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Received 26 January 2008; accepted in revised form 23 May 2008

Age and Ageing 2009; **38:** 51–55
doi: 10.1093/ageing/afn220
Published electronically 30 October 2008

Differentials in mortality up to 20 years after baseline interview among older people in East London and Essex

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Abstract

Objective: to identify socio-psychological predictors of mortality during a 20-year follow-up period among people aged 65 to <85 and 85+ at baseline interview.
Study design and setting: elderly people living at home in East London and mid-Essex, who responded to surveys of successful survival in older age in the late 1980s; their mortality was traced through the National Health Central Registry.
Results: adjusted analyses show that, as expected, the hazard rate for mortality over a 20-year follow-up was reduced for younger respondents and increased for less functionally able respondents. The hazard ratio for males was almost one and a half times that of females. The hazard rate was also reduced with each categorical increase in life satisfaction and was consistently reduced for those who undertook crafts, social visiting and activities regularly. There was some variation by age and sex.
Conclusion: the results show that social participation is associated with lower risks of death, particularly among people aged 65 to <85, and that life satisfaction is also protective, particularly among females and people aged 85+, even when health status and socio-demographic circumstances are controlled. The study thus provides support for the hypothesised influence of social participation and subjective well-being on survival in older age.

Keywords: *mortality, survival, ageing, life satisfaction, social participation, elderly*

Background

Self-rated health is predictive of mortality [1–4], although the extent of the association varies by gender and between studies. Prospective studies have also shown that low levels of social ties and participation, and being unmarried are independently associated with increased mortality risk in

older age [5–14]. Social relationships may be a vehicle for provision of information, help and support, implying that those with more social ties have greater access to these. Social relationships could be directly associated with disease via physiological mechanisms, including the influence on immunological function. Other subjective predictors of mortality in older age include poor subjective well-being [15] and older perceived age [16, 17]. The potential causal mechanisms linking well-being and increased mortality risk are debateable. Well-being may act as a buffer, mediating the negative effects of adverse circumstances and facilitating adaptation to ageing. However, there has been little substantial work on life satisfaction and mortality. Interpretations of data are complex because of the process of adaptation and the buffering effects of other potential mediating variables. With few exceptions [9], most studies have reported on associations over relatively short time periods. Thus, interpretation of causal relationships is problematic because poor health, which is clearly associated with mortality risk, may also restrict opportunities for social participation and influence morale and life satisfaction. More extended follow-up periods are required to ascertain whether psycho-social factors predict mortality over a longer time [7].

Aim

The aim was to identify socio-psychological predictors of mortality over a 20-year follow-up period in three samples of elderly people. It was hypothesised that indicators of social participation and support, and subjective well-being, would be independently associated with the duration of survival.

Data, design and methods

We used data from three face-to-face, home interview surveys of successful survival in older age conducted in the UK in the 1980s. Their aims were to assess the health, well-being and service needs among elderly people living in the then City and Hackney Health District, a deprived part of east London, and semi-rural Braintree, a more prosperous area in mid-Essex [18–25]. Sample members comprised everyone aged 85+ living at home in City and Hackney who could be traced from health-authority (then called 'Family Practitioner Committee') lists of general practitioners' patients, cross-validated against electoral rolls (to minimise selection of patients who had died [23]), and random samples of people aged 65 to <85 resident in City and Hackney and Braintree, again drawn from these lists. Response rates to the individual baseline surveys were 70% (629), 67% (467) and 82% (288), respectively, producing a combined sample of 1,384 [18–25]. Subsequent mortality of all sample members and of survey non-respondents was ascertained through tracing deaths in the National Health Service Central Register (NHSCR). All three surveys administered validated measures on activities of daily living [26], psychological morbidity [27], life satisfaction [28, 29], social networks and support [30, 31], self-rated health, service use, social activities, loneliness and socio-demographic characteristics.

Analyses

Following exploratory analysis, variables of *a priori* importance and those which were statistically associated with survival at least at the 5% level were included in Cox proportional hazards models of mortality from baseline interview to the end of June 2007. Analyses were conducted, using SPSS[13], first on the full merged sample, and then repeated for men and women separately, and by ages 65 to <85 (the two younger samples) and 85+ (the very elderly Hackney sample). Multivariate analyses included year of birth, sex, housing tenure (an indicator of socio-economic status), health (physical functioning), area of residence (Hackney or Braintree, Essex), all measured at baseline, and year of baseline interview (1987 or 1989).

Covariates were added to the model using hierarchical methods in order of theoretical importance, and in conceptually related groups. Multicollinearity was assessed using correlation matrices, and no variables exceeding intercorrelations of 0.50 were entered into the models. Where variables overlapped conceptually, or there was evidence of multicollinearity, only those variables with the fewest missing values and the strongest association with survival were included in the analyses [e.g. Neugarten's Life Satisfaction Scale (29) was entered, rather than the Delighted-Terrible Faces Scale (28) as an indicator of subjective well-being, and Activities of Daily Living (ADL) score (26) was selected for entry rather than number of health conditions as an indicator of physical condition]. Theoretically relevant concepts, included as independent variables in the multivariable analyses, were operationalised and measured using the following indicators (missing values ranged from 7 to 30):

Health and functioning: a variable was computed from Townsend's ADL scale (26) to represent degree of difficulty with the following personal care and transfer tasks: transferring to bed, transferring to chair, getting on/off WC, dressing, brushing/combing hair.

Social support: a dichotomised indicator identifying respondents who reported wanting to see more of friends (compared with those reporting seeing enough/too much of them), and actual number of people in respondents' social network that they could turn to ('feel close to, can confide in or turn to for help in an emergency') [30, 31].

Social participation: three dummy variables were computed each of which identified those who 'Regularly/Often' (as opposed to 'Never/Rarely' or 'Occasionally/Sometimes') visited friends and/or family; went out to pubs, clubs, or similar social gatherings; or undertook crafts or hobbies. Reference categories indicated those who did not undertake these activities 'Regularly/Often'.

Subjective well-being: Neugarten's Life Satisfaction Scale (29) score was used as an indicator of well-being. This includes

20 items with positive (good) responses to each scored as 1; higher scores thus indicate greater well-being. Self-reported frequency of loneliness (most of the time/often versus never/occasionally) was also included.

Socio-demographic indicators comprised year of birth, sex, marital status and housing tenure.

Results

The characteristics of the sample are shown in Table 1 (available at *Age and Ageing* online). Sample members aged 85+ were significantly more likely than 65- to <84-year-old sample members to be female, to have sub-optimal physical functioning (ADL), to want to see more of friends, to have poor life satisfaction, to feel lonely, to be unmarried and to live with others; and significantly less likely undertake leisure and social activities 'Regularly' or 'Often'. Additional testing showed significant area effects with the Braintree 65 to <84 sample members being more likely than both Hackney samples to be married, to have fewer health problems, better physical functioning (ADL), more people to turn to, to undertake leisure and social activities, to have optimal life satisfaction and to be home owners; and less likely to be lonely (all $P < 0.001$).

Numbers of decedents and survivors at the end of follow-up are shown in Table 2 (available at *Age and Ageing* online). By June 2007, 594 (94.4%) of the oldest old sample were known to have died, as had 389 (83.3%) of the younger Hackney sample and 228 (79.2%) of the Braintree sample; a total of 1211 (88%) deaths between baseline interview (1987, 1989) and end of follow-up (chi-square 53.489, 2 df, $P = 0.001$). Deaths among the 653 non-respondents were also traced, and by the end of the follow-up, 594 of them had died (91%) (not shown).

These results suggest that some deaths were not identified in NHSCR (or were notified late, after the end of our follow-up), as it is unlikely that 5.6% of the initial 85+ sample were still alive in 2007 by which time any survivors would have been aged 105 or more. We therefore ran separate models excluding and including these apparent survivors in the 85+ sample. The results were identical and thus the results for the full sample are reported here, in the interests of comparability with results from the younger samples (which may suffer a similar level of non-ascertainment of death).

The most common causes of death among both males and females were cardiovascular disease (35%), respiratory conditions (34%) and cancer (11%).

Cox proportional hazards analysis

Full sample model

The results reported relate to the full sample of deceased and surviving sample members. As reported earlier, for the purposes of sensitivity analyses, the data were also re-analysed with the 85+ sample 'survivors' removed. The results were identical, and thus the results for the full sample are reported here. The results of the model, in the form of hazard ratios, are shown for the total sample in Table 3 (available at *Age and Ageing* online). The model was highly significant ($P = 0.001$).

The table shows that age, sex, ADL, life satisfaction and the three indicators of social participation, but not social support or reported loneliness, were statistically significant in the model. The hazard ratio of mortality, in the fully adjusted model significantly increased for each categorical increase in the ADL scale score, indicating increasing difficulty with personal care and transfer tasks [relative hazard ratio: 1.026 (CI 1.007–1.044), $P = 0.006$]. The hazard ratio was significantly decreased for each unit increase in the Neugarten Life Satisfaction Scale score, indicating increased life satisfaction [relative hazard ratio: 0.985 (CI 0.970–0.999), $P = 0.040$]. The hazard ratio was consistently reduced for those who undertook 'Regularly/Often': crafts [relative hazard ratio: 0.854 (CI 0.747–0.975), $P = 0.020$], social visiting [relative hazard ratio: 0.854 (CI 0.750–0.973), $P = 0.018$] and social activities [relative hazard ratio: 0.872 (CI 0.770–0.880), $P = 0.032$]. As would be expected, the hazard ratio for males was almost one and a half times that of females [relative hazard ratio: 1.326 (CI 1.162–1.512), $P = 0.001$] and was reduced with each unit increase in the year of birth (indicating younger age) [relative hazard ratio: 0.956 (CI 0.944–0.969), $P = 0.001$].

A product term was created in order to test for a two-way interaction between age and sex, and entered into the model. This provided no evidence of an interaction effect between age and sex ($P = 0.170$).

The survival and hazard curves for the full sample are shown in Figures 1 and 2 (available at *Age and Ageing* online). Figure 1 shows that nearly 60% of respondents with mean scores on co-variates survived for 5 years and 20% for 10 years. Figure 2 shows that, for example, respondents with mean values of co-variates who survived 15 years would then have a hazard of death of 40% within the next year.

Gender-specific analysis

The data were analysed separately for males and females, and by age 65 to <85 (Hackney and Essex samples) and 85+ (Hackney sample). Adjusted for the year of interview, both models were highly significant ($P = 0.001$). While the hazard rate was increased for each categorical increase in ADL indicating poorer functioning, it did not achieve significance for females, and it just missed significance for males. The hazards for females, but not males, were significantly reduced with each unit increase in life satisfaction [relative hazard ratio: 0.979 (CI 0.062–0.996), $P = 0.015$]. Hazards were significantly reduced for males, but not females, who were less lonely [relative hazard ratio: 0.761 (CI 0.597–0.970), $P = 0.028$]. As would be expected, the hazard was reduced with each unit increase in the year of birth (indicating younger age) for both males and females [males: relative hazard ratio: 0.958 (CI 0.936–0.981), $P = 0.001$; females: relative hazard ratio: 0.957 (CI 0.942–0.973), $P = 0.001$].

Age-specific analysis

The analyses were repeated separately for respondents aged 65 to <85 and 85+. Both models were highly statistically significant [$P = 0.001$ and $P = 0.002$ for ages 65 to <85 and 85+, respectively]. For respondents aged 65 to <85, but not those aged 85+, the hazard rate of <20-year mortality was significantly increased for every categorical increase in the ADL score (indicating poorer functioning) [relative hazard ratio: 1.049 (CI 1.017–1.083), $P = 0.03$].

In the 65 to <85 samples only, the hazard rate was significantly reduced for those who engaged in crafts [relative hazard ratio: 0.783 (0.656–0.934), $P = 0.007$], who were less lonely [relative hazard ratio: 0.826 (CI 0.684–0.997), $P = 0.047$], who visited friends and/or family [relative hazard ratio: 0.814 (CI 0.664–0.997), $P = 0.047$] and their hazard rate just achieved statistical significance for the number of people they could turn to—it was reduced with each unit increase in the number of people they could turn to [relative hazard ratio: 0.948 (CI 0.902–0.997), $P = 0.037$]. In the 85+ sample only, the hazards rate just achieved significance and was reduced with each unit increase in life satisfaction [relative hazard ratio: 0.980 (CI 0.961–1.000), $P = 0.045$]. For both age groups, males had almost one and a half times the hazard rate of dying as females [age 65 to <85: relative hazard ratio: 1.223 (CI 1.031–1.452), $P = 0.021$; age 85+: relative hazard ratio: 1.483 (CI 1.212–1.815), $P = 0.001$].

Conclusion

This paper is unique in presenting the independent effect of psycho-social variables on survival in later life, over a relatively long time period. The study's strengths were the large population coverage, in contrasting areas, and high response rates. However, the effect of response bias is unknown; the analyses were limited to responders; the study was limited to people living at home, and thus excluded the 5% of older people living in care homes and institutions, who were likely to be less functionally able. A small number of the very elderly sample members at baseline, and labelled in the dataset as having 'survived', had not been identified as deceased in the NHS Central Registry. We tested the effect of this by running models including and excluding these 'survivors' and found the results to be identical. There may have also been a failure to identify deaths on a similar scale in the younger age groups; thus, the results should be interpreted with some caution.

In relation to the full sample, adjusted analyses show that, as would be expected, the hazard rate for mortality over a 20-year follow-up period was reduced for younger respondents and increased for less functionally able respondents. The hazard ratio for males was almost one and a half times that of females. In the fuller sample, survival was also associated with the ADL score and with life satisfaction, visits to friends and/or family, and participation in crafts and hobbies 'Regularly/Often'. Not all these variables were statistically significant in the stratified sub-analyses, although they had reduced statistical power. The social support indicators did not appear to be protective for the sample overall, although the hazard rate of <20-year mortality among those aged 65 to <85 was reduced with each unit increase in the number of people they could turn to. However, the sample aged 85+ was already a sample of survivors. The analyses adjusted for health, and the results could not be explained by people who were in better health having more people around them and being more socially active.

These results are consistent with the literature in suggesting an independent, protective effect of social participation, particularly among people aged 65 to <85, and of life satisfaction, particularly among females and people aged 85+. As indicated earlier, social support and participation may be directly or indirectly associated with disease. It is also likely that life satisfaction acts as an independent mediator to potentially negative physiological effects of stressful circumstances and also facilitates effective adaptations to the challenges of ageing. This study supports the existence of independent pathways relating to the influence of social participation and subjective well-being on survival in older age, and the importance of social participation and activity [32], in contradiction to early theories of disengagement [33].

Key points

- The adjusted hazard rate for mortality up to a 20-year follow-up period was reduced with each categorical increase in life satisfaction.
- The adjusted hazard rate for mortality was also consistently reduced for those who undertook crafts, social visiting and activities 'Regularly/Often'.
- Social participation was protective particularly for people aged 65 to <85,
- Life satisfaction was protective particularly for females, and people aged 85+.
- The study supports the existence of independent pathways relating to the influence of social participation and subjective well-being on survival in older age.

Acknowledgements

We thank the staff at the NHS Central registry for flagging the sample members and providing death certificates.

Conflict of interest

All authors declare that they have nothing to declare and no financial interests.

Funding

The original interview surveys were funded by the then health authorities covering City and Hackney and Braintree; the follow-up interview surveys were funded by Rowntree Trust.

Supplementary data

Supplementary data are available at *Age and Ageing* online.

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Received 22 November 2007; accepted in revised form 22 May 2008