

Contribution of risk factors to excess mortality in isolated and lonely individuals: an analysis of data from the UK Biobank cohort study

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Summary

Background The associations of social isolation and loneliness with premature mortality are well known, but the risk factors linking them remain unclear. We sought to identify risk factors that might explain the increased mortality in socially isolated and lonely individuals.

Methods We used prospective follow-up data from the UK Biobank cohort study to assess self-reported isolation (a three-item scale) and loneliness (two questions). The main outcomes were all-cause and cause-specific mortality. We calculated the percentage of excess risk mediated by risk factors to assess the extent to which the associations of social isolation and loneliness with mortality were attributable to differences between isolated and lonely individuals and others in biological (body-mass index, systolic and diastolic blood pressure, and handgrip strength), behavioural (smoking, alcohol consumption, and physical activity), socioeconomic (education, neighbourhood deprivation, and household income), and psychological (depressive symptoms and cognitive capacity) risk factors.

Findings 466 901 men and women (mean age at baseline 56.5 years [SD 8.1]) were included in the analyses, with a mean follow-up of 6.5 years (SD 0.8). The hazard ratio for all-cause mortality for social isolation compared with no social isolation was 1.73 (95% CI 1.65–1.82) after adjustment for age, sex, ethnic origin, and chronic disease (ie, minimally adjusted), and was 1.26 (95% CI 1.20–1.33) after further adjustment for socioeconomic factors, health-related behaviours, depressive symptoms, biological factors, cognitive performance, and self-rated health (ie, fully adjusted). The minimally adjusted hazard ratio for mortality risk related to loneliness was 1.38 (95% CI 1.30–1.47), which reduced to 0.99 (95% CI 0.93–1.06) after full adjustment for baseline risks.

Interpretation Isolated and lonely people are at increased risk of death. Health policies addressing risk factors such as adverse socioeconomic conditions, unhealthy lifestyle, and lower mental wellbeing might reduce excess mortality among the isolated and the lonely.

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Introduction

Socially isolated and lonely individuals have a higher mortality risk than people with social contacts.^{1–5} Several factors might contribute to these associations.⁶ According to one hypothesis, losing social connections and feeling lonely could be associated with depressive mood and cognitive decline,⁷ with accompanying downstream biological changes such as increased cortisol secretion, deterioration in immune function, and weight gain.⁶ Social isolation could also be associated with unhealthy lifestyle factors, such as increased smoking, increased alcohol consumption, and physical inactivity.⁸ Similarly, socioeconomic adversity is associated with an increased likelihood of social isolation,⁹ and thus might explain the reported associations. However, few extensive prospective data exist on which to test these hypotheses and assess the associations in different groups such as old and young individuals, low and high socioeconomic groups, and those with and without chronic disease. All these

factors might confound the association of social isolation and loneliness with mortality.

A better understanding of the factors underlying the associations between social isolation (ie, having no or few contacts with others), loneliness (ie, feeling lonely or unable to share one's thoughts), and mortality might facilitate the design of interventions to reduce excess health risk in socially isolated, lonely people. We used data from the UK Biobank study to quantify the extent to which the associations of social isolation and loneliness with mortality are related to biological, behavioural, socioeconomic, and psychological risk factors.

Methods

Study design and participants

We analysed baseline data and mortality follow-up data from the UK Biobank study.¹⁰ UK National Health Service registers maintain records of all individuals legally registered as resident in the UK. With the help of

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For the UK Biobank see www.ukbiobank.ac.uk

Research in context

Evidence before this study

Social isolation and loneliness are associated with increased health problems and excess mortality risk. We searched PubMed for studies published in English up to May 31, 2016, using the following combinations of search terms (in title): (A) social support AND mortalit*; (B) social relations AND mortalit*; (C) social networks AND mortalit*; (D) social isolation AND mortalit*; and (E) loneliness AND mortalit*. Search combination A yielded 37 publications, B eight, C 14, D 11, and E 14. Findings from these studies suggest that there is an association between social isolation and mortality and between loneliness and mortality.

Added value of this study

Our study is, to our knowledge, the largest investigation into factors linking social isolation and loneliness to an increased

mortality risk. We did a mediation analysis and found that the association between social isolation and mortality reduced by 64% after taking into account differences in lifestyle, socioeconomic factors, and mental health problems between socially isolated and non-isolated individuals. These risk factors explained the association between loneliness and mortality.

Implications of all the available evidence

Isolation and loneliness are markers of many risk factors, such as socioeconomic adversity, unhealthy lifestyles, and lowered mental wellbeing. Policies and public health interventions that tackle these risk factors in general could potentially reduce excess mortality among the isolated and the lonely.

these records, invitations were sent to individuals aged 40–69 years living within a sensible travelling distance of the 22 assessment centres across Great Britain in 2007–10.¹⁰ For the UK Biobank project, baseline questionnaires and physical measures (eg, standard anthropometry and spirometry) were collected and blood and urine samples were stored, as described elsewhere.¹¹ 502 656 individuals were recruited (5% of the eligible population) in the UK Biobank.

This study was done under generic approval from the National Health Service National Research Ethics Service (June 17, 2011; Ref 11/NW/0382). Participants provided electronic informed consent for the baseline assessments and the register linkage.

Procedures

The social isolation scale used by the UK Biobank was constructed from three questions: (1) “Including yourself, how many people are living together in your household? Include those who usually live in the house such as students living away from home during term time, partners in the armed forces or professions such as pilots” (1 point for living alone); (2) “How often do you visit friends or family or have them visit you?” (1 point for friends and family visit less than once a month); and (3) “Which of the following [leisure/social activities] do you engage in once a week or more often? You may select more than one” (1 point for no participation in social activities at least weekly). Thus, individuals could score a total of 0–3; an individual was defined as socially isolated if he or she scored 2 or 3; those who scored 0 or 1 were classified as not isolated. Similar scales have been used previously in other UK studies.¹²

Loneliness was assessed with two questions: “Do you often feel lonely?” (no=0, yes=1) and “How often are you able to confide in someone close to you?” (0=almost daily to once every few months; 1=never or almost never). An

individual was defined as lonely if he or she scored 2, and not lonely if he or she scored 0 or 1. Similar questions are included in scales such as the revised UCLA Loneliness Scale.¹³

Follow-up for all deaths irrespective of cause started at inclusion in the UK Biobank study (from national death registers) and ended on Aug 14, 2015, or upon death, for all participants. The cause-specific-mortality International Classification of Diseases (ICD) codes were as follows: neoplasms (C00–D48), diseases of the circulatory system (I05–I89), and other diseases (all remaining ICD-10 codes).

Details of the assessments of participants' variables are publicly available.¹⁴ Briefly, participants completed several touch-screen computer-based questionnaires, and then had a face-to-face interview with a trained researcher. The information collected included basic demographics (sex and age), ethnic origin (white *vs* other), socioeconomic factors (educational attainment, household income, and postcode of residence with the corresponding Townsend deprivation index score), and chronic diseases (diabetes, cardiovascular disease, cancer, and other long-standing illness, disability, or infirmity). The Townsend deprivation index is an integrated neighbourhood-level measure of unemployment, non-car ownership, non-home ownership, and household overcrowding across the UK.¹⁵

To assess biological factors, trained data collectors measured height and weight in all participants during clinic attendance using standard operating procedures, and the body-mass index (BMI) was subsequently calculated. Procedures for measuring systolic and diastolic blood pressure and handgrip strength are reported in the UK Biobank protocol, which is available online.¹¹ Behavioural factors, including cigarette smoking (current smoker [yes or no]; ex-smoker [yes or no]), physical activity (moderate and vigorous), and alcohol

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