions or may themselves influence social isolation and loneliness. We hypothesize that mental status and personality traits are associated with the discrepancy between social isolation and loneliness due to their association with individuals’ perceptions, which create gaps in their actual situation of social isolation and perception of loneliness. With the paucity of research on the discrepancy between social isolation and loneliness, especially the role of personality traits, our study would provide new empirical knowledge and is expected to offer new insight into mental health and social activity interventions. Therefore, this study aimed to examine the association of mental status and personality traits with the discrepancy between social isolation and loneliness.

## Methods

### Study design and setting

This cross-sectional study utilized data from the University of Michigan Health and Retirement Study (HRS), which is a biennial longitudinal study with a nationally representative sample. The HRS includes noninstitutionalized adults over the age of 50 and their spouses. The participants were selected using multistage probability sampling.

We analyzed the RAND HRS Longitudinal File [15] and linked RAND files with HRS Leave Behind Questionnaires (LBQ) [16] which include our interest variables, such as loneliness and social isolation. The LBQ introduced a rotating random subsample of the longitudinal panel. A random subsample of 50% of the HRS participants (Subsample A) responded in the relevant year, and the other 50% (Subsample B) responded in the next survey. Thus, we combined the 2016 (Subsample B) and 2018 (Subsample A) waves to obtain the whole sample. Information about educational attainment and institutionalized status was obtained from the Cross-Wave Tracker File.

The noninstitutionalized adult participants aged 50 and older who answered the items related to demographics (age, sex, educational attainment, and race) were included in the analysis. Participants who were missing all indicators on the LBQ, including loneliness, social isolation indicators, and personality traits, were excluded.

First, 17,869 participants aged over 50 who answered the LBQ (who were provided LBQ weight) during the 2016 or 2018 waves were initially enrolled. After participants were excluded due to institutionalization, 11,613 participants with no missing values regarding demographics were included in the final analysis.

### **Outcome variable**

#### ***Social isolation***

Although a variety of definitions and measurements for social isolation exist with no golden standard, we used the criteria from previous research in the ELSA and the HRS [17–20]. We assigned one point for each of six criteria: (i) lived alone, (ii) unmarried, (iii)–(v) had less than monthly contact with family, children, and friends, and (vi) had less than monthly participation in any social groups or organizations. The score ranged from 0 to 6, and a higher score indicates severe isolation. Given the prevalence of social isolation [1], the top quartile of the scores (score  $\geq 3$ ) was treated as socially isolated.

#### ***Loneliness***

Loneliness was measured using a three-item version of the Revised UCLA Loneliness Scale [21]. This scale assesses the frequency of feeling loneliness: (i) lacking companionship, (ii) feeling left out, and (iii) being isolated from others. Each question has three options as follows: “never or hardly ever,” “some of the time,” or “often,” with 1–3 points given for these responses. The total score ranged from 3 to 9 by summing the scores for each item. A high score corresponds to severe loneliness. Considering the prevalence of loneliness [22], the top quartile of the scores (score  $\geq 6$ ) was treated as loneliness.

#### ***Discrepancy between social isolation and loneliness***

The discrepancy between social isolation and loneliness, which is our main interest, was represented using a matrix between social isolation and loneliness. Based on the categorization of social isolation and loneliness as described earlier, we classified the combination of social isolation and loneliness into four categories: (i) No social isolation and loneliness (No SL), (ii) Only social isolation (Only S), (iii) Only loneliness (Only L), and (iv) Social isolation and loneliness (SL). In those groups, we defined Only S and Only L, as the discrepancy between social isolation and loneliness.

#### ***Explanatory variables: mental and psychological status***

Mental health status was measured using the eight-item short version of the Center for Epidemiologic Studies-Depression Scale (CES-D-8) [23]. This scale consists of eight items that assess depressive symptom experiences for much of the time during the past week (e.g., felt depressed, felt everything was an effort, and felt sleep

was restless). Each item was recorded as yes or no and the total score ranged from 0 to 8, with high scores indicating severe depressive symptoms. The broadly used cut-off for the CES-D 8 was a score of  $\geq 3$ . However, a previous study suggested using a more conservative cut-off for the CES-D in the older population [24], and data in the HRS showed that a cut-off of  $\geq 4$  for the CES-D-8 may be equivalent to a cut-off of 16 for the original CES-D (20-item) [25]. Thus, we used a cut-off of  $\geq 4$  and dichotomized scores into cases of depression syndrome ( $\geq 4$ ) or no depression syndrome. Neuroticism and extraversion from the Big 5 Personality traits were measured using the items of the Midlife Development Inventory Personality Scales [26]. This study adopted the neuroticism and extraversion domains as personality factors related to social isolation and loneliness, following their use in a previous study [27]. Neuroticism is the personality trait that describes negative affect, such as nervousness, moodiness, and temperament [28]. Extraversion is a personality trait that describes active people with sociable, talkative, and assertive natures [29].

#### ***Control variables***

Considering adjustments for potential confounding factors from previous literature [4, 5, 30–32], demographic (age and sex), socio-economic status (education, race, ethnicity, and household income), medical condition (self-reported health and multicommodity), and instrumental activities of daily living (IADL) were included into the model. Age was treated as a continuous variable in this study. Sex was categorized as female and male. Education was dichotomized into “high school or less” and “college or above.” Race was divided into three categories: “White/Caucasian,” “Black or African American,” and “Others.” Ethnicity was treated as a dummy variable to indicate “Hispanic” or “Non-Hispanic.” Household income, which is the sum of the income of respondents and their spouses or partners (\$1000/unit), was treated as a continuous variable. Subjective health was dichotomized into two groups: “Healthy” (excellent, very good, or good) or “Unhealthy” (fair or poor). Medical conditions, which assessed as a multicommodity, were treated based on the number of diseases: diabetes, stroke, cancer (excluding skin cancer), and heart disease. The conditions were divided into “no. of disease (0),” “no. of disease (1),” and “no. of disease ( $\geq 2$ ).” IADL were measured using five items that assess difficulty with preparing a meal, making phone calls, taking medications, paying bills and keeping track of expenses, and shopping. Each question has several response options, including “yes,” “no,” “can’t do,” and “don’t do.” Participants who reported difficulties with at least one item (i.e., answered “yes” or “can’t do”) were defined as dependent.

**Analysis**

First, participants were assigned to one of the four groups based on the classification of social isolation and loneliness. Then, a multinomial logistic regression model was performed to determine the factors related to the discrepancy between social isolation and loneliness; Only S (do not feel lonely even in social isolation) and Only L (feel lonely in the absence of social isolation) compared with SL (social isolation and loneliness). Subsequently, we examined the differences between Only S and Only L in the model with Only L set as the reference.

As a supplementary analysis, we applied a multinomial logistic regression model utilizing a top-10%tile cut-off threshold for social isolation and loneliness, meaning a greater focus on severe social isolation and loneliness.

Missing data in the multinomial logistic regression model were imputed by multiple imputations with the fully conditional specification method. We created five imputed datasets and integrated each result of the analysis.

The level of significance was set at 0.05. Statistical tests were performed using SAS version 9.4, and forest plots based on model statistics were created using the forestplot package [33] in R (version 4.3.1).

**Results**

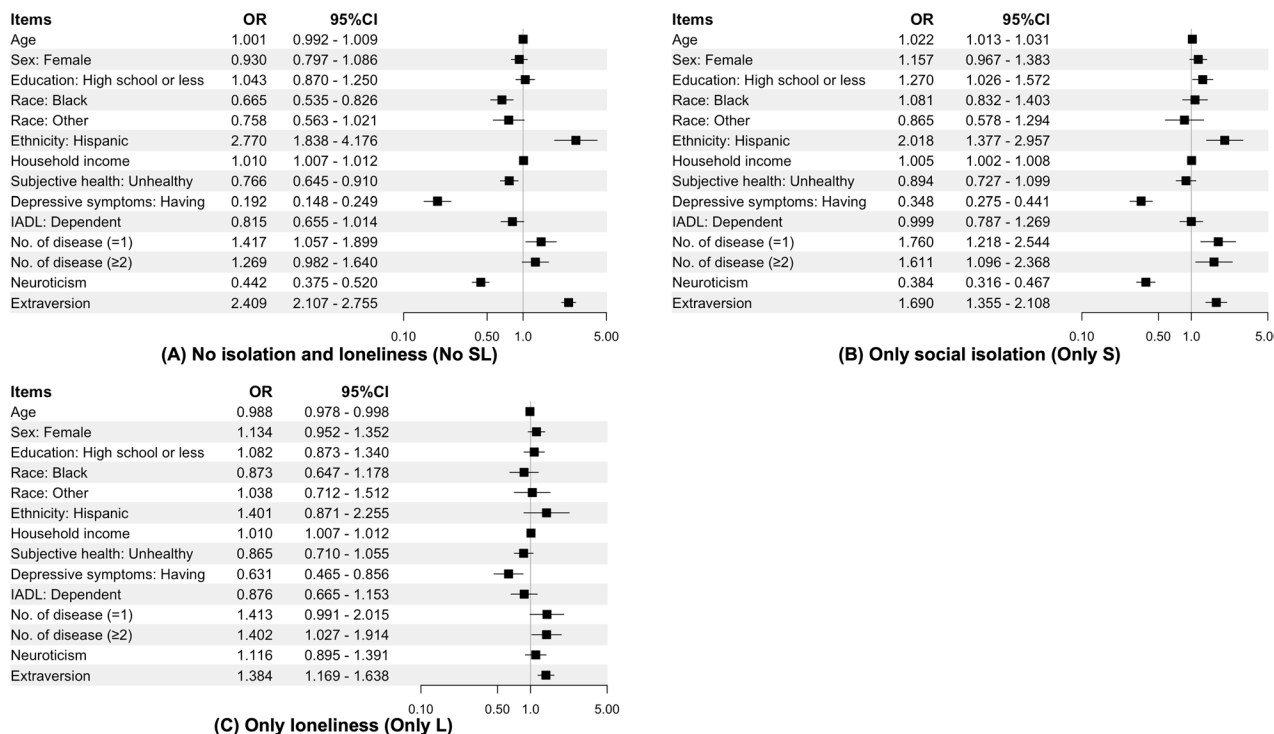
Table 1 shows the participants’ demographic characteristics by the social isolation and loneliness categories. The groups facing social isolation (Only S and SL) comprise older participants compared to those with no isolation. The groups with social isolation, loneliness, or both had higher proportions of females than the No SL group. The SL group had the highest prevalence of depressive symptoms (37.65%) and IADL dependence (25.34%).

Figure 1 describes the results of multinomial logistic regression analysis for the combinations of social isolation and loneliness, with the SL group set as the reference. Depressive symptoms and personality traits were closely associated with all three groups, No SL, Only S, and Only L. Participants with a less depressive tendency and higher extraversion were more likely to be in No SL,

**Table 1** Descriptive statistics of independent variables by social isolation and loneliness categories

		Only loneliness (Only L) n = 1141		Only social isolation (Only S) n = 1088		Socially isolation and loneliness (SL) n = 585		No social isolation and no loneliness (No SL) n = 4787	
Continuous variables		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (Year)		66.82	9.85	71.95	10.88	68.77	11.09	68.29	9.84
Household income (\$1000/unit)		81.60	145.92	48.17	78.38	38.15	52.84	93.32	145.80
Personality traits (Scores)	Neuroticism	2.27	0.60	1.82	0.56	2.27	0.64	1.84	0.55
	Extraversion	3.05	0.58	3.20	0.53	2.96	0.60	3.30	0.52
Categorical variables		n	%	n	%	n	%	n	%
Sex	Male	389	34.09	368	33.82	203	34.70	2061	43.05
	Female	752	65.91	720	66.18	382	65.30	2726	56.95
Educational attainment	High school or less	767	67.22	807	74.17	439	75.04	2957	61.77
	College and above	374	32.78	281	25.83	146	24.96	1830	38.23
Race	White	816	71.52	757	69.58	391	66.84	3684	76.96
	Black	215	18.84	264	24.26	140	23.93	708	14.79
	Others	110	9.64	67	6.16	54	9.23	395	8.25
Ethnicity	Hispanic	127	11.13	109	10.02	56	9.57	608	12.70
	Non-Hispanic	1014	88.87	979	89.98	529	90.43	4179	87.30
Subjective health	Healthy	746	65.55	777	71.48	321	54.87	3862	80.73
	Unhealthy	392	34.45	310	28.52	264	45.13	922	19.27
Number of diseases	No disease	129	11.32	78	7.21	60	10.29	700	14.67
	1	237	20.79	223	20.61	92	15.78	1179	24.71
	≥2	774	67.89	781	72.18	431	73.93	2892	60.62
IADL	Independent	939	82.44	938	86.45	436	74.66	4406	92.06
	Dependent	200	17.56	147	13.55	148	25.34	380	7.94
Depressive symptoms	Having	305	26.97	111	10.33	218	37.65	244	5.13
	Not having	826	73.03	964	89.67	361	62.35	4516	94.87

Note: The sample has 227 missing values for neuroticism, 286 for extraversion, 7 for subjective health, 25 for number of diseases, 7 for IADL, and 56 for depressive symptoms. The percentage is calculated using the value excluding missing data as the denominator



**Fig. 1** Multinomial logistic regression analysis for the combinations of social isolation and loneliness with SL set as the reference. *Note:* Ref: Social isolation and Loneliness (SL). OR: odds ratio; CI: confidence interval. Age (Continuous)/ Sex (ref. Male)/ Education (ref. College or above)/ Race: Black (ref. White)/ Race: Others (ref. White)/ Ethnicity (ref. Non-Hispanic)/ Household income (Continuous, \$1000/unit)/ Subjective health (ref. Healthy)/ Depressive symptoms (ref. Not having)/ IADL: Instrumental Activities of Daily Living (ref. Independent)/ No. of disease (ref. 0)/ Neuroticism (Continuous)/ Extraversion (Continuous)

Only S, and Only L than SL groups. Lower neuroticism had a higher likelihood of being No SL and Only S than SL groups.

Figure 2 describes the results of multinomial logistic regression analysis with the Only L group set as the reference. Participants with lower depressive symptoms, lower neuroticism, and higher extraversion were more likely to be Only S or No SL than Only L.

Supplementary Figs. 1 and 2 describe the models, focusing on severe social isolation and loneliness utilizing the top-10 percentile cut-off. In the model with the SL group set as the reference (S1 Figure), the significance of depressive tendency, neuroticism, and extraversion remained, consistent with Fig. 1. In the model with the Only L group set as the reference (S2 Figure), participants with lower depressive tendency and lower neuroticism were still likely to be Only S than Only L while extraversion was not associated with.

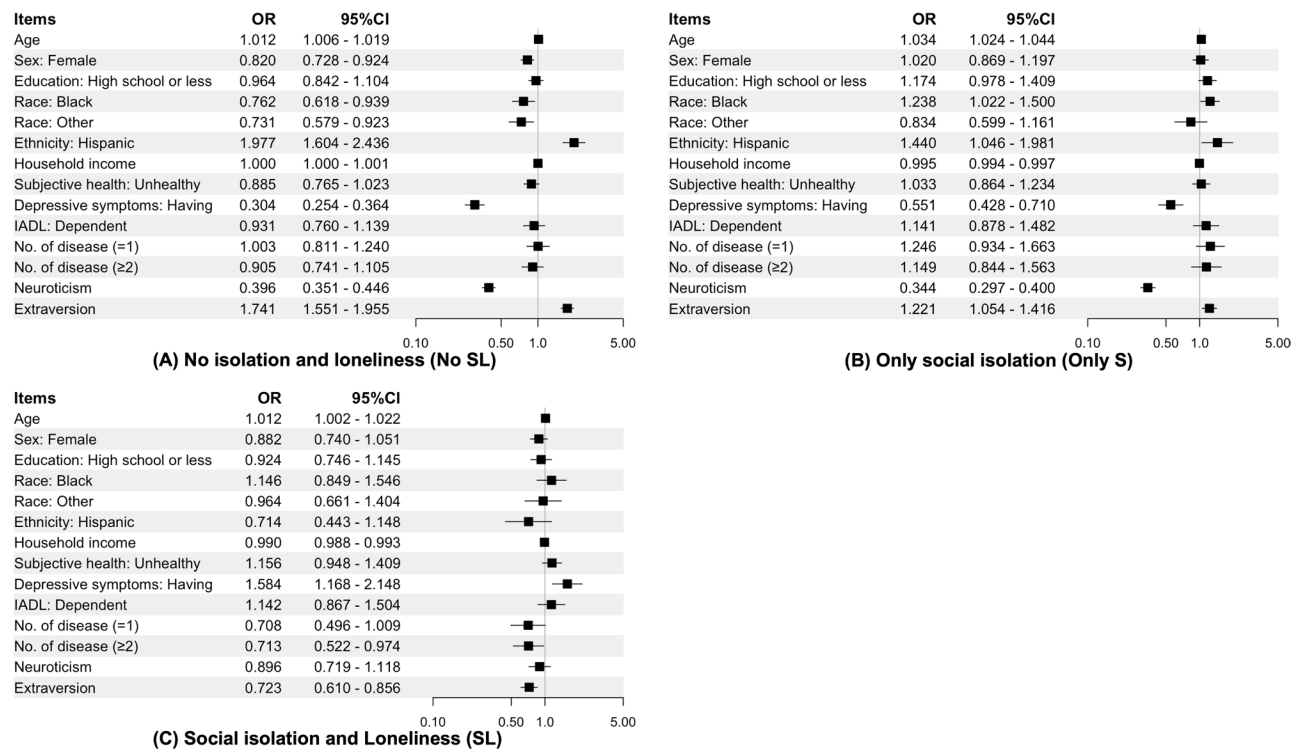
**Discussion**

This study addressed the factors associated with the discrepancy between actual social isolation and feelings of loneliness among community dwellers using large-scale data with relevant variables. We hypothesized that mental status and personality traits are associated with this

discrepancy due to their association with individuals’ perceptions, which create gaps in the actual situation of social isolation and perception of loneliness. While previous studies have reported the factors associated with social isolation and loneliness alone [1, 34, 35], our findings add new knowledge and insight into social isolation and loneliness prevention by directing a spotlight on the discrepancy between social isolation and loneliness as follows:

First, depressive symptoms and personality traits were consistently associated with the discrepancy between actual social isolation and feelings of loneliness. While social isolation is closely related to situational loneliness caused by environmental factors, internal loneliness—the perception of being alone that makes a person lonely—is influenced by psychological factors such as mental distress and personality traits [36]. Although the association between mental health and social isolation and loneliness is well established [4, 5], our work added that mental health is associated with the discrepancy between social isolation and loneliness, as loneliness and social isolation individually.

To summarize our findings regarding personality traits, higher extraversion and lower neuroticism were found to be key factors in the discrepancy between actual social



**Fig. 2** Multinomial logistic regression analysis for the combinations of social isolation and loneliness with Only L set as the reference. *Note:* Ref: Only loneliness (Only L). OR: odds ratio; CI: confidence interval. Age (Continuous)/ Sex (ref. Male)/ Education (ref. College or above)/ Race: Black (ref. White)/ Race: Other (ref. White)/ Ethnicity (ref. Non-Hispanic)/ Household income (Continuous, \$1000/unit)/ Subjective health (ref. Healthy)/ Depressive symptoms (ref. Not having)/ IADL: Instrumental Activities of Daily Living (ref. Independent)/ No. of disease (ref. 0)/ Extraversion (Continuous)

isolation and feeling of loneliness. Our finding suggests that in the gap between social isolation and loneliness, higher extraversion and low neuroticism were associated with not feeling loneliness with social isolation (Only S). Only higher extraversion was associated with loneliness without social isolation (Only L).

Neuroticism and extraversion are personality traits that may be closely associated with stress reactivity and resilience in daily life. A prior study suggested that people with higher neuroticism experience greater stress reactivity to daily stressors than those with lower neuroticism [37]. Additionally, people with lower extraversion and higher extraversion were associated with resilience [38]. Another study reported that higher neuroticism and lower extraversion were related to worse adaptation to the COVID-19 lockdown [39], which is a situation similar to social isolation. In addition, the big five personality traits including lower neuroticism and higher extraversion may affect the individual’s greater perception regarding how they feel about their availability of social support. Considering those reports, our result implies that the Only S group, which does not feel lonely in an isolated situation, feels less lonely because of lower stress-reactivity and higher perceived availability of social support via higher extraversion and lower neuroticism.

On the contrary, only higher extraversion was associated with Only L group, which indicated loneliness alone in the absence of social isolation. Extraversion is a personality trait that shows preference for interacting with others, and individuals with higher extraversion may expect deep social connections and fulfilling social interactions with others. When these higher expectations do not match the actual situation, individuals with higher extraversion may not be able to achieve the desired level of satisfaction and they experience loneliness.

In contrast to extraversion, neuroticism was not associated with feeling loneliness without social isolation (Only L). Individuals with high neuroticism tend to experience more distress to common stressors in daily life due to their higher stress-reactivity [37] as mentioned previously. However, in situations where a social isolation event is not recognized, stressors that cause psychological stress is not perceived. As a result, stress reactivity, which characterizes neuroticism, does not come into play, and neuroticism may not be associated with loneliness without social isolation.

From the perspective of social intervention, this study has implications for isolation and loneliness prevention. In recent years, much attention has been focused on interventions for social isolation and loneliness. According to comprehensive reviews [40, 41], many trials have

emphasized social contact, and most of them have intervened in a single way (e.g., increase social contact, social skill training). Social involvement intervention may help improve individuals' social isolation and situational loneliness; however, this study suggests that intervention in a single way could not sufficiently address the discrepancy of a state of feeling lonely even without social isolation in which individuals' characteristics such as depression, personality traits, and socioeconomic status may be connected in a complex manner. Thus, this study implies that incorporating social, mental, and psychotherapeutic aspects in social interventions, such as a combination of social involvement and cognitive-behavioral interventions, may be essential for future intervention strategies. Although not clarified in this analysis, it is also possible that the mechanisms underlying the cognitive aspect of loneliness, and effective intervention methods, differ depending on the type of combination of social isolation and loneliness. Further studies are needed to understand the mechanisms and differences of effective intervention among discrepancy types between social isolation and loneliness in depth.

The limitations of this study should be noted. First, our results could not address the causal relationship between variables and longitudinal changes. The factors related to the discrepancy between social isolation and loneliness in this study, such as depressive symptoms, can be bidirectionally linked to social isolation and loneliness. Second, the results were based on self-administered questionnaires. Self-reported bias, such as feelings of loneliness being influenced by the emotions at the time of completing the questionnaire, cannot be ruled out. Differences in evaluation between the clinical evaluation and self-reported indicators are possible in terms of mental and psychological factors, including depressive symptoms, loneliness, and personality traits. Third, there is a limitation in the validity of the cut-off of social isolation and loneliness as there is no clear gold standard when it comes to defining these concepts. Although we confirmed the robustness of the results and obtained consistent associations between mental status and personality traits with the outcomes across different cut-offs in the supplemental analysis, careful consideration is needed along with discussing the standard definition of social isolation and loneliness. Fourth, as we aim to capture the overall association, this study could not sufficiently consider some important social contexts. People may have more complex social backgrounds and potential mechanisms, such as the mediation effects of perceived social support. In addition, we have not fully incorporated the established theoretical and conceptual frameworks into this study as existing research is not well established on this topic, resulting in an insufficient theoretical foundation of the results. The future challenge is to refine both

the theoretical framework and the empirical research methods. Finally, it is important to note that this study utilized data collected before the COVID-19 pandemic, and it remains unclear whether there have been changes in the gap between social isolation after the pandemic. Although we do not expect the fundamental psychological process to change drastically before and after the pandemic, it is quite possible that new factors driving those processes have risen after the pandemic. Further investigation is necessary to ascertain whether there have been changes in the nature of the gap between social isolation and loneliness and its related factors after the pandemic.

## Conclusions

The current study examined the association between mental status, personality traits, and the discrepancy between social isolation and loneliness among community dwellers using the HRS dataset. As we hypothesized, depressive symptoms and personality traits were consistently associated with the discrepancy between social isolation and loneliness. The results indicated the possibility that mental status and personality traits are closely involved in creating gaps between social isolation and perceived loneliness. Our findings provided implications for social interventions, indicating that social, mental, and psychotherapeutic aspects may be essential for intervention. As this study has its set of limitations, future studies are expected to delve deeper into the mechanism of the discrepancy between social isolation and loneliness.

## Abbreviations

HRS	The University of Michigan Health and Retirement Study
TILDA	The Irish Longitudinal Study on Ageing
ELSA	The English Longitudinal Study of Aging
LBO	Leave Behind Questionnaires
No SL	No social isolation and loneliness
Only S	Only social isolation
Only L	Only loneliness
SL	Social isolation and loneliness
CES-D-8	The eight-item short version of the Center for Epidemiologic Studies-Depression Scale
IADL	Instrumental activities of daily living

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-024-19965-x>.

Supplementary Material 1

## Author contributions

KW contributed to the study design, analysis, drafting, and revision of this paper. TS and MOM contributed to the interpretation, drafting, and revision of this paper. All authors read and approved the final manuscript.

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**Data availability**

The data sets generated and/or analyzed during the current study are available in the HRS repository at <https://hrs.isr.umich.edu/about>.

**Declarations****Ethics approval and consent to participate**

Ethical approval for the HRS Study was obtained from the University of Michigan Institutional Review Board. Further ethical approval and informed consent for the secondary data analysis of HRS data was waived according to the Ethical Guidelines for Medical and Health Research Involving Human Subjects in Japan. All procedures were conducted in accordance with the ethical principles for medical research involving human subjects detailed in the Declaration of Helsinki.

**Consent for publication**

Not applicable.

**Competing interests**

The authors declare no competing interests.

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