Reading Daily Predicts Reduced Mortality Among Men From a Cohort of Community-Dwelling 70-Year-Olds

Article in The Journals of Gerontology Series B Psychological Sciences and Social Sciences · April 2008
DOI: 10.1093/geronb/63.2.S73 · Source: PubMed

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Reading Daily Predicts Reduced Mortality Among Men From a Cohort of Community-Dwelling 70-Year-Olds

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REMAINING active into old age is commonly regarded as being synonymous with successful aging, heralding both health and survival benefits (Rowe & Kahn, 1997). However, the nature and definition of activity among older people is clearly as diverse as the spectrum of human interests, and clarification is necessary concerning the specific types of activities that may bear either biological protection or enhancement. Research has demonstrated the benefits of both strenuous and nonstrenuous physical activity, including positive effects on cognition (Lindsay et al., 2002; Yaffe, Barnes, Nevitt, Lui, & Covinsky, 2001), functional status (Boyle, Buchman, Wilson, Bienias, & Bennett, 2007; Seeman et al., 1995; Simonsick et al., 1993; Stessman, Hammerman-Rozenberg, Maaravi, & Cohen, 2002), self-rated health (Rockwood et al., 2004), mood (Penendo & Dahn, 2005), cardiovascular risk (Janssen & Jolliffe, 2006), and longevity (Fried et al., 1998; Gregg et al., 2003; Landi et al., 2004; Stessman, Maaravi, Hammerman-Rozenberg, & Cohen, 2000). Similarly, research has shown social activity and continued social engagement to be associated with improved physical health (Everard, Lach, Fisher, & Baum, 2000), reduced disability and preservation of functional status (Mendes de Leon, Glass, & Berkman, 2003), diminished cognitive decline or dementia (Bassuk, Glass, & Berkman, 1999; Fratigioni, Paillard-Borg, & Winblad, 2004), reduced levels of incident depression and decreased likelihood of new depressive episodes (Glass, Mendes de Leon, Bassuk, & Berkman, 2006), and increased longevity (Glass, Mendes de Leon, Marottoli, & Berkman, 1999). Productive nonstrenuous leisure activities, whether social (e.g., volunteering) or solitary (e.g., gardening), are associated with improved survival (Hyypa, Maki, Impivaara, & Aromaa, 2005; Lennartsson & Silverstein, 2001; Musick, Herzog, & House, 1999). Cultural enrichment, attendance at religious services, and participation in creative activity have been the subjects of research (Bygren, Konlaan, & Johansson, 1996; Greaves, 2006; Konlaan, Bygren, & Johansson, 2000), however the results are inconclusive. Findings suggest that certain activities may be associated with improved survival; nonetheless, further clarification is necessary to determine if any consistent pattern of activities exists and, if so, at what degree of frequency or intensity of activity the benefit is observed.

Attempts to quantify activities that are beneficial to the aging process have suggested a categorization along two broad axes: physical versus sedentary, and social versus solitary. Indeed numerous activities often span different domains, with both physical and social benefits intermingling. Efforts to tease apart different aspects of activities have confirmed the positive effects of the social or physical component of activity on function, life satisfaction, and, on occasion, survival (Menec, 2003). Solitary yet active leisure activities are beneficial, and yet questions remain about the beneficial aspects for aging of activities devoid of both physical and social engagement.

Reading for leisure is an example of such activity—detached, nonstrenuous, and solitary, with little social or physical benefit or obvious utility. Despite the social ramifications that might exist (e.g., participation in book clubs, library attendance, or reading to grandchildren), nonetheless the act of reading on a frequent basis is predominantly solitary in nature. Furthermore,
although the act of reading clearly represents different things to different people, it is nonetheless primarily a form of mental stimulation, generally an enriching experience and sometimes creative. The effects of reading activity as a regular leisure pastime among older people are largely undefined. This study aimed to examine the hypothesis that reading is a solitary sedentary leisure activity that contributes to successful aging and decreased mortality.

**METHODS**

**Basic Methodology and Sampling**

Participants were recruited from the Jerusalem Longitudinal Study, which was initiated in 1990 and has followed an age-homogenous cohort of West Jerusalem residents born between June 1920 and May 1921. We have described the basic methodology and baseline characteristics of the cohort in detail elsewhere (Cohen et al., 1995; Stessman et al., 1995). In brief, a total sample frame of 1,859 people alive and living in Jerusalem, all born in 1920–1921, was identified from the electoral register. Of these, 759 participants were randomly designated as the study target sample, leaving 1,100 people who were not contacted. From the 759 participants approached, a total of 154 people refused to participate, leaving 605 people at baseline. Men were slightly overrepresented in the sample (52%), mainly due to a reduced rate of refusal to participate. Data collection was performed at age 70 and again at age 78. At each phase of data collection, participants were interviewed on two separate occasions, each session requiring the completion of a structured interview that lasted about an hour and a half. At baseline in 1990, the study group of 605 randomly chosen participants all underwent a detailed interview covering social, demographic, cultural, health behavior, and functional domains. From this group, a further 461 participants underwent a second interview by a physician, with in-depth medical anamnesis and physical examination as well as cognitive and psychological tests.

An examination of death certificates and hospital admission records 3 years after the initiation of the study compared study participants to other persons in the sample frame in Jerusalem who had either refused or not been invited to enroll in the cohort study. Participants of the study group (n = 605), refusers (n = 154), and those baseline cohort members not enrolled (n = 1,100) had near-identical mortality and disease-specific hospital morbidity, thus demonstrating the representative nature of the study group in comparison to the total same-age stratum of the Jerusalem population (Cohen et al., 1995; Stessman et al., 1995). The Helsinki Committee of the Hadassah Hebrew University Medical Center approved the study design, and written inform consent was obtained from all participants.

**Cohort Description**

The nature of the cohort at baseline in 1990 (age 70) was highly heterogeneous in origin. Only 16% were native-born Israelis; the remainder had been born in 40 different countries, spanning four continents. The study population had resided for an average of 29 years in Jerusalem. Overall the sample was highly educated, with 45% reporting 13 or more years of education. Although there were some significant differences between ethnic subgroups in self-reported chronic diseases, many of these disappeared when socioeconomic covariates were considered. Self-reported health was overall good at age 70 (54% reported very good/good health, and only 9% reported very poor self-rated health), and only 2% of the cohort were residents in a nursing department or sheltered housing project for elders. The vast majority of participants at age 70 were still leading active and independent lives in their own homes.

**Participants**

The present study focused on the 461 participants at baseline who underwent both comprehensive medical and social assessments, from whom were excluded 13 illiterate participants and 30 participants unable to read due to severe visual impairment or blindness. We excluded visually impaired and blind participants because the service of audio book-recordings is relatively underdeveloped in Israel. We further excluded 17 participants with Mini-Mental State Examination (MMSE) scores of less than 25 and 58 persons who failed to complete the MMSE during assessment. Data on reading habits were missing for a further 6 participants. Thus, the final sample group was 337 participants. We collected mortality data for 8 years for this group.

**Measures**

**Mortality data.**—The outcome measure of death came from comprehensive review of all death certificates issued in Israel through the Ministry of Interior spanning the period from 1990 to 1998. This method provided complete surveillance of mortality data within the sample for all participants remaining in Israel, and because the number of people leaving the country at this age is very low, we thus considered the capture complete.

**Demographic data.**—We collected information concerning marital status (married vs not married). We measured educational status by number of years of schooling and analyzed it as a continuous variable. We divided ethnicity into Western (Ashkenazi) descent versus Eastern (Sephardi/Asian/North African/Yemenite) origin.

We examined economic status according to self-reported overall household income divided into several income categories. Using reference data from the National Insurance Institute, we stratified participants as being either above or below the 1990 poverty line (high or low economic status) after adjusting the monthly household income (which included pensions and support from the National Insurance Institute) for number of people per household.

**Reading activity.**—The primary independent study variable was reading. Participants were asked “How often do you read a book?” Available answers were daily, at least once a week, at least once a month, at least once a year, never, illiterate, and unable to read due to poor vision. We dichotomized the variable to reading daily versus reading less than daily at age 70. The decision to examine reading frequency as a dichotomous variable was in part dictated by the distribution of answers across the categories. This cutoff point was justified by statistical analysis, which took into account the distribution and frequency of possible answers and confirmed the cutoff to be valid in comparison to a continuous variable (Gilula & Krieger, 1989).
Other measures of activity.—The baseline data set provided information concerning several areas of activity. We defined participation in physical activity as either walking at least 4 hr a week or engaging in sport at least twice weekly. Participants were questioned concerning regular weekly volunteer work or paid employment, with any positive answer composing a positive response, irrespective of the number of hours spent performing the activity. We examined frequency of leaving the house as a dichotomous variable (daily vs less than daily), and we dichotomized frequency of going out to cultural events (theater, cinema, etc.) as weekly versus less than weekly. Participants were questioned as to the frequency of attending religious services (daily, weekly, at least once a month, a few times a year, annually, or never).

Health status measures.—We measured self-rated health in absolute terms according to the following question: “How do you rate your state of health?” (good/bad). We defined loneliness as any positive response to the question “Do you ever feel lonely?” We identified depression using the Brief Symptoms Inventory (Derogatis & Melisaratos, 1983). We examined cognitive status using the MMSE (Folstein, Folstein, & McHugh, 1975) and, after excluding participants with MMSE scores less than 25, examined scores as a continuous variable. Participants were questioned for global sleep satisfaction (positive answers being always or generally satisfied vs negative answers of occasionally or never being satisfied with overall sleep, irrespective of hypnotic medication usage). We assessed functional status according to self-reported performance on six activities of daily living (ADLs; transferring, dressing, bathing, using the toilet, eating, and remaining continent; Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963) and five instrumental ADLs (IADLs; cleaning the home, doing laundry, cooking, using the telephone, and shopping; Lawton & Brody, 1982). As have previous studies (Stessman et al., 2002), we used self-reported “performance with ease” to define a more subtle and sensitive measurement of independence in ADLs and IADLs, with dependence being defined as self-reported difficulty (but not dependence) in at least one or more of the activities measured. A physician assessed health status according to self-reported diagnoses and a thorough physical examination. We defined poor vision as visual acuity worse than or equal to 20/40 on Snellen chart testing and assessed hearing such that good hearing was the ability to hear a whisper at 5 m. Participants were questioned concerning the presence or absence of musculoskeletal or joint pain. We calculated body mass index and examined it as a continuous variable. A detailed drug history was taken; psychiatric and hypnotic medications were grouped together as a single group for analyses, in view of their potential effects on reading habit. We took a smoking history and determined the total number of pack years. Diagnosis of ischemic heart disease was the composite of history of hospitalization for myocardial infarction, or an acute coronary syndrome, coronary catheterization with evidence of significant coronary artery disease, a positive stress test, myocardial infarction on electrocardiogram, a history typical for angina pectoris on exertion, a positive stress test, or previous coronary artery bypass grafting surgery. We defined hypertension as treatment with antihypertensive medications or a self-reported diagnosis of raised blood pressure. We identified diabetes by self-report and the presence of diabetic medication, and we determined history of neoplasm. In addition to considering self-reported medical diseases, we calculated the Charlson comorbidity index (Charlson, Pompei, Ales, & McKenzie, 1987), dichotomized as low (weighted score 0–3) versus high (weighted score >3) comorbidity.

Data Analysis

Due to gender differences observed at both baseline and subsequent 8-year mortality, we analyzed data concerning reading frequency separately for men and women. We performed descriptive statistics and calculated means and standard deviations as appropriate. We examined baseline data using chi-square tests for univariate analysis of categorical variables and the Wilcoxon test for continuous variables (see Table 1). We examined survival after 8 years using Kaplan–Meier survival curves, stratified according to gender, and the log rank test for statistical significance (see Figure 1). We examined the influence of reading daily at baseline on 8-year survival using proportional hazards models for men and women separately. We performed preliminary intermediate models for men and women separately and included in them all baseline variables identified with bivariate analysis as significant (p < .1), irrespective of gender. The intermediate model included the following variables: socioeconomic status, employment, origin, educational status, feeling lonely, going out to the theater, back or joint pain, use of sedative drugs, MMSE, and reading daily. We performed backward elimination (p < .1) for each gender and included in the first model the significant variables that emerged. We performed the final model separately for gender and in addition included the following well-known predictors of mortality: self-rated health, physical activity, smoking pack-years, ischemic heart disease, history of neoplasm, and diabetes mellitus (see Table 2).

We performed data storage and analysis using the SAS 8.1e package (SAS Institute, Cary, NC).

RESULTS

The majority of people (62%) read daily at age 70, with more women (66%) reading daily than men (59%). Among the follow-up sample at age 78, 68% of participants continued to read daily, with women (70%) still reading more frequently than men (67%). In all, 13% of men and 14% of women at age 70 reported reading a book weekly, whereas 11% of men and 12% of women read either monthly or annually. A further 10% of men and 15% of women never read a book, despite being literate. Table 1 shows the baseline characteristics at age 70 of the cohort according to gender and frequency of reading. Among both men and women, reading daily correlated positively with Western or Ashkenazi descent, having more education, going out to the theater, and having a higher MMSE score. Reading daily was significantly more frequent among women who worked or volunteered, whereas men who worked were less likely to read daily. Men who read daily reported fewer feelings of loneliness yet increased frequency of musculoskeletal pain. Significantly less women taking psychiatric or hypnotic medication read daily, and we saw a similar yet nonsignificant trend for men. Significant gender differences in reading frequency (p < .05) existed for numerous baseline...
Table 1. Baseline Characteristics at Age 70 of the Jerusalem Cohort

<table>
<thead>
<tr>
<th>Variable</th>
<th>Women (n = 148)</th>
<th>Men (n = 189)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not reading daily, n (%)</td>
<td>Reading daily, n (%)</td>
</tr>
<tr>
<td>n</td>
<td>50</td>
<td>98</td>
</tr>
<tr>
<td>Married</td>
<td>32 (64)</td>
<td>47 (48)</td>
</tr>
<tr>
<td>Western</td>
<td>34 (68)</td>
<td>90 (92)**</td>
</tr>
<tr>
<td>High economic status</td>
<td>37 (74)</td>
<td>84 (88)**</td>
</tr>
<tr>
<td>Education (M ± SD)</td>
<td>10.5 ± 4.0</td>
<td>14.3 ± 3.8***</td>
</tr>
<tr>
<td>High physical activity</td>
<td>26 (52)</td>
<td>54 (56)</td>
</tr>
<tr>
<td>Volunteer/employed</td>
<td>15 (30)</td>
<td>58 (59)**</td>
</tr>
<tr>
<td>Goes out of the house daily</td>
<td>27 (54)</td>
<td>53 (55)</td>
</tr>
<tr>
<td>Attends religious service at least once a week</td>
<td>13 (26)</td>
<td>24 (25)</td>
</tr>
<tr>
<td>Goes regularly to the theater</td>
<td>11 (22)</td>
<td>44 (45)**</td>
</tr>
<tr>
<td>Good self-rated health</td>
<td>32 (64)</td>
<td>74 (76)</td>
</tr>
<tr>
<td>Depression</td>
<td>8 (17)</td>
<td>13 (15)</td>
</tr>
<tr>
<td>MMSE (M ± SD)</td>
<td>28.6 ± 1.6</td>
<td>29.3 ± 1.1**</td>
</tr>
<tr>
<td>Feels lonely</td>
<td>23 (46)</td>
<td>41 (42)</td>
</tr>
<tr>
<td>Poor sleep satisfaction</td>
<td>12 (25)</td>
<td>24 (25)</td>
</tr>
<tr>
<td>IADL difficulty</td>
<td>12 (24)</td>
<td>18 (21)</td>
</tr>
<tr>
<td>ADL difficulty</td>
<td>20 (40)</td>
<td>45 (46)</td>
</tr>
<tr>
<td>Visual problems</td>
<td>8 (16)</td>
<td>22 (23)</td>
</tr>
<tr>
<td>Hearing problems</td>
<td>10 (21)</td>
<td>15 (16)</td>
</tr>
<tr>
<td>Joint or musculoskeletal pain</td>
<td>37 (74)</td>
<td>74 (75)</td>
</tr>
<tr>
<td>Body mass index (M ± SD)</td>
<td>27.9 ± 4.9</td>
<td>27.8 ± 4.4</td>
</tr>
<tr>
<td>Uses psychiatric/hypnotic medications</td>
<td>13 (26)</td>
<td>12 (12)**</td>
</tr>
<tr>
<td>Smoking pack-years</td>
<td>2.6 ± 8.5</td>
<td>12.1 ± 20.2*</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>10 (20)</td>
<td>20 (20)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>25 (50)</td>
<td>38 (39)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>7 (14)</td>
<td>9 (9)</td>
</tr>
<tr>
<td>High comorbidity index</td>
<td>3 (6)</td>
<td>9 (9)</td>
</tr>
</tbody>
</table>

Notes: Chi-square univariate analysis. MMSE = Mini-Mental State Examination; IADL = instrumental activity of daily living; ADL = activity of daily living; SD = standard deviation.
*p < .05; **p < .01; ***p < .001.

variables: marital status, origin, socioeconomic status, education, employment, going out of the house, attendance at religious services, loneliness, ADLs, IADLs, back or joint pain, and hypertension (data not shown).

Figure 1 shows Kaplan–Meier survival curves over an 8-year period according to frequency of reading and stratified according to gender, with log rank test for significance. During the 8-year study period, a total of 65 participants died (19% of the sample). We observed significant differences in 8-year survival among men who read daily in comparison to those who read less than daily (83% vs 61%, respectively; p = .0006). We observed no significant 8-year survival differences among women who read daily versus less than daily (90% vs 89%, respectively; p = .78).

Intermediate proportional hazards models (as described in the Methods section) identified significant hazard ratios (HRs) among the following covariates according to gender. Among men: pain HR = 0.48, 95% confidence interval (CI) = 0.26–0.90; low socioeconomic status HR = 2.13, 95% CI = 0.95–4.76; employment HR = 0.51, 95% CI = 0.27–0.97; sedative drug use HR = 3.1, 95% CI = 1.44–6.56; reading daily HR = 0.36, 95% CI = 0.20–0.67. Among women: employment HR = 0.14, 95% CI = 0.03–0.59; sedative drug use HR = 2.35, 95% CI = 0.85–6.50. We then included these in the final regression model, which included, in addition, the known predictors of mortality shown in Table 2. Reading daily among men remained independently associated with mortality with HR = 0.43 (95% CI = 0.23–0.84). We observed no such effect among women (HR = 1.24, 95% CI = 0.36–4.23).

In order to strengthen the validity of this finding and to confirm the gender difference, we performed a further analysis using data from men and women together in a proportional hazards model. The model included gender and the interaction of Gender × Reading, as well as the following covariates: low socioeconomic status, high physical activity, employment, good self-rated health, musculoskeletal or joint pain, psychiatric or sedative drug usage, smoking, ischemic heart disease, history of neoplasm, diabetes mellitus, and reading. Although reading by itself was not significant (HR = 2.24, 95% CI = 0.67–7.48), nonetheless the HR for 8-year survival for the interaction term of Reading × Male Gender was significant (HR = 0.19, 95% CI = 0.05–0.74; p = .017), thus confirming the gender-specific nature of the findings. A likelihood ratio test (which compares log-likelihood statistics for the interaction model and no interaction model) was significant (p < .025), thus justifying the addition of the interaction term into the model.

**DISCUSSION**

This study found that the activity of reading daily predicts reduced mortality among men taken from a representative cohort of visually and cognitively intact 70-year-olds. This finding was consistent over 8 years of follow-up after we
controlled for measures of physical and social activity as well as known mortality risk factors, and it was reproducible when we examined the genders both separately and together with the inclusion of an interaction variable between reading and male gender. To our knowledge this is the first such study to focus exclusively on reading activity among an age-homogenous cohort of older people free from confounding cognitive or visual impairments.

Although life-span theories have included continued activity as a prerequisite for successful aging, nonetheless a definition of what activity entails remains elusive. In distinction to the proven survival benefits of physical activity and social engagement, much less is known concerning the health, functional, or survival benefits of activities that are both solitary and sedentary.

The Aging in Manitoba study found that older people who participated in solitary nonstrenuous activities were happier 6 years later at follow-up (Menec, 2003). When researchers examined reading or writing activity as a separate variable, they found it to indeed be predictive of subsequent happiness, yet it failed to predict the other 6-year outcomes of life satisfaction, function, or mortality. Researchers investigated solitary sedentary activities in the Chinese Longitudinal Healthy Longevity Survey (Sun & Liu, 2006). Among the study sample, whose average age was 92 years old, 51% reported the frequency of reading, watching television, or listening to the radio as “sometimes or daily.” This frequency of activity for these solitary sedentary activities was predictive of improved survival after 2 years of follow-up. Of interest is that there was a decrease in benefit of social activities with increasing age, a finding that led the authors to conclude that withdrawing from social contact may be an adaptive process to facing the challenges of very advanced old age, when one reaps increased benefits from more introspective and solitary modes of activity. Whether reading and watching television are comparable activities is itself a subject of debate, and recent research has suggested opposite effects on subsequent cognitive function. Whereas watching television is essentially passive and was not shown to be protective, reading activity was predictive of reduced cognitive decline (Wang et al., 2006).
Table 2. Adjusted HRs for 8-Year Mortality Among 70-Year-Olds

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men HR (95% CI)</th>
<th>Women HR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low economic status</td>
<td>2.32 (0.95-5.67)</td>
<td></td>
</tr>
<tr>
<td>High physical activity</td>
<td>0.85 (0.43-1.68)</td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td>0.59 (0.29-1.20)</td>
<td>0.08** (0.01-0.44)</td>
</tr>
<tr>
<td>Good self-rated health</td>
<td>0.48 (0.22-1.05)</td>
<td>0.87 (0.24-3.16)</td>
</tr>
<tr>
<td>Chronic joint or musculoskeletal pain</td>
<td>0.35** (0.17-0.72)</td>
<td></td>
</tr>
<tr>
<td>Uses psychiatric/sedative medications</td>
<td>2.96** (1.36-6.49)</td>
<td>1.27 (0.38-4.21)</td>
</tr>
<tr>
<td>Smoking</td>
<td>1.01 (1.00-1.02)</td>
<td>1.04** (1.02-1.07)</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>2.04* (1.02-4.08)</td>
<td>1.18 (0.32-4.10)</td>
</tr>
<tr>
<td>History of neoplasm</td>
<td>7.64*** (2.49-23.5)</td>
<td>13.72** (2.05-91.9)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>2.38* (1.12-5.02)</td>
<td>0.69 (0.13-3.72)</td>
</tr>
<tr>
<td>Reading daily</td>
<td>0.44* (0.23-0.84)</td>
<td>1.24 (0.36-4.23)</td>
</tr>
<tr>
<td>Likelihood ratio ($\chi^2$)</td>
<td>50.4***</td>
<td>70.3***</td>
</tr>
</tbody>
</table>

Notes: HR = hazard ratio; CI = confidence interval.
*p < .05; **p < .01; ***p < .001.

The mechanism by which reading confers survival benefits is unknown, and the finding that this benefit was restricted to men is enigmatic. Unlike physical activity, which induces positive cardiovascular and physiological changes, sustained mental engagement and stimulation may induce positive neurophysiological and neuroprotective changes. Reading daily may well be a prototype of the "use it or lose it" paradigm (Coyle, 2003; Hultsch, Hertzog, Small, & Dixon, 1999), which is commonly invoked to inspire and motivate mental activity as a protective strategy against cognitive decline. Indeed, evidence does exist that reading protects against subsequent dementia (Vergehese et al., 2003; Wang et al., 2006). In addition, continued activity of a mental nature may both sustain and induce good self-esteem through a sense of meaningful and creative activity. Several studies among visually impaired elders have shown increased mortality rates even after controlling for increased trauma and accidents (known to be increased among this group). It may be that the common pathway is shared through loss of mental engagement, which late-onset blindness often heralds.

The possibility that reading represents a social rather than solitary activity exists, bringing into play numerous potential positive social interactions such as participating in a book club, meeting people at the library or book store, and interacting with young family members through reading to them. The potential social benefits of such activities (e.g., improved self-worth, meaning, motivation) are numerous, and unfortunately information on these areas was unavailable among our cohort. Nonetheless, as a rule these activities tend to be occasional, and furthermore the provision of organized services among elders in Jerusalem is unfortunately scarce and yet to be fully developed. Although in theory such benefits may exist on an occasional basis, the activity of high-frequency daily reading remains predominantly solitary.

We can identify several limitations to this study. First, the quality and content of reading activities was unknown, other than the fact that the participants read a book. This prevented attempts to address the hypothesis that more meaningful stimulation would provide greater benefit. Similarly, the amount of time spent reading per day was lacking. The cutoff used for analysis of reading frequency was daily versus cutoffs used in other studies, mainly due to the distribution of the reading variable. Using a continuous variable for reading frequency would have allowed the possibility of examining a dose–response relationship of reading on mortality and given greater confidence in the causal inference attributed to reading behavior. Second, although we controlled for markers of both social and physical activities in the proportional hazards models, nonetheless the confounding variables were not exhaustive. In particular, beyond the MMSE score and depression score, which we included in the assessment and subsequent data analyses, a more subtle cognitive and psychological assessment would no doubt have helped shed light on the findings and perhaps would have identified possible character traits associated with frequent reading and survival. It might well have been informative to analyze change in reading behavior over time as a dependent variable and to assess potential correlations and predictors. Unfortunately, the power of this analysis was insufficient due to the sample size at age 78. Finally, the associations over time and predictive value of reading with survival did not necessarily suggest a causative
relationship, and clearly one must exercise caution in interpreting results such as these.

The strengths of our study include the age-homogeneous nature of the study cohort and its representative nature of the same-age cohort of older people in Jerusalem, as well as the completeness of surveillance of mortality data.

In summary, the present findings show that reading daily, a solitary and sedentary leisure activity, predicts improved longevity among elderly men. As reading is an activity devoid of either physical or social benefit, this finding sheds light on the importance of purely mental activity for successful aging and suggests that a broader definition of what comprises activity among elderly adults is needed.

ACKNOWLEDGMENTS

The Jerusalem Longitudinal Study received funds from the Ministry of Labor and Social Affairs of the State of Israel; Eshel-The Association for the Planning and Development of Services for the Aged in Israel; the National Insurance Institute; and various private, charitable donors. No support was offered by any commercial venture. These funds were used exclusively to support the research effort, primarily as salaries to ancillary staff. No research funds were received by any of us.

There were no conflicts of interest involved in our undertaking of this study. We thank Ms. Ella Ein-Mor for statistical work and Ms. Etti Arbel for organizational and secretarial contributions.

J. M. Jacobs was involved in the conceptual basis and data analysis of this study. He wrote the first draft of the manuscript and coordinated the review and editing process leading to the final manuscript. R. Hammerman-Roenzberg participated in the design of the study questionnaire and in data collection. He participated in the data analysis and contributed to the editorial process and review of the manuscript. A. Cohen participated in the design of the study questionnaire and in data collection. He participated in the data analysis and subsequent editorial process. J. Stessman is the head of the Jerusalem Longitudinal Study, which he established in 1990. He was integrally involved in every step of the project, including the design of the study itself, creation of the study questionnaire, data collection, and data analysis. He suggested many of the ideas that have been pursued in this research and participated in the review of study findings and the creation of avenues of investigation. He was closely involved in the present data analysis of the present study and actively participated in the planning, editorial, and review processes that led to the final manuscript.

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Received October 1, 2007
Accepted January 10, 2008
Decision Editor: Kenneth F. Ferraro, PhD