Another kind of lonely death: the effects of changes in loneliness on the end-of-life self-care ability of elderly people from the perspective of the distance to death

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Abstract

Objective

Lonely death, in the general sense, refers to the phenomenon in which the elderly pass away unattended and not unnoticed for some time thereafter. The objective of this paper is to examine whether a distinct form of lonely death exists, separate from the conventional understanding of lonely death, through an analysis of the impact of trends in loneliness on the end-of-life self-care ability of elderly individuals.

Methods

This study utilized data from a sample of 1,423 older adults aged 65 and over who participated in three waves of the Chinese Longitudinal Healthy Longevity Survey 2008–2014. Loneliness trends were characterised using the group-based growth model. Logistic and linear regressions were used to test the effect of changing loneliness trends on the self-care abilities of older adults nearing the end of life. Finally, path analyses were conducted to explore the specific mechanisms underlying the relationship between loneliness trends and end-of-life self-care.

Results

Among the older participants, people who were not lonely (61.9%) had greater health gains and, therefore, exhibited lower rates of chronic bedriddenness and higher levels of end-of-life self-care ability. In contrast, increased loneliness (30.8%) is associated with reduced health gains for the elderly population, resulting in a higher likelihood of chronic bedriddenness and decreased self-care abilities in their final days. The remaining older adults (7.3%) report reduced loneliness as a result of the 'attention' they receive as their health deteriorates. Reduced loneliness significantly impaired their end-of-life self-care ability.

Conclusion

30.8% of older people experienced increased loneliness during their lifetimes with a significant negative impact on their end-of-life self-care ability, i.e. "a different kind of lonely death". 7.3% of older people did not benefit from reduced loneliness, which was a "death by attention".

Introduction

Lonely Death is a phenomenon in which death occurs without anyone's care or discovery, and there is a certain period before it is discovered. It represents a serious social issue in countries with a significant ageing trend. According to a survey by Japan's NHK television station for the national municipality, an estimated 32,000 cases of lonely deaths among the elderly were reported in 2008[1]. Yujiro Nagai

estimated around 20,000 to 25,000 cases of lonely deaths among the elderly in Japan per year[2]. In 2013, the Korea Broadcasting Corporation reported 11,000 cases of lonely deaths in South Korea[3].In contrast, there has been a growing trend of young labor force migration from rural to southeast coastal cities in China for employment. This has resulted in the prevalence of empty-nesting elderly people in the countryside, where many experience an amplified sense of loneliness. In urban areas, the increasing prevalence of high-rise modern housing and the growth of China's individualistic society have contributed to a perceived division between people, resulting in greater atomisation and isolation. This phenomenon has also had a negative impact on the elderly population and exacerbated loneliness among elderly urban dwellers.

Currently, no statistical data indicates that the lonely death of older adults in China are a common social issue. However, it is undeniable that older adults in both urban and rural areas are increasingly confronted with loneliness. In China,The majority of family members provide care to older adults based on their end-of-life self-care ability. As a result, many older adults in China have been prevented from lonely death. In addition, it is common for older people to experience a rapid decline in their self-care ability during the dying process due to illness. Therefore, they are unlikely to choose to live alone at this time and may not pass away without companionship.

One possible conjecture based on the above is that the lonely deaths of older Chinese people do not necessarily denote dying unattended in the general sense. Rather, it is a form of death in which older Chinese people suffer from loneliness for two, four or more years leading up to their death, leading to a decline in their physical and mental health. This decline weakens their end-of-life self-care ability, yet it is a form of death in which they receive care at the time of death. Further, lonely death in the general sense is limited to the period before or after death and focuses only on whether the older person is accompanied at the time of death. If the temporal definition of dying alone includes a longer period before the older person's death and the assessment of the outcome is based on the quality of death (self-care ability), how does the feeling of loneliness in the ordinary course affect the self-care ability towards the end of life, or is there an "another kind of lonely death"?

Literature Review

Loneliness, particularly among older adults, is widely discussed in academia. Numerous studies have examined its adverse effects on the physical and mental health of older adults in their daily lives. Additionally, researchers have investigated the unique characteristics of the dying process, with a series of studies on end-of-life loneliness.

Loneliness during daily life

Health status during daily life is an important factor influencing loneliness and end-of-life self-care ability in older people

The health status during daily life is an important factor influencing loneliness among older adults. Poor health status increases the risk of loneliness among older adults[4]. Limitations in physical function escalate the probability of loneliness among the elderly, with multiple diseases [5] and leg pain [6] exacerbating such risk. Research by Hawkley et al [7] and Warner et al. [8]suggests that a decrease in scores on activities of daily living (ADLs) correlates with increased loneliness among older adults. The end-of-life self-care ability of older people is significantly influenced by their health status during their daily lives. Murray et al. [9], [10] summarise three trajectories of disease progression in older people. The first trajectory is represented by cancer, which has a clear end-stage and relative stability until that stage. Such diseases lead to a rapid decline in end-of-life self-care ability, with little impact on usual self-care. The second trajectory involves gradual deterioration and sudden death, as represented by respiratory and cardiac diseases. These conditions exert a greater impact on the usual self-care and a lesser impact on the end-stage self-care of patients. The third trajectory is marked by slow deterioration over time until death, represented by "frailty" and dementia, a category of disease that progresses almost in parallel with the decline in self-care.

Loneliness can have a negative impact on health and end-of-life self-care

On the one hand, several studies have shown that loneliness during everyday life increases the risk of physical and mental illness among older adults. Loneliness and social isolation are linked to an increased incidence of dementia [11] and depression [12] in this group. Furthermore, loneliness is associated with a greater probability of limited physical function [13], [14] and coronary artery disease as well as stroke among older adults [15], [16]. On the other hand, it is likely that loneliness during everyday periods has a negative impact on the end-of-life self-care ability of older people. Research by Harris et al. [17] has shown that changes in forms of loneliness can have an impact on physical health. The results indicated that adolescents with high levels of loneliness and a decline in such levels had poorer health compared to those with other forms of loneliness change. Martín-María et al.[18] discovered that individuals with increased loneliness and stably higher levels of loneliness had worse current health compared to those experiencing other forms of loneliness changes, according to a nationwide tracking survey in Spain. Similar to these studies, self-care during the end of life for older adults is a specific manifestation of health status, so changes in their daily loneliness may also affect their end-of-life self-care.

Loneliness at the end of life

End-stage disease symptoms exacerbate patients' feelings of loneliness at end-of-life

In terms of symptoms of end-stage diseases, Song et al. [19]found that hypertension and diabetes did not affect the loneliness of older adults in normal times. However, as these chronic diseases progressed to end-stage symptoms, they elicited stronger loneliness. For patients with end-stage chronic obstructive pulmonary disease, symptoms like shortness of breath and limited limb movement exacerbate feelings of loneliness [20]; for patients with advanced oesophageal cancer, the disease restricts normal social

interaction and difficulties in eating and drinking enhance patients' feelings of loneliness [21]. Some studies have also analysed symptoms and psychological changes at various stages of cancer and found that the various rapidly progressing symptoms of end-stage cancer can exacerbate patients' feelings of isolation and fear [22].

Symptoms of end-stage disease reduce older adults' end-of-life self-care ability

Pain reduces self-care ability in older people [23], [24], and end-stage illnesses tend to intensify patients' feelings of pain. McCarthy et al. [25] based on a study of 1,066 cancer patients, noted that 25% of them endured severe pain between the first three days and six months before death, while 40% experienced severe pain in the final three days before death. Frailty amplifies the probability of prolonged bed rest in older adults, decreasing their end-of-life self-care ability. Among those with the highest frailty scores, men are more prone to more than 30 days of bed rest accompanied by a painful death, while women are more likely to experience more than 30 days of bed rest without a painful death [26]. Symptoms of respiratory diseases can impair self-care ability in older adults [27],[28], and these symptoms tend to worsen as individuals approach the end of life.

Current studies

A literature review reveals that symptoms of end-stage illness exacerbate loneliness and reduce end-of-life self-care among older people. However, end-of-life illness symptoms in older people are the ultimate manifestation of ongoing deterioration in everyday physical health. This decline in physical health is closely related to feelings of loneliness among older people during everyday life. Therefore, the contributing factors to the lower end-of-life self-care ability of the elderly extend beyond the diseases they are afflicted with. They are also closely related to the progression of these diseases during daily life and the impact of loneliness on disease progression. This paper aims to investigate whether loneliness has an impact on the daily health status of older people and their end-of-life self-care ability. Specifically, it aims to explore the concept of 'another kind of lonely death' from the perspective of psychological development.

The Distance to Death Perspective is a methodology used to observe the psychological and physiological development of older adults and the factors influencing this development by tracing them over a period of four, six, or more years leading up to the end of life. The Distance to Death Perspective has been more widely used in the field of psychology, as seen in studies by Gerstorf et al.[29] on the life satisfaction of older adults before death and by Diegelmann et al.[30] on the heterogeneity of depression development in older adults up to 10 years before dying. This study utilises the Distance to Death perspective to combine the psychological developmental history of older adults with their end-of-life state. Its objective is to understand the differences in end-of-life self-care ability among older adults in relation to the development of loneliness in their usual lives.

Methodology

Sample sources

The Chinese Longitudinal Healthy Longevity Survey (CLHLS) is a follow-up survey of the elderly organised by the Centre for Healthy Ageing and Development of Peking University. The survey targets elderly people aged 65 and above, as well as adult children aged 35-64. The questionnaire is divided into two types: one for surviving respondents and the other for family members of deceased elderly people. The survey project has been conducted periodically since its baseline in 1998, with follow-up surveys in 2000, 2002, 2005, 2008-2009, 2011-2012, 2014 and 2017-2018. In 2008, the survey included 16,954 samples, with 5,620 deaths reported by the time of the 2011 follow-up, 2,485 deaths by the 2014 survey, and 1,478 deaths by the 2018 survey. This study focuses on individuals who were consistently followed up in the 2008-2014 surveys and had passed away by the time of the 2018 follow-up. Therefore, a total of 1,478 samples were included in this study.

Measure

Loneliness

Loneliness was measured using a single question, "Do you often feel lonely or isolated?" This question was measured on a 5-point Likert scale ranging from 1 (always) to 5 (never)). Previous studies have utilized this single-question measure of loneliness and have validated its good reliability and validity [31].

End-of-life self-care ability

End-of-life self-care refers to the overall self-care ability of an older person two years before death. On the one hand, it is measured using a composite indicator of "end-of-life self-care ability", which is based on six questions in a questionnaire examining "bathing", "dressing", "going to the toilet", "indoor activities", "Control of urination and defecation", and "self-feeding". On the other hand, it was measured using an objective indicator to determine "whether the person was bedridden for more than 30 days before death".

Control variable

Many studies have shown that end-of-life self-care in older adults is influenced by the environment at the time of death, with dying at home often preferable over at the hospital. At the same time, various diseases contribute to the suffering of the elderly, so the control variables include:" death at home or not", "lived alone or not ", "Marital status ", and "whether or not the elderly had suffered from diseases before death." Among them, "whether or not the elderly had suffered from diseases before death" refers to whether they had been hospitalised or bedridden at home due to illnesses from the last survey in 2014 until their death, excluding cases of prolonged bedridden status or those at the end of their lives. In addition, since loneliness during daily life interacts with self-rated health, as shown in the literature review, this paper uses the "mean value of self-rated health over the three survey periods" (hereafter referred to as "self-rated health") to represent the health status of older people in their day-to-day lives.

Elderly individuals with higher socio-economic status are expected to receive better disease treatment and end-of-life symptom management. This paper controls for socioeconomic variables including "urban residence or not", "availability of pension insurance", "pension amount" and "years of schooling" among older adults. Additionally, demographic variables, such as age at death and sex, are also controlled for.

Methods of analysis

Descriptive statistics were used to observe the overall trend of changes in loneliness among older adults from 2008 to 2014, as well as the basic factors affecting their end-of-life self-care ability. Secondly, the prevalence of loneliness among older adults has been increasing over time, albeit with heterogeneity in the trend among different older adults. To analyse this heterogeneity, the paper introduces the Latent Class Growth Model (LCGM) based on the cohort. Model fit was evaluated using information evaluation metrics such as AIC, BIC, and aBIC, with smaller values indicating better fit. Additionally, the Entropy index, which ranges from 0 to 1, was used to measure classification accuracy, where values closer to 1 suggest higher accuracy. Regarding the selection of model categories for the LCGM model, the significant likelihood ratio metrics (LMR and BLRT) suggest that a model with k categories is superior to one with k-1 categories. Third, considering the heterogeneity in loneliness among older adults, this paper examines the relationship between different forms of loneliness changes and older adults' end-of-life self-care ability using logistic regression. Additionally, path analysis is used to investigate the specific mechanism of the effect of loneliness changes on end-of-life self-care ability.

Result

Descriptive statistics

Table 1 shows that among the deceased elderly, 51.7% were women and 48.3% were men. A significant proportion of the sample passed away at an advanced age, with 26.6% aged between 80-89 years and 41.0% aged between 90-99 years. In terms of educational attainment, the majority had no schooling (60.4%), while 31.7% had primary education. The data shows that the majority reside in towns or villages (87.8%), with only a small percentage living in cities (12.2%). Additionally, 23.6% were married at the time of death, while 76.4% had other marital statuses. Roughly equal proportions participated in old-age insurance (48.2%) and did not (51.8%). Most (73.6%) lived with others, while 26.4% lived alone. The majority (88.3%) passed away at home, with the remaining 11.7% passing away in other locations. Among those who passed away, 64.5% suffered serious illness before death, 18.4% were completely self-sufficient, and 24.5% were unable to take care of themselves.

Table 2 shows a significant change in the severity of loneliness among older individuals from 2008 to 2014. In 2008, 37.8% reported no feelings of loneliness, a percentage that decreased to 29.2% in 2014. The majority of those reporting loneliness felt 'rarely lonely' or 'sometimes lonely', accounting for 54.1% in 2008 and increasing to 62% in 2014. The minimum proportion (8.2%) of older people reported frequent or constant feelings of loneliness and showed little change (8.8%) by 2014. Table 3 shows a decline in the proportion of people rating their health as 'very good' and 'good' from 52.5% in 2008 to 37.9% in 2014.

Conversely, the proportion of those rating their self-assessed health as 'poor' and 'very poor' increased from 14.6% in 2008 to 22.2% in 2014.

Table 1 Descriptive statistics of the sample

	subcategory	N	Percentage/mean
N	/	1423	/
Live alone or not	Yes	376	26.4
	No	1047	73.6
place of death	Home	1257	88.3
	Others	166	11.7
Seriously ill before death	Yes	505	35.5
	No	918	64.5
Self-care ability before death	/	1423	3.6
Sex	Male	687	48.3
	Female	736	51.7
Age of Death	65-69	2	0.2
	70-79	152	10.7
	80-89	376	26.6
	90-99	580	41.0
	100 above	304	21.5
Number of years of schooling	No Schooling	859	60.4
	Primary School	451	31.7
	Junior Middle School	76	5.5
	High School	25	1.8
	University and above	10	0.7
Residence	City	173	12.2
	Others	1250	87.8
Marital Status	Married	336	23.6
	Others	1087	76.4
Pension insurance before death	Participated	686	48.2
	Non-participation	737	51.8

Amount of pension	Less than 1,000	708	72.7
	1000- 1999	96	10.5
	2000- 2999	89	8.5
	3000and above	81	8.3

Table 2 Change in loneliness among older persons, 2008-2014 (%)

Degree of loneliness	2008	2011	2014
Always lonely	2.0	1.6	1.6
Often lonely	6.2	5.6	7.2
Sometimes lonely	21.4	23.4	28.2
Rarely lonely	32.7	36.5	33.8
Never lonely	37.8	32.8	29.2

Table 3 Change in self-rated health of older persons, 2008-2014 (%)

Self-rated health	2008	2011	2014
Very good	12.5	10.4	5.8
Good	40.0	33.2	32.1
Average	32.9	36.3	39.9
Bad	13.3	19.0	19.2
Very bad	1.3	1.2	3.0

Group-based growth model

To better reflect the internal heterogeneity of changes in loneliness, this section introduces the group-based growth model to investigate the trend of loneliness among older adults. Table 4 shows that the three-category fit outperformed the two-category one, as indicated by the significant LMR and BLMR, along with increasing Entropy, while the AIC, BIC, and aBIC continued to decrease. The AIC, BIC, and aBIC values increased in category four compared to category three, indicating that category four was less well-fitted. In category five, although the AIC, BIC, and aBIC values are on the decline, the LMR of the model in category five was not significant. Therefore, the three-category model in LCGM was selected as the analytical tool for subsequent analyses in this paper.

Table 4 LCGM model fitting information

Categories	LL	AIC	BIC	aBIC	LMR	BLRT	Entropy
2C	-5839.62	11695.25	11737.33	11711.92	0.0013	0.0000	0.61
3C	**-5799.18**	**11620.37**	**11678.23**	**11643.29**	**0.0404**	**0.0000**	**0.68**
4C	-5764.35	11626.37	11700.01	11655.54	0.0384	0.0000	0.75
5C	-5743.79	11521.58	11611.00	11557.00	0.0564	0.0000	0.75

Fig. 1 illustrates the classification of changes in loneliness among older people into three groups using the LCGM model. The largest group (61.9%) is characterized as the 'not lonely group,' which has maintained low levels of loneliness from the first measurement in 2008 to the final measurement in 2014. The second group, the 'rising loneliness group', accounts for the second-largest share (30.8%). Loneliness was low in the first survey (2008), but it gradually increased in both the second (2011) and third (2014) surveys, i.e. older people were becoming 'lonelier'. The third and smallest group (7.3%) is the decreasing loneliness group. Members of this group had a high level of loneliness in the first survey (2008) but saw a gradual decrease in loneliness gradually over the second survey (2011) and the third survey (2014). It is evident that the majority do not feel lonely. However, there is an increase over time in the number of older people experiencing loneliness, with minimal reduction among those whose loneliness decreases.

Regression analysis

Table 5 shows that increased loneliness among older adults correlates with a higher likelihood of being chronically bedridden at the end of life compared to those in the non-lonely group. Surprisingly, falling loneliness did not decrease but rather increased the probability of chronic bedriddenness in older adults. Conversely, those not lonely exhibited a significantly lower probability of chronic bedriddenness at the end of life compared to the other groups. Among the control variables, the probability of being bedridden at the end of life was significantly higher for those seriously ill compared to those not. Model 2's -2log likelihood decreased upon the addition of the variable 'serious illness before dying', indicating an enhanced explanatory power compared to Model 1. The significance levels for the prediction of long-term bedriddenness decreased in both the groups that experienced an increase and a decrease in loneliness. The significance of loneliness in both groups could be partially explained by the component of 'serious illness at the end of life'. The -2loglikelihood of Model 3 continued to decrease with the inclusion of 'self-rated health', indicating a further enhancement in the explanatory power of the model.

In Model 4, older adults categorized in the non-lonely group underwent a significant reduction in their end-of-life self-care inability when 'serious illness before dying' and 'self-rated health' were not factored in. In Model 5, the inclusion of 'serious illness before dying' gave rise to a significant decrease in the -2 log likelihood, indicating an enhancement in the model's explanatory power. Similarly, in Model 6, the inclusion of 'self-rated health' led to a continued decrease in -2log likelihood and a decrease in the significance level of the non-loneliness group's prediction of long-term bed rest. The significance level for the non-lonely group's prediction of long-term bedriddenness also declined. Among the control variables,

older adults who lived alone exhibited a lower probability of chronic bedriddenness at the end of life. In conclusion, the impact of changes in loneliness on chronic bedriddenness at the end of life became less significant when the influence of 'self-rated health' or 'serious illness at the end of life' was factored in. This suggests that the physical health of older adults may serve as a potential pathway through which changes in loneliness contribute to chronic bedriddenness at the end of life.

Table 5 Effect of changes in loneliness on prolonged bedriddenness at end of life

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sex (Female)	-0.205	-0.223	-0.219	-0.236	-0.236	-0.249
Years of Schooling	0.001	0.001	0.001	-0.001	-0.001	0.001
Urban residence (town and rural area)	0.173	0.172	0.189	0.155	0.155	0.172
Age of Death	0.005	0.008	0.009	0.004	0.004	0.009
Married (Other marital status)	0.106	0.072	0.073	0.11	0.078	0.079
Participation in pension insurance (non-participation)	-0.035	-0.061	-0.066	-0.04	-0.065	-0.07
Amount of pension	0.000	0.000	0.000	0.000	0.000	0.000
Live alone (Non-living alone)	-0.275+	-0.257+	-0.271+	-0.268+	-0.251+	-0.266+
Died at home (Other places)	0.197	0.235	0.247	0.178	0.214	0.228
Illness before dying (No illnesses)		0.392*	0.372**		0.391**	0.371**
Self-rated health			0.124			0.133
Loneliness Rising Group (Not Alone Group)	0.229**	0.229*	0.204*			
Loneliness Decline Group (Not Alone Group)	1.214***	1.216**	1.177**			
Not Alone Group (Other Groups)				-0.364**	-0.365**	-0.335*
Constant	-0.91	-1.334	-1.797	-0.622	-0.884	-1.417
-2loglikelihood	1303.98	1295.96	1294.23	1313.62	1305.53	1303.48

Note:+ P 0.1;*P 0.05;**P 0.01;***P 0.001

As shown in Table 6, increased loneliness and decreased loneliness significantly weakened the end-of-life self-care ability of the elderly, and the absence of loneliness significantly increased this ability. Compared with Model1 and Model2, the R of the model increased significantly upon the inclusion of "serious illness before dying," and the significance level of the effect of increasing loneliness and decreasing loneliness on the elderly's self-care ability began to decrease. Model 3 showed results similar to Model 2 without significant changes. In terms of the other control variables, men had a better end-of-life self-care ability compared to women, and older people who lived alone displayed a superior end-of-life self-care ability.

In Model 4, the probability of end-of-life self-care inability is significantly lower for older adults in the non-loneliness group when "serious illness before dying" and "self-rated health" are not included. The addition of "serious illness before dying" in Model 5 significantly increases R, suggesting an increased explanatory power of the model. Model 6 showed that the significance level of the prediction of loneliness on the end-of-life self-care ability of older adults decreased significantly after the addition of "self-rated health". In conclusion, after adding "self-rated health" or "serious illness before dying", the significance of changes in loneliness on elderly people's end-of-life self-care ability is weakening, i.e., elderly people's physical health may serve as a potential pathway through which changes in loneliness affect their end-of-life self-care ability.

Table 6 Effect of changes in loneliness on self-care at the end of life

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sex (Female)	-0.378*	-0.408*	-0.402*	-0.396*	-0.425**	-0.418**
Years of Schooling	0.023	0.024	0.025	0.022	0.023	0.024
Urban residence (town and rural area)	0.085	0.082	0.102	0.076	0.072	0.094
Age of Death	0.002	0.007	0.010	0.002	0.007	0.010
Married (Other marital status)	-0.119	-0.176	-0.175	-0.116	-0.174	-0.173
Participation in pension insurance (non-participation)	0.286*	0.242	0.236	0.284+	0.239	0.233
Amount of pension	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
Live alone (Non-living alone)	-0.507**	-0.474**	-0.491**	-0.506**	-0.473**	-0.490**
Died at home (Other places)	0.035	0.098	0.114	0.024	0.088	0.105
Illness before dying (No illnesses)		0.691***	0.663***		0.693***	0.665***
Self-rated health			0.167+			0.173+
Loneliness Rising Group (Not Alone Group)	0.224**	0.222*	0.187*			
Loneliness Decline Group (Not Alone Group)	0.736*	0.718*	0.661*			
Not Alone Group (Other Groups)				-0.299*	-0.294*	-0.255+
Constant	3.305	2.561	1.940	3.652	2.900	2.216
R	0.182	0.231	0.237	0.176	0.226	0.233

Note:+ P 0.1;*P 0.05;**P 0.01;***P 0.001

Path analysis

The above analyses suggest that changes in loneliness may have an impact on older people's end-of-life self-care ability, with this influence potentially mediated by health status. Therefore, in this section, the variable of "self-rated health" was introduced to further explore the underlying mechanism through path analysis. First, as shown in Fig. 2, the highest proportion of older adults (61.9%) belongs to the non-lonely group, characterized by better self-rated health. This significantly reduces the probability of end-of-life bedriddenness and significantly improves the end-of-life self-care ability of older adults. Secondly, the previous analysis revealed that a large proportion (30.8%) of older persons were "becoming lonely", which, as shown in Fig. 3, led to a decline in self-rated health, which further increased the probability of bedriddenness and end-of-life self-care inability.

Finally, older people with declining loneliness are the least represented of the three categories (7.3%), and this group of older people has a unique pattern of changes in loneliness compared to the other two categories. Fig. 4 shows a positive correlation between self-rated health and declining loneliness. The analysis of the previous two categories of older adults suggests that declining loneliness in older adults is accompanied by declining self-rated health, a conclusion inconsistent with established facts. One possible explanation for the decline in loneliness among older people is a passive decline due to much attention from family members as a result of their poor self-rated health. This form of care, although passive, reduces older people's feelings of loneliness. Regarding end-of-life autonomy, the reduction in loneliness does not positively impact older individuals due to disadvantages resulting from a prolonged history of poor self-assessed health. As a result, older individuals may still experience low end-of-life autonomy.

Discussion and Conclusion

This paper analyses the effect of changes in loneliness on the end-of-life self-care ability of older adults, using data from CLHLS between 2008 and 2014. The study found that the non-lonely group showed a significant increase in end-of-life self-care ability. In contrast, an increase in loneliness significantly decreased the end-of-life self-care ability of older adults. It is noteworthy that contrary to popular belief, loneliness alleviation also weakens end-of-life self-care ability among older adults.

Further research has identified similarities in the mechanisms affecting end-of-life self-care ability between non-lonely older people and those who suffered increased loneliness. Higher levels of loneliness had detrimental effects on the health of older people, which in turn reduced their end-of-life self-care ability. Conversely, lower levels of loneliness increased health gains for older adults, resulting in enhanced end-of-life self-care performance. For older people with reduced loneliness, the mechanism behind the decline in end-of-life self-care ability is the attention they receive as a result of their deteriorating health. However, decreased loneliness does not fully reverse the continued trend of health deterioration and ultimately reduces end-of-life self-care ability.

Lonely death, in the general sense, is a phenomenon where an older person is left unattended at the end of life and unnoticed for a period of time after death. However, this study has found that both loneliness at the time of death and daily loneliness have a significant negative impact on the quality of death (end-of-life self-care ability). Therefore, this kind of lonely death is different from the traditional ones as "another kind of lonely death". As shown in Fig. 5, the difference in self-rated health between the 'rising loneliness group' and the 'non-lonely group' was relatively small in 2008. However, over time, older adults in the 'rising loneliness' group underwent a significantly faster decline in self-rated health than those in the 'non-lonely' group. This suggests that adult children or other caregivers of older people may initially believe that less attention is required as the older adult appears to be in good health. Thus, they overlook the detrimental effects of persistent loneliness on older people's health, which ultimately develops into a negative impact on their end-of-life self-care ability.

This study also found a subset of older adults who did not meet the traditional definition of loneliness or 'another kind of loneliness.' For this group, the decline in loneliness was a result of 'passive attention' in the context of deteriorating health conditions. As shown in Fig. 5, compared with the other two loneliness groups, the mean self-rated health scores of the loneliness decline group in 2008 were significantly lower than those of the other two groups, further confirming that the declining loneliness in this group was a consequence of early-stage physical health deterioration. From the mechanisms of 'another kind of lonely death' and 'death from attention', most Chinese caregivers emphasise 'medical care' for the elderly but neglect 'spiritual care' or 'emotional care'. By the time caregivers turn attention to the mental health of older people, they may already be suffering from a variety of illnesses that require long-term care, which has a significantly negative impact on their end-of-life self-care ability.

This paper has some limitations. Firstly, this study used the LCGM to map the trajectory of changes in loneliness among older adults, but premature deaths among older adults and sample loss during data collection are inevitable factors that influence the findings. Secondly, in terms of mechanism analyses, this paper argues that self-assessed health influences changes in loneliness among older adults or that changes exert some influence on self-assessed health, which generates differences in end-of-life self-care ability of older adults. However, self-assessed health is merely one of the variables affecting loneliness among the elderly. There are many deeper mechanisms that remain to be further explored.

Declarations

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Author’s contributions

Shubin Li was responsible for the conceptual framework, literature review, data processing, writing the first draft and revising the manuscript of this paper. Yu Zhu was responsible for reviewing the manuscript and making critical revisions.

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Availability of data and materials

Data are available on the official website of the Chinese Longitudinal Healthy Longevity Survey.

Ethics approval and consent to participate

This study used externally available de-identified samples and these data were ethically approved and publicly available prior to release.

Consent for publication

Not applicable.

Competing interests

None.

References

1. Allison A. Precarious Japan[M]. Duke University Press, 2014.
2. NAGAI Yujiro. Study on Group Living Part1 Observations of Lifestyles in Group Living Z . Summaries of technical papers of Annual Meeting Architectural Institute of Japan 2010 1443-1444.
3. Yonhap . Statistics: Number of lonely deaths in Korea increased by 40% in the past five years.2002.
4. Liu G, Dupre M E, Gu D, et al. Psychological well-being of the institutionalized and community-residing oldest old in China: The role of children[J]. Social Science & Medicine, 2012, 75(10): 1874-1882.https://doi.org/10.1016/j.socscimed.2012.07.019
5. Cohen-Mansfield J, Shmotkin D, Goldberg S. Loneliness in old age: longitudinal changes and their determinants in an Israeli sample[J]. International psychogeriatrics, 2009, 21(6): 1160-1170. https://doi.org/10.1017/S1041610209990974
6. Taube E, Kristensson J, Sandberg M, et al. Loneliness and health care consumption among older people[J]. Scandinavian journal of caring sciences, 2015, 29(3): 435-443. https://doi.org/10.1111/scs.12147
7. Hawkley L C, Kocherginsky M. Transitions in loneliness among older adults: A 5-year follow-up in the National Social Life, Health, and Aging Project [J]. Research on Aging, 2018, 40(4): 365-387.https://doi.org/10.1177/0164027517698965
8. Warner D F, Adams S A. Physical disability and increased loneliness among married older adults: The role of changing social relations[J]. Society and Mental Health, 2016, 6(2): 106-

128.https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6469865/

9. Murray S A, Kendall M, Boyd K, et al. Illness trajectories and palliative care[J]. Bmj, 2005, 330(7498): 1007-1011. https://doi.org/10.1136/bmj.330.7498.1007
10. Murray S A, Kendall M, Grant E, et al. Patterns of social, psychological, and spiritual decline toward the end of life in lung cancer and heart failure[J]. Journal of pain and symptom management, 2007, 34(4): 393-402. https://doi.org/10.1016/j.jpainsymman.2006.12.009
11. Kuiper J S, Zuidersma M, Voshaar R C O, et al. Social relationships and risk of dementia: A systematic review and meta-analysis of longitudinal cohort studies[J]. Ageing research reviews, 2015, 22: 39-57.https://doi.org/10.1016/j.arr.2015.04.006
12. Singh A, Misra N. Loneliness, depression and sociability in old age[J]. Industrial psychiatry journal, 2009, 18(1): 51. https://doi.org/10.4103/0972-6748.57861
13. Greenfield E A, Russell D. Identifying living arrangements that heighten risk for loneliness in later life: Evidence from the US National Social Life, Health, and Aging Project[J]. Journal of Applied Gerontology, 2011, 30(4): 524-534.https://doi.org/10.1177/0733464810364985
14. Luo Y, Hawkley L C, Waite L J, et al. Loneliness, health, and mortality in old age: A national longitudinal study[J]. Social science & medicine, 2012, 74(6): 907-914. https://doi.org/10.1016/j.socscimed.2011.11.028
15. Valtorta N K, Kanaan M, Gilbody S, et al. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies[J]. Heart, 2016, 102(13): 1009-1016. https://pubmed.ncbi.nlm.nih.gov/27091846/
16. Holt-Lunstad J, Smith T B. Loneliness and social isolation as risk factors for CVD: implications for evidence-based patient care and scientific inquiry[J]. Heart, 2016, 102(13): 987-989.https://doi.org/10.1177/1745691614568352
17. Harris R A, Qualter P, Robinson S J. Loneliness trajectories from middle childhood to pre-adolescence: Impact on perceived health and sleep disturbance[J]. Journal of adolescence, 2013, 36(6): 1295-1304. https://doi.org/10.1016/j.adolescence.2012.12.009
18. Martín-María N, Caballero F F, Miret M, et al. Differential impact of transient and chronic loneliness on health status. A longitudinal study[J]. Psychology & Health, 2020, 35(2): 177-195. https://doi.org/10.1080/08870446.2019.1632312
19. Song J, Wu H, Lan H, et al. The influence of disease status on loneliness of the elderly: evidence from rural China[J]. International Journal of Environmental Research and Public Health, 2022, 19(5): 3023. https://pubmed.ncbi.nlm.nih.gov/35270713/
20. Kinoshita H, Maeda I, Morita T, et al. Place of death and the differences in patient quality of death and dying and caregiver burden[J]. Journal of clinical oncology, 2015, 33(4): 357-363. https://doi.org/10.1200/JCO.2014.55.7355
21. Laursen L, Schønau M N, Bergenholtz H M, et al. Table in the corner: a qualitative study of life situation and perspectives of the everyday lives of oesophageal cancer patients in palliative care[J]. BMC palliative care, 2019, 18(1): 1-10.https://doi.org/10.1186/s12904-019-0445-2

22. Coward D D. Constructing meaning from the experience of cancer[C]//Seminars in Oncology Nursing. WB Saunders, 1997, 13(4): 248-251.https://doi.org/10.1016/S0749-2081(97)80019-8
23. van Dalen-Kok A H, Pieper M J C, de Waal M W M, et al. Association between pain, neuropsychiatric symptoms, and physical function in dementia: a systematic review and meta-analysis[J]. BMC geriatrics, 2015, 15(1): 1-18.https://doi.org/10.1186/s12877-015-0048-6
24. Cole C S, Carpenter J S, Blackburn J, et al. Pain trajectories of nursing home residents[J]. Journal of the American Geriatrics Society, 2023, 71(4): 1188-1197.https://doi.org/10.1111/jgs.18182
25. McCarthy E P, Phillips R S, Zhong Z, et al. Dying with cancer: patients' function, symptoms, and care preferences as death approaches[J]. Journal of the American Geriatrics Society, 2000, 48(S1): S110-S121.https://doi.org/10.1111/j.1532-5415.2000.tb03120.x
26. Dupre M E, Gu D, Warner D F, et al. Frailty and type of death among older adults in China: prospective cohort study[J]. Bmj, 2009, 338. https://doi.org/10.1136/bmj.b1175
27. Fong J H. Disability incidence and functional decline among older adults with major chronic diseases[J]. BMC geriatrics, 2019, 19(1): 1-9. https://doi.org/10.1186/s12877-019-1348-z
28. Kogure E, Ohnuma T, Sugita Y, et al. Comparison of respiratory function, physical function, and activities of daily living among community-dwelling patients with respiratory and non-respiratory disease[J]. Journal of Physical Therapy Science, 2022, 34(3): 213-217.https://doi.org/10.1589/jpts.34.213
29. Gerstorf D, Ram N, Estabrook R, et al. Life satisfaction shows terminal decline in old age: longitudinal evidence from the German Socio-Economic Panel Study (SOEP)[J]. Developmental psychology, 2008, 44(4): 1148. https://doi.org/10.1037/0012-1649.44.4.1148
30. Diegelmann M, Schilling O K, Wahl H W. Feeling blue at the end of life: Trajectories of depressive symptoms from a distance-to-death perspective[J]. Psychology and Aging, 2016, 31(7): 672.https://doi.org/10.1037/pag0000114
31. Luo Y, Waite L J. Loneliness and mortality among older adults in China[J]. Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 2014, 69(4): 633-645.https://doi.org/10.1093/geronb/gbu007

Figures

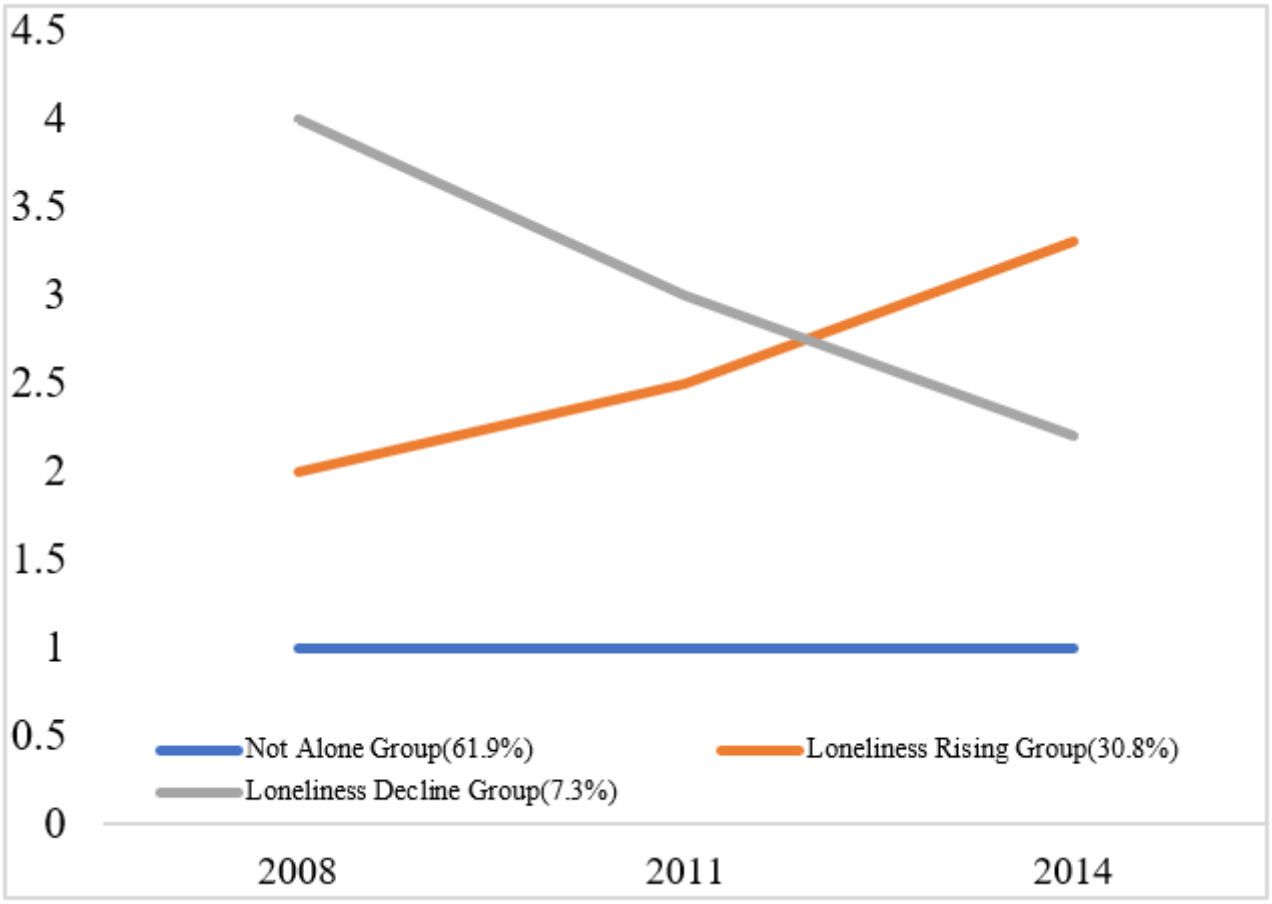

Figure 1

Graph of the LCGM showing changes in loneliness in older adults

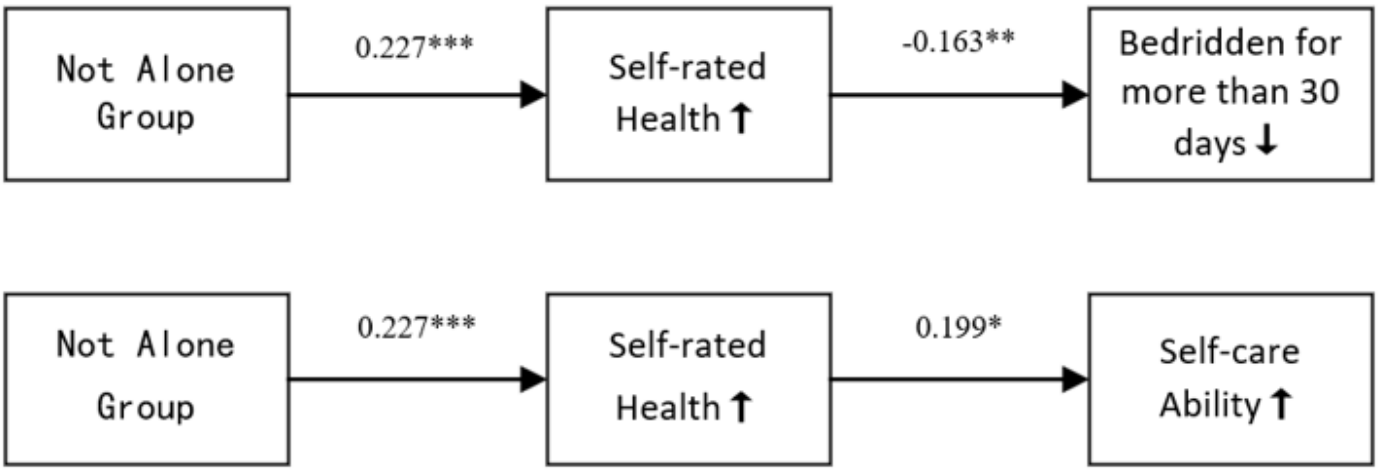

Figure 2

Effect of the non-lonely group on end-of-life self-care ability

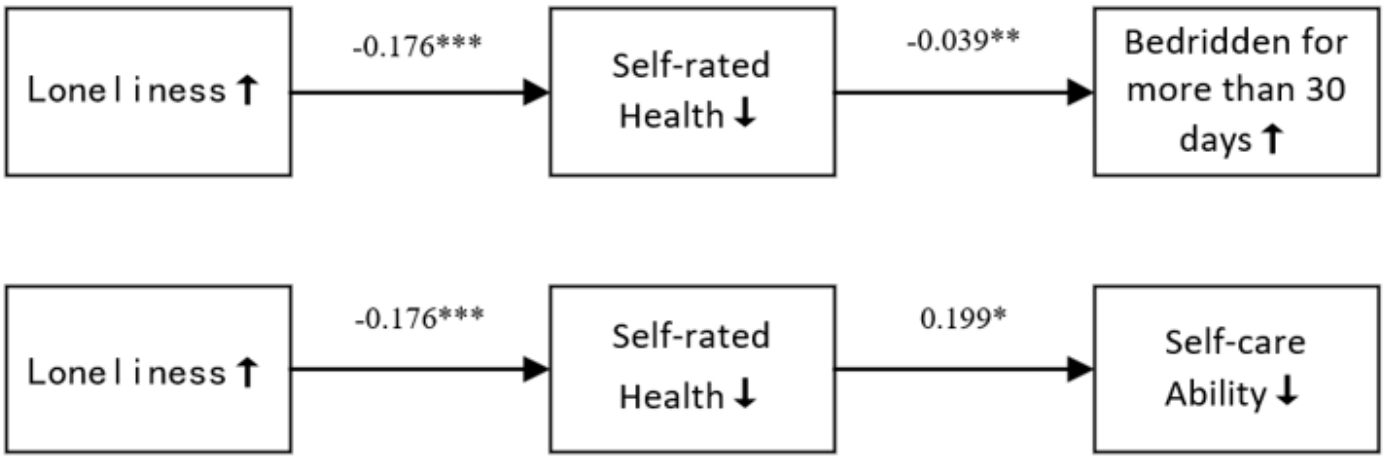

Figure 3

Effect of rising loneliness group on end-of-life self-care ability

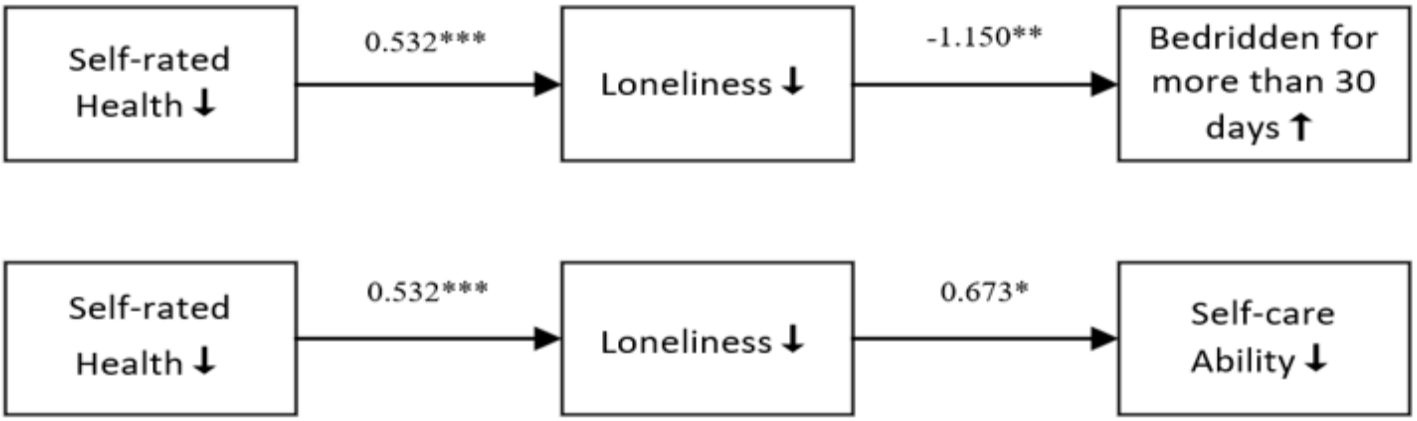

Figure 4

Effect of declining loneliness on end-of-life self-care ability

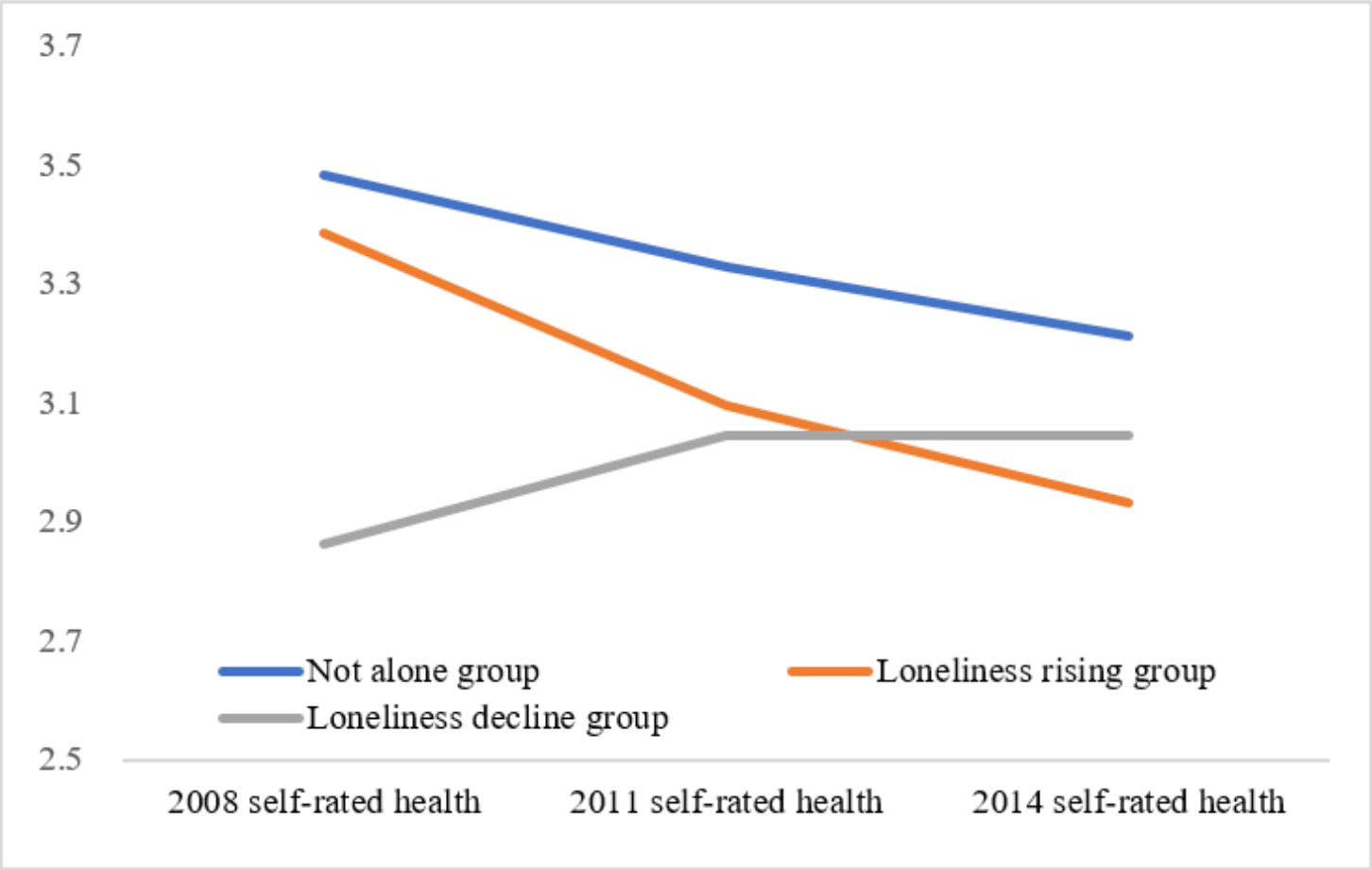

Figure 5

Changes in self-rated health across loneliness groups