Loneliness, Health, and Longevity

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Background. Objective measures of loneliness and poor social contacts are associated with negative health outcomes. However, the influence of subjective loneliness among elderly persons is poorly documented. We hypothesized that loneliness among persons aged 70–90 years is associated with subsequent decline in health, function, and longevity.

Methods. Mortality data for subjects aged 70–90 years were obtained; subjective loneliness, health, comorbidity, depression, and functional status were assessed through the Jerusalem Longitudinal Cohort Study (1990–2010), a prospective longitudinal study. A representative sample of 407, 661, and 1,113 participants born 1920–1921 were assessed at home at ages 70, 78, and 85, respectively. Participants were asked how often they felt lonely, with answers dichotomized to never versus rarely/often/very often. In the age group of 70, 78, and 85, we excluded 67, 141, and 408 depressed participants from the study sample, which, thus, comprised 340, 520, and 705 participants, respectively.

Results. At age 70, 78, and 85, prevalence of loneliness was 27.9% ($n = 95$), 23.8% ($n = 124$), and 24% ($n = 169$), respectively. The only factor consistently associated at all ages with increased likelihood of loneliness was not being married. After adjusting for baseline variables, we found no association between loneliness and subsequent deterioration 7 years later in functional status, mood, cognition, chronic pain, or rising comorbidity between ages 70 and 78 or 78 and 85. Loneliness was not associated with mortality among the participants aged 70–78, 78–85, and 85–90. We repeated all data analysis, without excluding depressed participants, without any change in overall findings.

Conclusions. Our findings do not support the hypothesis that subjective loneliness is associated with increased morbidity or mortality from age 70 to 90.

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Loneliness—A common subjective complaint among older people and is closely linked to decreasing number of social contacts and objective social isolation. Objective measures of loneliness and lack of social contacts have been found to be associated with poor health outcomes among middle-aged populations and have been suggested to be predictive of subsequent functional decline and increased mortality in old age (1–4). Similarly, successful aging has been associated with the absence of loneliness among children of centenarians (5). The subjective measure of loneliness has more recently become an area of interest, and here too findings are suggestive of negative outcomes. Data from the Health and Retirement Study (HRS), a representative national sample of American adults aged 50 years and older, have been analyzed by different research groups and have shown an association between loneliness and subsequent decline in functional status and longevity (6–8). Much of existing literature stems from cross-sectional research, and the longitudinal studies that do exist have included participants with a wide age span, with poor representation of the oldest old. Furthermore, studies have generally included depressed participants, despite the potential bias that this may have upon the results.

The purpose of this study was to examine the association of subjective loneliness with subsequent health, function, mood, and longevity. In keeping with findings concerning objective measures of poor social contact among younger participants, we hypothesized that the negative effects of loneliness would be observed with increasing age, up to and including the oldest old.

Methods

Study Sample

The Jerusalem Longitudinal Cohort Study has followed up a birth cohort of Jerusalem residents (born June 1920–May 1921) from age 70 at baseline in 1990 until the present time. A detailed description of study methodology has been described previously (9–11). The present study examines data from 407, 661, and 1,113 participants, aged 70, 78, and 85, enrolled at 1990–1991, 1997–1998, and 2005–2006,
respectively. The study sample, which formed about one third of the total birth cohort, was randomly selected from the electoral registry. The representative nature of the study sample was confirmed by finding similar rates of hospital inpatient morbidity, health service utilization and mortality between the study sample, participants who refused, and those not approached to enroll (12). In order to maintain study sample size and to counteract the effects of mortality, the original sample was augmented at subsequent phases with new participants randomly recruited from the same birth cohort. No significant differences existed for either comorbidity or subsequent mortality rates among participants enrolled at later stages. Proxy informants, with consent from legal guardians, were used for extremely frail or demented participants unable to provide factual information. Only participants able to answer concerning loneliness were included in this study. Each participant, or legal guardian, provided informed consent, and the Hadassah-Hebrew University Medical Center Institutional Review Board approved the study.

Measures and Data Collection
The study instrument was a structured questionnaire, performed by interview at home, by a trained study nurse or occupational therapist (demographic characteristics, personal history, lifestyle, health services utilization, function, and cognitive status) and the study physician (medical history, system review, and examination).

Loneliness
Participants were asked how often they felt lonely, with possible answers being (1) never, (2) rarely, (3) often, and (4) very often. We dichotomized loneliness to “not lonely” (positive answer to question 1) versus “lonely” (positive answers to questions 2, 3, and 4). This single global subjective assessment of loneliness was used in the longitudinal Gothenburg population study of 70-year-olds (13,14).

Depression
We assessed depression using the Brief Symptoms Inventory (BSI) (15). Participants were asked how much they suffered in the previous month from (a) loneliness, (b) lack of interest, (c) thoughts of ending their life, (d) bad mood, (e) hopelessness concerning the future, and (f) worthlessness. Each question was scored from 0 to 4 points (0 = none, 4 = greatly). Depression was defined as a total of ≥6/24 points. Participants unable to answer the questions (due to severe cognitive impairment) were not included in the study. Depressed participants identified (BSI ≥ 6/24) were excluded from the primary data analysis, irrespective of their loneliness status.

Study Measures
Self-rated health was evaluated using the question: “Do you feel healthy in comparison to people your age?”; we determined functional assessment by self-report according to direct questioning at age 70, 78, and 85. For each of the various basic activities of daily living (ADLs) (transfer, dressing, bathing, toilet hygiene, eating, continence), participants were graded as independent with ease/independent with difficulty/dependent on another person for mild assistance/completely dependent upon another person. Participants who reported being independent yet with difficulty in at least one of the basic ADLs were defined “performing ADLs with difficulty,” and participants requiring help from another person in one or more of the basic functions was defined being “dependent on another person” (16–18); Mini-Mental State Examination (19); smoking defined as ever versus never smoked; participants were questioned: “How often are you physically active?” answers being (1) <4 h/wk, (2) about 4 h/wk, (3) at least 1 h/d (eg, regular physical activity such as walking), (4) vigorous sports at least two per week (eg, jogging, swimming). This questionnaire was adapted from the Gothenburg population study of 70-year olds, and it predicted functional status and morbidity among our cohort (18). Physical activity was dichotomized to inactive (answer 1) versus active (answers 2, 3, or 4). This cutoff was justified statistically (20).

Hypertension was defined by either self-reported history or treatment with antihypertensive medications (21). Diagnoses of ischemic heart disease (IHD), diabetes mellitus (DM), and other major diseases were made by the study physician, according to the International Classification of Disease, Ninth Edition (22). Chronic pain was defined as joint or musculoskeletal pain of 3 or more month’s duration. Charlson Comorbidity Scale was determined with high defined as ≥3 (23).

Outcomes
Death was the primary outcome throughout the study period from 1990 to 2010. Mortality data were obtained from review of all obligatory notifications of death issued by the Ministry of Interior. This provided 100% surveillance of mortality data for participants in Israel. We examined deterioration (new onset) from age 70 to 78 and 78 to 85 of ADL dependence, ADL difficulty, depression, cognitive decline (Mini-Mental State Examination < 24), and increased Charlson comorbidity (≥3). Analysis for deteriorating health variables included only participants among whom the outcome variable was “normal” at baseline.

Statistical Analysis
Descriptive statistics were performed using chi-square tests for categorical variables. Logistic regression analysis
determined odds ratios (ORs) and 95% confidence intervals (95% CIs) for cross-section and longitudinal data. Mortality was examined using Kaplan–Meier survival curves, log rank test, and Cox proportional hazard models. All p values were two tailed, and p < .05 was considered significant. The sample size was sufficient to achieve a power of 80% with an α coefficient of 0.05. Data storage and analysis were performed using SAS version 9.1e (SAS Institute, Inc., Cary, NC).

Results

Full data concerning loneliness and depressive symptoms were available for 407, 661, and 1,113 participants at ages 70, 78, and 85, respectively. A total of 67, 141, and 408 participants were depressed (BSI ≥ 6/24) at ages 70, 78, and 85, respectively, among whom loneliness was reported by 47 (70.2%), 96 (68.1%), 320 (78.4%), respectively. After excluding these depressed participants, the resulting study sample was 340, 520, and 705 at age 70, 78, and 85, respectively, among whom the prevalence of loneliness was 27.9% (n = 95), 23.8% (n = 124), and 24% (n = 169), respectively. The number of participants who died during follow-up from age 70 to 78 among lonely versus not lonely was 14/95 (14.7%) versus 49/246 (19.9%), from age 78 to 85 was 29/124 (23.4%) versus 94/396 (23.7%), and from age 85 to 90 was 37/169 (21.9%) versus 118/532 (22.2%). Baseline characteristics are shown in Table 1, with loneliness being reported more frequently among participants with negative sociodemographic status, functional impairment, and chronic pain. There were no significant differences in loneliness prevalence among participants with hypertension, IHD, or DM, although loneliness was more frequent at age 85 among participants with increased comorbidity score. We examined loneliness as the dependent outcome variable in a logistic regression analysis of cross-sectional data, which adjusted for sex, marital status, low educational level, poor self-rated health, low physical activity level, ADL dependence, chronic pain, hypertension, IHD, and DM. The only factor to be consistently associated at ages 70, 78, and 85 with an increased likelihood of feeling lonely was marital status. Significantly increased likelihood of feeling lonely was associated with chronic pain at ages 78 and 85; with low educational status, poor self-rated health, and low physical activity at age 78; and with being female at age 70 alone (Table 2). We determined whether baseline loneliness (either at age 70 or 78) was associated with an increased likelihood of subsequent decline in function or health (from age 70 to 78 and 78 to 85, respectively). Participants examined at two consecutive study phases were included in the logistic regression analyses, and follow-up data for the dependent outcome variable were adjusted for baseline variables of sex, marital status, educational status, self-rated health, physical activity, chronic pain, hypertension, IHD, DM as well as loneliness. Only participants for whom the dependent outcome variable being examined was “normal” at baseline were included. We defined normal ADLs as participants who were independent, without difficulty or dependence. The model examining declining comorbidity at follow-up included baseline comorbidity, in place of baseline hypertension, IHD, or DM. As shown in Table 3, baseline loneliness was...
not significantly associated, after adjustment, with increased likelihood of new onset of ADL dependence or difficulty, depression, cognitive impairment (only examined at age 85), chronic pain, or rising comorbidity. The survival rates among lonely versus nonlonely participants were very similar throughout follow-up, and no differences were observed on Kaplan–Meier charts. Furthermore, after adjusting for gender, marital status, educational status, physical activity level, chronic pain, hypertension, IHDs, and DM in Cox proportional hazards models, we found that loneliness was not associated with an increased mortality between the ages 70 and 78, 78 and 85, and 85 and 90 (Table 4).

We repeated all data analyses, however, without excluding depressed participants. All models were identical, except for the additional adjustment of baseline depression. The overall findings remained unchanged. Furthermore, in order to address the possibility that the cutoff point for loneliness was too inclusive (never lonely vs rarely, often, or very often lonely), we repeated the data analyses this time restricting the definition of loneliness by using the cutoff as “never or rarely lonely” versus “often or very often lonely.”

The only meaningful changes in the results described were a weakening of the adjusted associations observed in Table 2, such that DM at age 70 and self-rated health and physical activity at age 78 were no longer associated with a significantly higher likelihood of subsequent depression at age 85 (adjusted OR: 2.42, 95% CI: 1.18–4.9).

No other meaningful differences were observed concerning both the association with subsequent deterioration for any of the outcomes examined or for mortality throughout follow-up.

In order to address the possibility of an interaction effect between loneliness and gender, we repeated data analyses separately by gender. No significant changes in the results were observed. We also examined for a possible interaction effect between Loneliness × Diabetes, Loneliness × IHD, and Loneliness × Chronic pain. No significant association with mortality was observed for any of these interaction effects.
variables, which were separately included into the proportional hazards models.

**DISCUSSION**

The findings of this study fail to support the hypothesis that subjective loneliness is associated with deteriorating function, worsening morbidity, or increased mortality among a representative sample of community-dwelling older people, up to and including the oldest old. To our knowledge, this is the first study on loneliness among elderly persons to have excluded depressed participants from the sample, and the findings to emerge are unique in the literature concerning loneliness among older people. Our observation that loneliness is remarkably free from associated morbidity and mortality appears to stand in contrast to some of the recent literature, which suggests that loneliness among older people is not only a source of great suffering but also contributes to poor health, impaired function, and declining longevity. Our findings do not stand completely alone and are indeed in keeping with recent research from the English Longitudinal Study of Ageing, which examined data from 2004 to 2005 among 6,500 men and women aged 52 and older. In this study, increased mortality was observed among both socially isolated as well as lonely participants. However, the effect of loneliness was not independent of demographic characteristics or health problems, and the effect was no longer observed after adjustment for confounding variables, thus leading the authors to conclude that although social isolation and loneliness impair quality of life and well-being, efforts to reduce isolation are likely to be more relevant to mortality (24).

Lack of social contacts and measures of social isolation among older people, particularly among men, have been shown to be associated with increased mortality (25). More recently, the subjective aspect of loneliness has become an area of attention, and several research findings have pointed to an association with negative health and functional outcomes. Different researchers have examined data from the HRS, which is a longitudinal study of a nationally representative sample of Americans aged 50 years and older (6–8). The HRS findings lend support to the inclusion of loneliness as a potential risk factor, which warrants the attention and potential intervention by health care professionals, including medical practitioners. Methodological differences between our study and the HRS may be responsible in part in explaining the contradictory findings. First, the HRS included participants aged 50 years and older, with an average age of 71 years for lonely participants (6), and only 29% of participants were over the age of 75 years. The heterogeneous natures of the ages included, together with the relatively low representation of older people in general, and of the oldest old in particular, are important methodological differences. The HRS defined depression using the eight-question short version of Center for Epidemiological Studies Depression Scale, from which they excluded the loneliness question from the scale (6). In keeping with other loneliness research, they also included depressed participants in the study sample in their overall analyses, choosing to adjust for depression in subsequent statistical models. In contrast, our study focuses upon a very narrow age group of older people (born 1920–1921) and is, thus, relatively free from confounding cohort effects of different age strata combined together. The study sample is also free from the possibility of confounding by depressed participants, and finally our study extends the period of follow-up to include the oldest old. Our use of a single global measure of subjective loneliness is in contrast to the three-item Revised UCLA Loneliness Scale used in the HRS (26). However, not only has the use of other single global measures been enforced in previous loneliness research (27,28), but also the measure of loneliness used in our study was similar to that used in the Longitudinal Gothenburg Population Study (13,14), where it has itself been validated and employed. Importantly, the prevalence of loneliness identified among our cohort using this measure was not only very similar to that described by Svanborg and coworkers in the Gothenburg study but were also similar to prevalence rates described using the three-item loneliness instrument in the HRS, thus lending further support to the validity of the single-item loneliness question used in our study. Svanborg and coworkers investigated feelings of loneliness using the same question in a cross-sectional study among a representative sample of Swedish people aged 70. They also found that the strongest

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Survival Rate</th>
<th>Log Rank</th>
<th>Hazard Ratio (95% CI)*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (n)</td>
<td></td>
<td>p Value</td>
</tr>
<tr>
<td>70–78</td>
<td>80.1% (197/246)</td>
<td>.284</td>
<td>1.06 (0.54–2.1)</td>
</tr>
<tr>
<td>78–85</td>
<td>76.3% (302/396)</td>
<td>.95</td>
<td>1.10 (0.69–1.77)</td>
</tr>
<tr>
<td>85–90</td>
<td>78% (418/536)</td>
<td>.995</td>
<td>0.84 (0.56–1.27)</td>
</tr>
</tbody>
</table>

*Adjusted for sex, marital status, educational status, physical activity level, chronic pain, hypertension, ischemic heart disease, diabetes mellitus, and loneliness.

| Notes: The survival compares survival rates throughout follow-up between lonely and nonlonely participants and shows the mortality hazards ratios associated with loneliness.
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associated factor with feeling lonely was marital status, in addition to being depressed, poor self-rated health, and an apparent increase in social and medical care services. Loneliness, however, was not associated with a higher prevalence of medical morbidity or functional dependence findings similar to our own. The possibility that loneliness might serve to exacerbate the negative effects of other factors was examined in our study, in particular the question of whether an interaction with gender might be present. No such interaction with gender was observed when data were examined separately for males and females.

The possible proximity or overlap of a subjective, global assessment of loneliness to the diagnosis of mild depression or depressive symptomatology is an unresolved issue. Indeed, both the BSI depression scale and Center for Epidemiological Studies Depression Scale include loneliness as an item, and yet depression clearly can exist without a sense of loneliness, and vice versa. In our study depression was defined by the six items of the BSI, one of which was loneliness. We did find that lonely nondepressed participants at age 78 were twice as likely to develop subsequent depression at age 85 (unadjusted OR: 2.46, 95% CI: 1.18–4.29), a finding which nonetheless lost significance after adjustment. When we repeated the entire data analyses using a restricted and more severe definition of loneliness, we found that loneliness at age 78 (among nondepressed participants) remained associated with increased likelihood of depression at age 85 (adjusted OR: 2.42, 95% CI: 1.18–4.9). Whether or not an isolated sense of loneliness represents an entity in itself, outside of the sphere of medical diagnosis, or whether it falls at one end of a dysthymic spectrum whose pole may culminate in full blown depression, remains to be clarified. Some researchers have suggested that loneliness might play a mediating role between social isolation and depression (29). Other researchers have suggested the influence of gender, with poor marital quality leading to increased social isolation among men and increased subjective loneliness among women (30). Our findings would suggest that among older people, loneliness appears to be a separate state, distinguishable from depression, and surprisingly independent of the burden of comorbidity found with depression among older people (31). It is of interest to note that research among the oldest old (32) also finds a blunting of the negative health outcomes that would be expected with depression and that have been well documented among younger depressed participants.

Our findings stand in contrast to much of the published data concerning loneliness among the elderly people. Indeed our hypothesis from the outset was the opposite direction to the negative findings from our study, which, at first glance, seems counterintuitive and challenging. However, the findings appear to be robust and remain unchanged despite repeating our analysis with and without depressed participants and changing the cutoff point for severity in the definition of loneliness.

Limitations to our study exist. First, our use of a single global measure may have been insensitive in comparison to scales, which include a larger number of questions. Numerous other studies have, however, used single-item tools for assessment of loneliness with valid results, and furthermore, the same question we used has been widely investigated by the Gothenburg Longitudinal Study by Svanborg and coworkers (13,14). An additional methodological point was the use of the BSI to determine depression. Like the Center for Epidemiological Studies Depression Scale, this assessment scale also includes loneliness as one of the criteria for depression. We choose not to exclude the loneliness question from the BSI tool because its validity would be affected. This issue serves to highlight an unresolved dilemma concerning the dual nature of subjective loneliness, which, on the one hand, may be part of the spectrum of depressive symptomatology or on the other hand, may exist as an entity in and of itself. Indeed there is perhaps a need to differentiate between subtle differences in quality of perceived loneliness among very old people.

An additional limitation is the degree to which our findings may be applied to different populations. Our study cohort has been shown to be representative of the same aged local Jerusalem population. Longitudinal data concerning the profile of numerous measures of health, function, and disease, from our cohort are similar in magnitude to other published data from primarily Western countries (33). Nonetheless, caution is clearly necessary in drawing parallels, in particularly since feelings of loneliness, as well as more objective measure of being alone are culturally bound.

In conclusion, we describe the novel finding that loneliness among older people, up to and including the oldest old, was unrelated to poor health outcomes, declining function, morbidity, or survival.

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