Activity patterns in very old people: a survey of cognitively intact subjects aged 90 years or older

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Abstract

Aim: to measure activity patterns in very old people, the factors related to this and the association of different types of activity with well-being.

Methods: a study of 105 people, aged 90 years or older, who were not cognitively impaired, living in Stockholm. The activities carried out during the previous day were recorded and each activity was rated.

Results and conclusions: the degrees of intellectual, social and physical activity are independent of each other. Very elderly people tended to have variable but relatively low activity levels over a day. Good health and not moving home were associated with greater intellectual activity. Extraversion and negative life events (such as death of close friend or family member) were associated with greater social activity, while relatively younger age and better health were associated with greater physical activity. There was positive association between physical activity and well-being.

Keywords: activity patterns, nonagenarians, very old, well-being

Introduction

We know more about frail and cognitively impaired very elderly subjects than about the daily lives of cognitively intact very old people. Research on the very old has mostly concentrated on disability and cognitive impairment rather than on quality of life and well-being. We have examined the daily activity patterns of a representative population of very elderly people who are not cognitively impaired, assessing the factors associated with activity and the consequences of activity patterns for well-being.

Activity research in old age has mostly considered leisure activities and has mainly been on younger elderly people. Few studies have investigated what old people do during a day (see for example [1–4]). The usual way to measure activity is the ‘time budget’ method, where a 24-hour diary of different activities is recorded for the previous day. In a review of activity research, Juster and Stafford [5] concluded that ‘a 24-hour time diary (yesterday interview) of activities on the day preceding the interview was the simplest and most cost effective method of measuring actual time use’. Studies using this method have found that elderly people spend more time sleeping, resting and eating meals than do younger adults [4].

A time-budget research report describes time allocated to particular activities and the proportion of people spending any time in that activity. Activities are often collapsed into general categories [6] and most research on younger elderly people has used these classifications (see [4] for an overview). However, they may not be suitable for very old people. In our study, we have used an approach similar to that used by Christensen and Mackinnon [7], which involves rating each activity for degree of social, physical and intellectual activity on a 7-point scale. By this method we can investigate variation in activities over the day and also factors which might be associated with various types of activity such as living situation, health, socio-demographic characteristics and personality.
Sport, adult education, community work, involvement in drama and dancing may involve pleasant social interaction and raise the spirits [8–10]. There might be a reciprocal influence between what very elderly people do during the day and well-being. We have assessed this by correlating the degree of intellectual, social and physical activity with measurements of well-being.

Methods

Subjects

This study is part of the Kungsholmen project, which involves investigations of elderly people, aged 75 years or over who live in inner Stockholm [11]. All subjects 90 years or older, scoring 24 points or above (mean score 26.6) on the Mini-Mental State Examination (MMSE [12]), were asked to participate. The cut-off score of 24 was chosen to exclude those with cognitive impairment [13], who might have had difficulty comprehending parts of the questionnaire. Of 355 subjects, 116 scored above 24 or more on the MMSE [14]. Of the 116 subjects, 11 were unwilling to participate. The 105 participants were aged between 90 and 99 years (mean 92.9).

Measures and procedure

The interviews were conducted using a semi-structured oral questionnaire in the elderly person’s home or at the Stockholm Gerontology Research Centre.

Activities

Activity was measured using separate ratings of mental, social and physical activity developed from reported daily activities. The interviewer asked about the activities carried out during the previous day and recorded them hour by hour on a diary form [7]. Each activity was rated on (i) intellectual or mental activity, (ii) social activity and (iii) physical activity according to seven-point scales from 1 (completely inactive) to 7 (intensely active). Thus, watching television news scored rather high on intellectual activity but lower on social and physical activity (mean scores 4.0, 1.6 and 1.0 respectively), talking had a higher mean score for social activity (4.6) than for intellectual (3.0) or physical activity (1.6), while going for a walk scored more highly on physical activity (4.6) than on intellectual (2.0) or social activity (1.6). If more than one activity was coded in an hourly period, the mean of all activities was calculated for that hour.

Personality

This was measured by the extraversion and neuroticism scales of the short form of the Eysenck personality questionnaire (revised) [15].

Health status

Functional impairment was measured by a standard instrument measuring ability to perform activities of daily living (ADL) [16] and instrumental activities of daily living (IADL) [16]. Measured on a three-point scale, responses ranged from ‘can do all myself’ to ‘need total help with it’. Subjective health was assessed on a five-point scale [17] where respondents rated their current physical health status from 1 (excellent) to 5 (poor).

Occurrence of life events

This was assessed using a modified version of a checklist developed for gerontological research [18]. Respondents indicated whether any of the 10 events had happened to them in the last 6 months.

Measures of well-being

Positive affect and negative affect represent the affective or emotional components of well-being, while life satisfaction represents the cognitive component [19]. We therefore included measures of positive affect, negative affect and life satisfaction.

Mood was assessed by a short version of the positive affect and negative affect schedule (PANAS) [20]. PANAS positive affect included the following mood adjectives: ‘enthusiastic’, ‘alert’, ‘inspired’, ‘determined’. PANAS negative affect included ‘distressed’, ‘upset’, ‘scared’, ‘nervous’, ‘afraid’. The response options were ‘not at all’, ‘a little’, ‘somewhat’, ‘quite a bit’ and ‘very much’ (coded 1–5). The respondents were asked to report their positive affect and negative affect for the past year. The ‘past year’ time frame was chosen because it shows greater intra-individual stability than shorter time frames [21], yet still reflects affect experienced in the recent past.

To assess life satisfaction, the life satisfaction index Z (LSI-Z [22]) and life satisfaction index B (LSI-B [23]) were used. In the LSI-Z, respondents indicated if they agreed or disagreed with each of 13 items, or were not sure. In the LSI-B the respondents were asked to answer by commenting freely on the items and their responses were coded by the interviewer.

Results

Activity patterns during the day

To calculate the average activity patterns over a whole day for the sample, individual means were averaged for each hour. As can be seen in Figure 1, the mean scores for the various types of activity varied considerably throughout the day. Intellectual activity was higher than the other activities and had a peak from 1800 h to 2000 h. Physical activity had a peak from 1000 h to 1600 h, while social activity peaked at 1300 h and from
Activity patterns in very old people

1700 h to 1900 h. Overall, the four most frequent activities were ‘watched television’, ‘sat in living room and/or rested’, ‘ate dinner’ and ‘talked’.

Associations of activity with respondent characteristics

To assess the relationships between the activity means and other continuous variables, activity means were calculated for each person for their waking hours. Pearson correlation coefficients were used and the $P < 0.05$ significance level was used in all analyses. The results are shown in Table 1. There were no significant correlations between intellectual, social and physical activity across individuals, showing that these three measures of activities were independent.

Age was negatively associated with physical activity and was marginally associated with intellectual activity. Education was not significantly associated with either measure of activity.

All health measures, including the MMSE, were negatively related to intellectual activity. No health measurements were related to social activity. The disability measurements, ADL and IADL, were negatively related to physical activity.

When personality was examined, extraversion was related to social activity, while neuroticism was not significantly associated with any of the activity ratings.

All life events were reported by someone in the sample and certain negative life events predicted the activity ratings. Moving home was negatively associated with intellectual activity. Death of close family member, death of close friend, moving home and the total count of negative life events correlated positively with social activity. Moving house, money problems and own major illness were negatively related to physical activity.

Table 1. Pearson correlations coefficients ($r$) and $P$-values between activity ratings and other variables

<table>
<thead>
<tr>
<th>Activity rating</th>
<th>Intellectual</th>
<th>Social</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$r$</td>
<td>$P$</td>
<td>$r$</td>
</tr>
<tr>
<td>Socio-demographic factor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.19</td>
<td>0.054</td>
<td>-0.08</td>
</tr>
<tr>
<td>Education</td>
<td>0.06</td>
<td>0.565</td>
<td>-0.03</td>
</tr>
<tr>
<td>Health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADL</td>
<td>-0.41</td>
<td>0.000</td>
<td>-0.15</td>
</tr>
<tr>
<td>IADL</td>
<td>-0.39</td>
<td>0.000</td>
<td>0.04</td>
</tr>
<tr>
<td>Poor subjective health</td>
<td>-0.26</td>
<td>0.006</td>
<td>-0.03</td>
</tr>
<tr>
<td>MMSE</td>
<td>0.21</td>
<td>0.035</td>
<td>-0.03</td>
</tr>
<tr>
<td>Personality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>-0.07</td>
<td>0.487</td>
<td>0.25</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-0.07</td>
<td>0.452</td>
<td>-0.04</td>
</tr>
<tr>
<td>Life event in last 6 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death of close family member</td>
<td>-0.11</td>
<td>0.264</td>
<td>0.19</td>
</tr>
<tr>
<td>Major illness of spouse</td>
<td>0.05</td>
<td>0.617</td>
<td>0.11</td>
</tr>
<tr>
<td>Death of close friend</td>
<td>0.00</td>
<td>0.965</td>
<td>0.22</td>
</tr>
<tr>
<td>Move home</td>
<td>-0.20</td>
<td>0.037</td>
<td>0.32</td>
</tr>
<tr>
<td>Being victim of crime</td>
<td>0.02</td>
<td>0.851</td>
<td>0.12</td>
</tr>
<tr>
<td>Relative being victim of crime</td>
<td>-0.02</td>
<td>0.865</td>
<td>0.05</td>
</tr>
<tr>
<td>Being denied a driving license</td>
<td>0.11</td>
<td>0.206</td>
<td>-0.03</td>
</tr>
<tr>
<td>Money problems</td>
<td>0.17</td>
<td>0.082</td>
<td>-0.01</td>
</tr>
<tr>
<td>Own major illness</td>
<td>-0.05</td>
<td>0.582</td>
<td>-0.03</td>
</tr>
<tr>
<td>Total score</td>
<td>-0.07</td>
<td>0.497</td>
<td>0.29</td>
</tr>
</tbody>
</table>

ADL, activities of daily living; IADL, instrumental activities of daily living; MMSE, Mini-Mental State Examination.
One-way analyses of variance were used to compare activity scores between various categories. Table 2 shows the mean activity rating scores for various subgroups. Gender was associated with intellectual activity, with men having higher mean intellectual activity than women. Those who lived in an apartment had a higher mean intellectual activity than those who lived in another type of residence. Marital status was associated with social activity, with the divorced having a higher rating for social activity than those who were widowed, married and unmarried. Housing was associated with social activity, so that those living in an apartment had lower levels of social activities than those in other residences. Residence was also associated with physical activity with those living in an apartment being relatively physically active.

**Associations of activity with well-being**

The results presented in Table 3 show that LSI-B and positive affect correlated positively with physical activity.

**Discussion**

**Patterns of activity across the day**

The mean was higher for intellectual activity than for the other two activity types throughout the day, showing that this is the predominant type of activity in very elderly people. The three types of activity had different peaks, with intellectual activity peaking in the evening, physical activity peaking during the late morning and early afternoon, and social activity peaking around lunch and dinnertime. Comparing these results with those of Christensen and Mackinnon, who recorded the same activity ratings in young and old adults with high or low levels of education [7], we found that the mean intellectual activity (2.56) was slightly lower, but comparable with the mean value for the group of old adults with a low level of education. A likely explanation is that our group of elderly people and the group of subjects with low education in Christensen and Mackinnon’s study had comparable length of education. While the social activity scores from our group of very old adults were comparable to those reported earlier [7], the physical activity scores were much lower, probably because our subjects were much older.

There were no correlations between the intellectual, social and physical activity ratings in our study, showing that these represent independent types of activity. By contrast, Christensen and Mackinnon [7] found that physical activity correlated negatively with intellectual activity and positively with social activities. The reason for this discrepancy may be the inclusion of young adults in their sample.

**Correlations with respondent characteristics**

Age was negatively correlated with physical activity, as shown previously [7, 24]. Gender was associated with intellectual activity, men having a higher intellectual activity level than women. This difference is probably mediated by health, since the men rated themselves as healthier (MM = 2.58 versus MW = 3.13) and had better ADL and IADL scores (MM = 0.08 versus MW = 0.53 for

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### Table 2. Results from one-way analyses of variance together with means, standard deviations (SDs) and P-values for subgroups on activity ratings

<table>
<thead>
<tr>
<th>Variable</th>
<th>Intellectual</th>
<th>Social</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>24</td>
<td>2.78</td>
<td>0.49</td>
</tr>
<tr>
<td>Female</td>
<td>81</td>
<td>2.50</td>
<td>0.40</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/cohabiting</td>
<td>12</td>
<td>2.81</td>
<td>0.51</td>
</tr>
<tr>
<td>Unmarried</td>
<td>16</td>
<td>2.46</td>
<td>0.47</td>
</tr>
<tr>
<td>Divorced</td>
<td>4</td>
<td>2.71</td>
<td>0.17</td>
</tr>
<tr>
<td>Widowed</td>
<td>75</td>
<td>2.53</td>
<td>0.41</td>
</tr>
<tr>
<td>Living conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alone</td>
<td>90</td>
<td>2.53</td>
<td>0.44</td>
</tr>
<tr>
<td>With another person</td>
<td>15</td>
<td>2.75</td>
<td>0.51</td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apartment</td>
<td>81</td>
<td>2.62</td>
<td>0.40</td>
</tr>
<tr>
<td>Other</td>
<td>24</td>
<td>2.38</td>
<td>0.48</td>
</tr>
</tbody>
</table>

This group had a significantly higher score on social activities than the other groups (P < 0.05).
ADL and MM = 0.96 versus MW = 1.46 for IADL). Those who lived in an apartment had higher intellectual and physical activity, but a lower social activity than those who lived in other categories of residence. The reason for this might be that people with cognitive and physical decline live in nursing homes, service houses or with relatives. Divorced people had a more active social life than married, unmarried and widowed subjects. The reasons for this are unclear.

A range of health measures (ADL, IADL and subjective health) correlated with intellectual activity. This is in line with previous research [25]. Cognitive functioning (i.e. MMSE) was positively associated with intellectual activity. Other expected findings were the association between extraversion and social activity [9] and between ADL measurements and physical activity [26].

Adverse life events in the previous 6 months were correlated with activities. As expected, having experienced a major illness was associated with less physical activity. Moving home was negatively correlated with intellectual activity, positively with social activity and negatively with physical activity. Perhaps a move to a supported residence with more social contacts is a result of physical and cognitive decline. Somewhat puzzling was the positive correlation between death of close friend/family member and social activity, although it is likely that a recent death elicits more social contacts. The total number of life events was also positively correlated with social activity.

Correlations with well-being
The LSI-B was correlated with physical activity, which is in concordance with our previously reported results that the LSI-B is more sensitive to health than the LSI-Z [27]. Health status and functional ability are important for well-being in very elderly subjects [3, 20, 27–29] and are determinants of physical activity. The previously reported beneficial effects of exercise on positive affect [9, 30] are confirmed by our results. Of interest is that social activity is not correlated with well-being in this very old age group. Other research with younger age groups has suggested that social contacts might increase well-being [31]. One reason could be that this group had a relatively low level of social activity.

Limitations of the study
Although the 24-h diary method is a simple and cost-effective method of measuring actual time use [5], it has some limitations. These are, first, that it involves self-report of activities rather than objective observation [5] and secondly, that using a single day as a sample of a person’s life is limited [32]. However, the time and cost of using objective observers would have been prohibitive and a 7-day diary would have probably resulted in incomplete data. The method used in the study differed from that used in earlier ‘time-budget studies’ in that we made judgements about the degree of physical, social and intellectual activity in each hour. While those ratings have been found to be highly reliable [7], validity is harder to assess. However, the pattern of associations observed with variables like health, personality and place of residence produces indirect evidence of validity.

Key points
- People who are aged 90 and older and have no cognitive impairment tend to have a variable but relatively low daily activity level.
- Good health and not moving home are associated with higher intellectual activity.
- Extraversion and negative life events such as death of close friend or family member are associated with greater social activity.
- In very old people, there is a positive association between physical activity and well-being.

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References


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