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Effects of transient versus chronic loneliness on cognitive function in older adults: Findings from the Chinese Longitudinal Healthy Longevity Survey

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Abstract

Objectives—Loneliness is a risk factor for poor cognitive function in older adults (OAs), however, to date, no studies have explored whether transient and chronic loneliness have differential effects on OAs' cognitive function. The present study evaluates the impacts of transient versus chronic loneliness on cognitive function in OAs.

Design—A 6-year follow-up cohort study.

Setting—Rural and urban communities of 23 provinces in China.

Participants—2995 OAs who were cognitively healthy (the modified Mini-mental State Examination [mMMSE] ≥ 14) and completed the 2005, 2008 and 2011 waves of the Chinese Longitudinal Healthy Longevity Survey.

Measurements—Self-report loneliness and mMMSE.

Results—Both transient ($\beta = -0.389$, $t = -2.191$, $df = 2994$, $P = 0.029$) and chronic loneliness ($\beta = -0.640$, $t = -2.109$, $df = 2994$, $P = 0.035$) were significantly associated with lower mMMSE scores six years later, net of potential confounding effects of baseline covariates. Sensitivity analyses found that regression coefficients of mMMSE scores on transient loneliness were statistically significant and relatively stable across samples with various levels of cognitive function. In contrast, coefficients of mMMSE scores on chronic loneliness were statistically significant only among samples with normal cognitive function and the absolute values of these coefficients increased with the degree of cognitive health of the analytic sample. In the sample with mMMSE ≥ 21 , the coefficient of chronic loneliness was 2.59 times as large as that of transient loneliness (-1.017 versus -0.392).

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Conclusions—Both transient and chronic loneliness are significant predictors of cognitive decline in OAs. Relative to transient loneliness, chronic loneliness has more pronounced negative effects on the brain health of OAs.

Keywords

Cognitive function; dementia; loneliness; older adults; China; prevention

BACKGROUND

In 2013, an estimated 200 million Chinese people, 15% of China's population, were aged 60 or older¹. By 2050, this number is expected to reach 483 million, representing nearly 1/3 of China's population¹ and 1/4 of the world's elderly population². In parallel with this rapid aging, the number of Chinese older adults (OAs) with dementia is projected to increase from approximately 9 million in 2010 to 18 million in 2030^{3, 4}. Dementia is one of the major causes of disability and dependency among OAs worldwide². It also imposes a huge burden of long-term care on families and society and poses serious threats to the health and quality of life of patients' caregivers². The overwhelming disease burden has made the prevention and treatment of late-life dementia public health priorities for China. However, at present, there is still no cure for dementia, thus many efforts have been made aiming to identify modifiable factors that may prevent or slow the progression of cognitive decline⁵.

Social connectedness is one factor that has shown promise in recent studies for preventing or delaying cognitive decline⁶. Most of these studies utilized objective indices of social connectedness (e.g., marital status, living arrangements, social network size and frequency of social contacts) but presented highly inconsistent results on their associations with cognitive function⁷. For example, some studies found that never having married, small social network size, and social isolation significantly increased the risk of developing dementia and cognitive impairment⁸⁻¹⁰, whereas others found these factors were not significant predictors of cognitive decline and dementia^{7, 11-14}. In contrast, the association of loneliness, a subjective measure of social connectedness, with dementia and cognitive decline is consistently reported across the few existing prospective studies^{10, 14-16}. Because loneliness is the inner experience of social disconnectedness, socially isolated people are less likely to report feeling lonely if they actually prefer to be alone, and others who have frequent social contacts could still feel lonely if they find no satisfaction with their friendships. Therefore, loneliness is a reliable predictor of cognitive decline relative to other objective measures of social connectedness and could be regarded as a novel modifiable target for interventions designed to prevent dementia and cognitive decline.

Loneliness is an emotional state resulting from perceived deficiencies in one's social relationships¹⁷. It is subject to influence by environmental factors (e.g., bereavement and migration) as well as characteristics of the individual such as their health status and personality¹⁸. OAs' level of loneliness, therefore, is likely to vary over time in some individuals (referred to here as "transient" loneliness) while it is constant in others ("chronic" loneliness)¹⁹. Studies to date, however, have focused predominantly on the relationship between cognitive impairment and severe/frequent loneliness¹⁵. Very few

concern the persistence of loneliness over time. One exception is a 4-year cohort study showing that “chronically lonely” OAs had greater mortality risk than “situationally lonely” OAs²⁰. It remains unclear, however, whether transient and chronic loneliness have differential impacts on cognitive function among OAs.

Loneliness is potentially modifiable by a variety of psychosocial interventions. Therefore, a greater understanding of the relationship between loneliness and cognitive decline may suggest strategies that would help prevent incident dementia, resulting in great public health impact. The present study assessed the prospective effects of transient versus chronic loneliness on cognitive function. Since we consider that loneliness should act cumulatively to increase a person’s vulnerability to cognitive decline, we hypothesized that compared to transient loneliness, persistent exposure to loneliness would lead to more severe cognitive deficits.

METHODS

Data and subjects

The Chinese Longitudinal Health Longevity Study (CLHLS) is a dynamic cohort study of a nationally representative sample of rural and urban community-residing OAs living in 22 of the 31 provinces in China. The first CLHLS survey was carried out in 1998 and five follow-up surveys with replacement of deceased old people were conducted between 2000 and 2011. Participants take part in a triennial interview that covers a range of topics including demographic characteristics, socioeconomic status, lifestyle, loneliness, cognitive function and health. Individual interviews are conducted by trained investigators and occur at the respondents’ home. Further details regarding the study design, sampling, measures and data quality of the CLHLS are provided elsewhere²¹.

The current study used data from the fourth-wave (2005, “baseline” for this study), fifth-wave (2008) and sixth-wave (2011). Participants who completed all three waves, and provided complete data on loneliness, mMMSE, and covariates were included. Those respondents who were under age 65 years at baseline, added to replace deceased respondents, and died or were lost to follow up were excluded. Because subjects who had been cognitively impaired are unlikely to answer questions accurately at baseline and may further have more difficulties in providing accurate information on their mental well-being at follow-up, our analysis only included participants who had normal cognitive function (the modified Mini-Mental State Examination [mMMSE] ≥ 14) at baseline. Further, the use of a cognitively healthy sample at baseline potentially satisfies a prerequisite for the causal inference: temporality, for example, cognitive decline must occur after loneliness if we want to test whether loneliness causes cognitive decline. This resulted in an analytic sample of 2995 OAs from 15,638 subjects of the baseline cohort. Figure 1 depicts the flow chart of study sample inclusion and follow-up.

Measures

Outcome variable

Cognitive function: The cognitive function of participants was assessed with a Chinese mMMSE²². The original MMSE has 30 items and tests seven domains of cognitive function: orientation to time, orientation to place, immediate registration, attention & calculation, delayed recall, language and complex command²³. Many Chinese OAs have little formal education, and of those included in the CLHLS, 61.1% were illiterate. Therefore the CLHLS deleted two items of language (write a complete sentence and follow a written instruction to close eyes) from the original version. To make questions easily understandable and practically answerable by OAs, it further deleted one item of orientation to time and four items of orientation to place, and culturally adapted the remaining 23 items^{22, 24}. Each item of the mMMSE is scored 1 if the answer is correct and 0 for an incorrect or “unable to” answer²⁴. The more right answers a respondent has, the better cognitive function he/she will demonstrate. An exploratory factor analysis using 2005 mMMSE data revealed a four-factor structure: orientation (orientation to time and place), memory (registration and delayed recall), attention & calculation (calculation and copying intersecting polygons), and language (repeating phrase, three step command, and naming). A further confirmatory factor analysis (CFA), separately performed using 2008 and 2011 mMMSE data, supported the stability of this four-factor structure over time. Additional second-order CFA based on mMMSE data of each wave found these four seemingly distinct but correlated factors can be accounted for by a common second-order construct, cognitive function. The outcome of this study is the mMMSE score measured at 2011.

Based on previous work with a 30-item MMSE used in China^{25, 26}, we operationally defined a 23-item mMMSE score less than 14 as the indication of cognitive impairment.

Predictor

Loneliness: To assess participants’ subjective feeling of loneliness, the CLHLS uses a single question that asks respondents how often they feel lonely. Response options are “1=never”, “2=seldom”, “3=sometimes”, “4=often” and “5=always”. A single-item self-report measure of loneliness has been successfully used in previous studies^{27, 28}. We first dichotomized the 5-category loneliness item: “never” and “seldom” coded as “not lonely”, and “sometimes”, “often” and “always” coded as “lonely”. Since loneliness is more likely to be under-reported in self-report surveys due to its undesirable nature²⁹, we considered response of “sometimes” as “lonely”. By using the approach described in two previous studies^{20, 30}, the trichotomized loneliness variable was generated through recoding the 2005 and 2008 loneliness variables into three categories: not lonely (not lonely for 2005 and 2008), transiently lonely (lonely in one wave only) and chronically lonely (lonely for both 2005 and 2008). According to this classification, 1726, 1019 and 250 respondents were classified as not lonely, transiently lonely and chronically lonely, respectively.

Covariates—The observed prospective association between loneliness and cognitive function at follow up might be spurious if covariates that contribute to cognitive function are not controlled for. In this study, baseline covariates were measured as follows:

- Sociodemographic factors: gender (0=male, 1=female), age (in years), education (0=no schooling [0 year of education], 1=some schooling [1 year of education]), place of 3=poor, 4=very poor).
- Objective measures of social disconnectedness: marital status (0=never-married, separated, divorced, or widowed, 1= married and living with spouses) and co-residence (0=alone or in an institution, 1=with family members).
- Behavioral variables: 1) physical exercise habits (0=yes, 1=no): “Do you regularly participate in physical exercise?” and 2) current smoking (0=yes, 1=no): “Do you currently smoke?”
- Health-related covariates: 1) interviewer-rated physical health (0=surprisingly healthy, 1= relatively healthy, 2= moderately ill, 3= very ill): the CLHLS requires the interviewer to rate the overall health of the subject at the end of the interview; 2) negative emotion (continuous variable, range: 0-16): the CLHLS used four items on affective experiences to create an index of emotional well-being. Two capture negative affect (anxiety and feeling of uselessness) and two tap positive affect (happiness and optimism)²⁹. These items are rated in a 5-point response format (0= never to 4= always). When computing the total score, the two positive items are reversely coded and then added to the two negative items, so that a higher total score denotes more negative emotion. The composite reliability of this negative emotion scale ranges from 0.58 to 0.65 for the three waves; and 3) Baseline cognitive function: mMMSE score (continuous variable, range: 14-23) measured at 2005.

Analysis

The predictive effect of loneliness on cognitive function was assessed in univariate linear regression with 2011 mMMSE score as the outcome variable and transient and chronic loneliness as predictors, followed by multiple linear regression that entered the two predictors and all prospective relationship between loneliness and cognitive functioning has yet to be established, our focus here is on the main effects of transient and chronic loneliness and interaction terms between loneliness and other significant covariates were not added to the regression model³¹. Using the variance inflation factor (VIF) statistic prior to these analyses, we found no evidence of multicollinearity in the regression model (VIF values [1.1-1.6] of all independent variables were lower than 5, a threshold value that is indicative of multicollinearity). We quantify prospective associations of transient and chronic loneliness and cognitive function by reporting their respective unstandardized regression coefficients (β s) with the no loneliness group as the reference category.

Considering that our cut-off score of 14 for baseline mMMSE, indicating the presence of normal cognitive function, was operationally determined, we repeated the above multiple regression analysis using 24 samples of “cognitively healthy” OAs, defined by 24 cut-off values of baseline mMMSE (range: 0-23). This sensitivity analysis was conducted to test the stability of the predictive effects of transient and chronic loneliness on cognitive function.

Two-sided $P = 0.05$ was regarded as statistically significant. SPSS software version 15.0 was used to analyze the data.

RESULTS

Description of the study sample

Of the 2995 subjects, 1516 (50.6%) were women, and their mean age was 75.6 years (standard deviation: 8.3, range: 65–108). Detailed socio-demographic, behavioral and health characteristics and social disconnectedness of the respondents are summarized in the second column of Table 1.

Table 1 also shows the characteristics of subjects by level of persistence in loneliness. The three loneliness groups differed significantly in terms of all socio-demographic, social disconnectedness, behavioral and health variables. Relative to “not lonely” respondents, transiently or chronically lonely OAs were more likely to be female, older, illiterate, rural residents, poor, non-married (never-married, divorced, widowed or separated), non-smokers and ill, and to live alone or reside in institutions, not participate in physical exercise regularly, suffer negative emotion, and have lower 2005 and 2011 mMMSE scores. In addition, compared to those classified as transiently lonely, those classified as chronically lonely were more likely to be poor ($\chi^2=6.844$, $df=2$, $P=0.033$) and non-married ($\chi^2=22.357$, $df=1$, $P<0.001$), to reside without family members ($\chi^2=10.650$, $df=1$, $P=0.001$), and to endorse negative emotions ($t=-6.265$, $df=407.327$, $P<0.001$) (results not shown in Table 1).

Prospective effects of transient versus chronic loneliness on cognitive function

In univariate analysis both transient and chronic loneliness were significantly associated with lower 2011 mMMSE scores (transient loneliness: $\beta=-1.254$, standard error [se]=0.183, $t=-2.191$, $df=2994$, $P<0.001$; chronic loneliness: $\beta=-1.818$, $se=0.313$, $t=-2.109$, $df=2994$, $P<0.001$) with no loneliness as the reference. After controlling for potential confounders, results of the multiple linear regression analysis (Table 2) reveal that, although the effects of transient and chronic loneliness on mMMSE scores attenuated, their respective contributions remained significant (transient loneliness: $\beta=-0.389$, $se=0.178$, $P=0.029$; chronic loneliness: $\beta=-0.640$, $se=0.303$, $P=0.035$). Hence, both transient and chronic loneliness significantly and adversely impact cognitive function, with chronic loneliness being a stronger predictor of cognitive decline.

Sensitivity analysis: predictive effects of transient versus chronic loneliness on cognitive function

Univariate and multiple linear regression analyses using 24 samples (range of sample size: 972–3108) generated 48 pairs of coefficients of 2011 mMMSE scores on transient and chronic loneliness (Figure 2). All coefficients of transient and chronic loneliness were statistically significant in univariate analyses. After adjustment for covariates in multiple analyses, overall, coefficients of transient loneliness were statistically significant and relatively stable across almost all of the samples (22/24), irrespective of baseline cognitive health status of analytic samples. Unlike transient loneliness, coefficients of chronic loneliness were not significant in samples with poor baseline cognitive function

(0 mMMSE 13), but became statistically significant in samples with normal baseline cognitive function (14 mMMSE 22). The absolute values of coefficients of 2011 mMMSE scores on chronic loneliness increased with levels of cognitive health of analytic samples. In the group with intact cognition at baseline (MMSE 21), the impact of chronic loneliness on mMMSE score at follow-up reached the maximum value ($\beta=-1.017$, $t=-2.942$, $df=2944$, $P=0.003$) with an effect 2.59 times as large as that of transient loneliness ($\beta=-0.392$, $t=-2.049$, $df=2944$, $P=0.041$).

DISCUSSION

Understanding the detrimental effect of loneliness on cognitive function, particularly the distinct effects of different types of, or exposures to, loneliness could give insight into design of psychosocial and environmental interventions to prevent cognitive decline. In this 3-wave prospective cohort study we used data of the 2005-2011 CLHLS to calculate the direction and strength of the prospective effects of transient and chronic loneliness on cognitive function 6 years later, controlling for potential causes of spuriousness. The results showed that among Chinese OAs, the negative effect of transient loneliness on cognition at follow up was statistically significant and relatively stable among mixed samples with poor and good baseline cognitive function. The adverse effect of chronic loneliness on cognition was significant only among those with normal cognitive function at baseline, but with an effect larger than that of transient loneliness. Sensitivity analyses further revealed that the better one's baseline cognitive health, the greater the adverse effect of chronic loneliness on one's cognitive functioning over time.

Similar to previous studies¹⁵, we found that loneliness, no matter whether it is transient or chronic, was a risk factor for cognitive decline. The present study goes farther, however, by reporting the greater cognitive-damaging effect of a chronic loneliness subtype, as we had hypothesized. We did not expect, however, the significant deleterious impact of transient loneliness, which we conceptualized as a lower toxic exposure, on cognitive function. This finding is similar to the results from Shiovitz-Ezra et al. (2010)²⁰, who reported both transient and chronic loneliness serve as significant risk factors for mortality, with chronic loneliness being a slightly stronger mortality risk. As these authors proposed²⁰, a reasonable explanation for the unexpectedly significant effect of transient loneliness is the limited number of time points used to define transient loneliness²⁰, constraining our ability to make a refined distinction between low and high exposure.

Inflammation and activation of the hypothalamic-pituitary-adrenal (HPA) axis may be the mechanisms underlying associations between loneliness and cognitive decline¹⁵. Because loneliness can cause individuals to experience daily life as more stressful and feel more chronic stress and depression. Long-term stress and depression could further induce chronic immune dysfunction and a prolonged HPA axis activation, in turn causing damage in neuronal networks^{34, 35}. As well, chronic loneliness has been associated with development of hypertension and diabetes mellitus, both of which are in turn associated with increased risk for developing dementia³⁶⁻³⁸.

Still, there is a need to investigate further whether the difference in effect of transient and chronic loneliness on cognition is explained by differences in degree of persistence in loneliness between the two subtypes. Our descriptive analysis showed transiently and chronically lonely groups were different in terms of economic status, marital status, co-residence and emotional health, suggesting the possibility that the two subtypes of loneliness are distinct entities, rather than two ranks of the persistent loneliness continuum. In fact, the different patterns of transient and chronic loneliness influencing cognitive function at follow up may indicate an interaction effect between level of loneliness and baseline cognitive function of the analytic samples, because, as shown in Figure 2, the effect of loneliness partly depends on whether the baseline cognitive function is intact. However, it seems that the relationship between loneliness and cognitive function at follow up is not entirely a linear relationship within samples with and without intact cognition, therefore, the underlying mechanisms of different effects of transient and chronic loneliness are complex and warrant further study.

The present study has several limitations. First, our analyses were restricted to 6-year survivors from the CLHLS and a large number of subjects were excluded due to poor baseline cognitive function, death or being lost to follow-up, resulting in possible selection bias in our analytic sample. Although those excluded had significantly lower baseline mMMSE scores than those who were included ($[17.5\pm6.3]$ versus $[21.3\pm2.1]$, $t=52.274$, $df=12817.767$, $P<0.001$), our sensitivity analyses showed that the effect of transient loneliness was relatively independent of baseline level of cognitive function, and that the effect of chronic loneliness was only significant in samples that were cognitively healthy at baseline. Therefore, we believe selection bias has very limited influence on our findings.

Second, it is also possible that cognitive deterioration could lead to loneliness by causing impairments in individuals' ability to maintain friendships, communicate with others, and participate in social activities. However, we feel it is unlikely to explore this possibility using the present analytic sample, because the cognitive function of this sample was initially intact and became worse later, but some subjects of the sample had been lonely at baseline.

Third, the time interval between two successive measures of loneliness used to determine chronic loneliness in our study was three years. If we were to use this approach to identify chronically lonely OAs for preventive intervention, three years is likely to be too long a period for practical use in public health and clinical settings. A more precise definition of chronic loneliness and reliable means of detecting it should be developed and validated in future studies.

Fourth, although we have adjusted for putative risk factors for cognitive impairment, it remains possible that residual confounding might still exist owing to imperfect measurement of these factors. For instance, our multiple analyses had to include negative emotion as a proxy for depression, a common risk factor for dementia, which was not included in the CLHLS instruments.

Last, it seems that the actual mMMSE differences across the three groups at baseline and follow up are not so obvious. We believe, however, that the findings are meaningful both

from clinical and public health perspectives. The effect sizes in our analyses (measured by Cohen's *d*) of no loneliness, transient loneliness and chronic loneliness on mMMSE scores during the 6-year period were 0.50, 0.57 and 0.63, respectively. These values represent a medium, a medium-to-large and a large effect³⁹, respectively. The findings also have important implications from the perspective of public health, because interventions aimed at reducing loneliness, especially chronic loneliness, would still delay cognitive decline in a large number of OAs'. Given the enormous burden of disease associated with dementia worldwide, even a small reduction or delay in the progression of cognitive impairment would have great benefits at a population level. The fact that social isolation is a potentially modifiable factor further underscores the importance of the findings.

CONCLUSIONS

In China, the one-child policy and internal migration by workers from rural areas to urban centers have resulted in large increases in the numbers of OAs who live alone or with their spouses only. In 2013 they accounted for over 50% of Chinese OAs¹, with the proportion expected to rise to 90% by 2030⁴⁰. Of these "empty-nested elders", over 80% had moderate to high levels of loneliness^{40, 41}. The problem of dementia and cognitive decline in China, therefore, may be exacerbated by their association with loneliness. Systematic reviews suggest that loneliness can be reduced with certain interventions, particularly those that address maladaptive social cognition^{42, 43}. Hence, from the perspective of public health, the disease burden of dementia in China could be reduced through effective interventions aimed at preventing/reducing loneliness, especially chronic loneliness. Future studies should develop a more detailed approach to assess transient and chronic loneliness and also examine factors and circumstances that influence the relationship between loneliness and cognition observed here, establishing a firmer basis on which to test the impact on dementia and cognitive decline of preventive interventions designed to reduce chronic loneliness in older adults.

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Figure 1.

Flow chart of study sample inclusion and follow-up. mMMSE: The modified version of Mini-Mental State Examination.

Note: Solid and hollow circles/triangles represent that coefficients of modified Mini-Mental State Examination (mMMSE) scores on transient and chronic loneliness are statistically significant and insignificant, respectively.

Figure 2. Coefficients of transient and chronic loneliness in the univariate and multiple linear regression models using 24 samples defined by 24 mMMSE cut-off values.

Table 1

Characteristics of the whole sample and sample characteristics by loneliness status

Variables	Total (N=2995)	Not lonely (N=1726)	Transiently lonely (N=1019)	Chronically lonely (N=250)	Statistic ^d	df	P
Female ^a	1516(50.6)	780(45.2)	583(57.2)	153(61.2)	$\chi^2=49.266$	2	<0.001
Age ^b	75.6(8.3)	74.8(8.3)	76.6(8.4)	76.7(7.9)	F=17.160	2,2992	<0.001
No schooling ^a	1454(48.5)	743(43.0)	562(55.2)	149(59.6)	$\chi^2=50.923$	2	<0.001
Rural residence ^a	1827(61.0)	986(57.1)	674(66.1)	167(66.8)	$\chi^2=27.753$	2	<0.001
Poor or very poor economic status ^{ac}	413(13.8)	173(10.0)	179(17.6)	61(24.4)	X2=65.838	4	<0.001
Never-married, divorced, widowed or separated ^{ac}	1347(45.0)	590(34.2)	575(56.4)	182(72.8)	$\chi^2=213.451$	2	<0.001
Residing alone or in an institution ^{ac}	435(14.5)	152(8.8)	208(20.4)	75(30.0)	$\chi^2=122.137$	2	<0.001
No physical exercise habits ^a	1815(60.6)	947(54.9)	687(67.4)	181(72.4)	$\chi^2=58.186$	2	<0.001
Current smoking ^a	816(27.2)	520(30.1)	246(24.1)	50(20.0)	$\chi^2=18.807$	2	<0.001
Moderately or very ill ^a	140(4.7)	59(3.4)	62(6.1)	19(7.6)	$\chi^2=15.460$	2	<0.001
Negative emotion ^{bc}	5.1(2.7)	4.3(2.5)	6.0(2.6)	7.0(2.4)	F=228.902	2,2992	<0.001
Mini-mental State Examination at 2005 ^b	21.3(2.1)	21.6(1.9)	21.1(2.2)	20.8(2.3)	F=30.097	2,2992	<0.001
Mini-mental State Examination at 2011 ^b	19.5(4.7)	20.0(4.1)	18.8(5.2)	18.2(5.4)	F=33.398	2,2992	<0.001

^aFrequency(%) for categorical variables, chi-square test is used to compare variables across loneliness groups;^bMean (standard deviation) for continuous variables, one-way ANOVA is used to compare variables across loneliness groups;^cStatistically significant differences were detected between transient and chronic loneliness groups;^dFigures in parentheses represent numbers of degree of freedom.

Table 2

Multiple linear regression of predictors of the modified Mini-Mental State Examination score at 2011

Variable	Coefficient	Stand Error	t*	P
Gender	-0.579	0.196	-2.962	0.003
Age	-0.162	0.010	-15.702	<0.001
Education	1.197	0.184	6.506	<0.001
Residence	-0.287	0.168	-1.708	0.088
Self-rated economic status	0.006	0.128	0.048	0.962
Marital status	0.456	0.196	2.329	0.020
Co-residence	-0.045	0.245	-0.183	0.855
Physical exercise habits	-0.243	0.171	-1.425	0.154
Current smoking	-0.302	0.191	-1.577	0.115
Interviewer-rated physical health	-0.332	0.142	-2.328	0.020
Negative emotion	-0.036	0.033	-1.104	0.270
Mini-Mental State Examination score at 2005	0.174	0.040	4.329	<0.001
Transient loneliness	-0.389	0.178	-2.191	0.029
Chronic loneliness	-0.640	0.303	-2.109	0.035

* Numbers of degree of freedom of all t tests = 2994.