Mortality in relation to urinary and faecal incontinence in elderly people living at home

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Abstract
Objective: to examine the relationship between incontinence and mortality in elderly people living at home.

Design: of the randomly selected people aged 65 years and older living in Settsu city, Osaka in October 1992, 1405 were contacted and constituted the study cohort. Follow-up for 42 months was completed for 1318 (93.8%; 1129 alive, 189 dead).

Measures: data on general health status, history of health management, psychosocial conditions and urinary and faecal incontinence were collected by interview during home visits at the time of enrolment.

Results: from the Kaplan–Meier analysis, the estimated survival rates decreased with a decline in continence in both the 65–74 and 75 years and older age groups. From the Cox proportional hazards model, unadjusted hazard ratios of minor, moderate and severe incontinence for mortality, compared with continence, were 2.27, 2.96 and 5.94, respectively. Multivariate analysis yielded adjusted hazard ratios of minor, moderate and severe incontinence of 0.99, 1.17 and 1.91, respectively, leaving severe incontinence as the significant factor, when other indicators are controlled.

Conclusions: incontinence is related to mortality and severe incontinence represents an increased risk factor for mortality in elderly people living at home.

Keywords: cohort study, elderly people, faecal incontinence, mortality, urinary incontinence

Introduction
Incontinence is a common, disruptive and expensive health problem not only in old people in care [1–4] but also in those living at home [5–15]. Although incontinence adversely affects psychological and social well-being; its relationship to longevity has not been rigorously investigated.

Several studies have showed a significant relationship between incontinence and mortality by the univariate life-table analyses [8, 9, 16–18]. From multivariate analyses controlling for age, education and health status, Herzog et al. [19] reported that neither incontinence status nor its severity were associated with 6-year mortality. Lewis et al. [20] also reported that incontinence remained an important factor for mortality in the short term, but not in the long run, when health and social factors were controlled. One of the key conceptual issues which the association of incontinence and mortality raises is whether incontinence is a marker for general decline or if it plays a causative role.

The present analysis was undertaken to determine whether incontinence was predictive of mortality in a community-residing elderly population.

Methods
Subjects and baseline data
On 1 October 1992, Settsu city in Osaka had a population of 87 293, of whom 6674 were aged 65 years and older. A randomly selected sample of 1491 people aged 65 years and older (22.3%) from the computerized sex–age register, including 21 in a nursing home, were visited at home and were interviewed with the aid of a questionnaire. The interviews were conducted by well-trained district welfare commissioners between 1 and 26 October.
1992. Five people had died and 13 had moved from Settsu, leaving 1473 people to be contacted; responses were obtained from 1405, a response rate of 95.4%. Reasons for non-response were: absent (15), in hospital (25), in an institution (21) and refusal to participate (seven).

The questionnaire consisted of items relating to demographic variables, general health status [as indicated by activities of daily living (ADL) scores], history of health management, psychosocial conditions and incontinence. For assessing general health status, we used the criteria developed by the Working Party of the Health and Welfare Plan for the Elderly organized by the Japanese Ministry of Health and Welfare. The respondent was asked to rate his or her ADL on a scale from N1 to C2 (as defined in the Appendix). This continuum is represented by 10 categories, with N1 and N2 indicating total independence, J1 and J2 more-or-less total independence, A1 and A2 partial dependence and B1, B2, C1 and C2 high levels of dependence. Partial dependence or high levels of dependence were considered to be indicators of poor general health.

For health maintenance, we inquired about the history of health checks, daily preventive health practices related to diet and exercise and current medical treatment. For assessing psychosocial conditions, we asked about elderly people’s involvement in their social network, their engagement in activities considered as particularly meaningful (known as ikigai, which refers to things considered worth living for [21]) and about anxieties for the future.

Incontinence was assessed by the methods developed by the Social Survey Division of the Office of Population Censuses and used for a survey of disability in the UK [22]. The symptoms of urinary and faecal incontinence were broached in the question ‘do you wet or soil yourself’ by indicating the severity of incontinence. Incontinence of urine and faeces is scored on the following scale: 0 for ‘never’; 1.0 for ‘loses control of bladder occasionally/uses a device to control bowels or bladder’; 2.5 for ‘loses control of bladder at least once a month’; 4.0 for ‘loses control of bladder at least twice a month/loses control of bowels occasionally’; 5.0 for ‘loses control of bowels at least once a month’; 5.5 for ‘loses control of bladder at least

Table 1. Baseline characteristics of the study sample according to level of incontinence

<table>
<thead>
<tr>
<th>Characteristic/subclass</th>
<th>Intact (n = 1238)</th>
<th>Minor (n = 46)</th>
<th>Moderate (n = 60)</th>
<th>Severe (n = 61)</th>
<th>Total (n = 1405)</th>
<th>P value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>39.9</td>
<td>52.6</td>
<td>48.3</td>
<td>42.6</td>
<td>40.1</td>
<td>0.416</td>
</tr>
<tr>
<td>Female</td>
<td>60.1</td>
<td>47.4</td>
<td>51.7</td>
<td>57.4</td>
<td>59.9</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;75</td>
<td>35.7</td>
<td>71.7</td>
<td>70.0</td>
<td>75.4</td>
<td>38.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>75–74</td>
<td>66.3</td>
<td>28.3</td>
<td>30.0</td>
<td>24.6</td>
<td>61.7</td>
<td></td>
</tr>
<tr>
<td>Poor general health&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>4.4</td>
<td>35.6</td>
<td>39.0</td>
<td>70.0</td>
<td>9.8</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>95.6</td>
<td>64.4</td>
<td>61.0</td>
<td>30.0</td>
<td>90.2</td>
<td></td>
</tr>
<tr>
<td>Use of health checks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>77.2</td>
<td>65.2</td>
<td>61.7</td>
<td>59.0</td>
<td>75.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>22.8</td>
<td>34.8</td>
<td>38.3</td>
<td>41.0</td>
<td>24.6</td>
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<tr>
<td>Daily preventive health practices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>55.5</td>
<td>54.6</td>
<td>28.3</td>
<td>24.6</td>
<td>34.7</td>
<td>0.046</td>
</tr>
<tr>
<td>No</td>
<td>44.5</td>
<td>45.4</td>
<td>71.7</td>
<td>75.4</td>
<td>65.3</td>
<td></td>
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<tr>
<td>Medical treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>73.2</td>
<td>89.1</td>
<td>86.7</td>
<td>88.5</td>
<td>74.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>26.8</td>
<td>10.9</td>
<td>13.3</td>
<td>11.5</td>
<td>25.1</td>
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<tr>
<td>Participation in social activities</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Yes</td>
<td>45.2</td>
<td>25.9</td>
<td>18.3</td>
<td>9.8</td>
<td>40.1</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>54.8</td>
<td>74.1</td>
<td>81.7</td>
<td>90.2</td>
<td>59.9</td>
<td></td>
</tr>
<tr>
<td>Life worth living (ikigai)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>84.9</td>
<td>78.3</td>
<td>58.8</td>
<td>57.4</td>
<td>82.3</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>15.1</td>
<td>21.7</td>
<td>41.7</td>
<td>42.6</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>70.4</td>
<td>78.5</td>
<td>80.0</td>
<td>75.8</td>
<td>71.2</td>
<td>0.138</td>
</tr>
<tr>
<td>No</td>
<td>29.6</td>
<td>21.7</td>
<td>20.0</td>
<td>24.2</td>
<td>28.8</td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup>Mantel–Haenszel test for linear association.

<sup>b</sup>Data for general health status were available for 1219 people without incontinence, 45 with minor incontinence, 59 with moderate incontinence and 60 with severe incontinence.
once a week'; 6.5 for 'loses control of bowels at least twice a month'; 8.0 for 'loses control of bowels at least once a week/loses control of bladder at least once every 24 h'; 10.0 for 'loses control of bowels at least once every 24 h'; 10.5 for 'no voluntary control over bladder'; and 11.5 for 'no voluntary control over bowels'. Incontinence was grouped into four categories for analysis: 'none' for a score of 0, 'minor' for 1–2.5, 'moderate' for 4.0–6.5 and 'severe' for 8.0 and greater.

Follow-up survey

The survey population's status at the end of March 1996 was determined from their resident registration cards and death certificates to verify their eligibility and outcomes. Of the 1405 subjects enrolled in this study, follow-up was completed for 1318 (1129 alive and 189 deceased) because 87 had moved from Settsu by the time of the follow-up.

Statistical methods

The survival times were calculated by using the date of enrolment and the date of death or the date of follow-up or the date of last registration. Those who had moved from Settsu during the follow-up period have censored survival times, as do those members of the cohort who were living in Settsu at end of the follow-up and who were still alive.

The method of Kaplan–Meier [23] was used to estimate the cumulative survival according to the baseline characteristics. The log rank test was used to assess the significance of differences between survival curves. The Cox proportional hazards model [24] was used to identify subsets of independent prognostic factors for survival. For these analyses, all the variables were used in a dichotomized format. All reported $P$-values are two-tailed and the level of significance is $P < 0.05$.

Results

Table 1 shows the characteristics of the subjects at enrolment. There was no sex difference between the four levels of incontinence. The proportions of those who were 75 years and over or were receiving medical treatment were high in those with incontinence. Those with poor general health were more incontinent. On the other hand, those who had undergone regular health checks, had been practising daily health promotion measures, took part in social activities or said that they found life worth living were less incontinent. The proportion of those who experienced anxiety about the future tended to be higher among those with incontinence.

Table 2 shows the estimated survival rates of the subjects over the 42 months according to level of incontinence. The estimated survival rates decreased with a decline in continence both in those aged 65–74 and those aged 75 years and older. The estimated survival rates for men were lower than those for women for the subjects without incontinence, with minor incontinence and with moderate incontinence.

Table 3 shows univariate hazard ratios of risk factors for mortality. For incontinence, a hazard ratio was calculated for each level of incontinence, with mortality in those with no incontinence as the standard for comparison. Significant factors for mortality were male sex, age over 75, poor general health, any level of incontinence, no use of health checks, no daily preventive health practices, undergoing medical treatment, no participation in social activities and no reason for living (no ikigai). Unadjusted hazard ratios for minor, moderate and severe incontinence were 2.27, 2.96 and 5.94, respectively.

Table 4 shows multivariate hazard ratios of risk factors for mortality. As for incontinence, three dummy variables were created for calculating the hazard ratios for minor, moderate and severe incontinence: $x_1 = 0, x_2 = 0, x_3 = 0$ for none; $x_1 = 1, x_2 = 0, x_3 = 0$ for minor; $x_1 = 0, x_2 = 1, x_3 = 0$ for moderate; and $x_1 = 0, x_2 = 0, x_3 = 1$ for severe.


**Table 3. Hazard ratios for mortality by univariate analysis, using Cox proportional hazards model**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>1.66</td>
<td>1.25–2.21</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age ≥ 75 years</td>
<td>2.70</td>
<td>2.02–3.62</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Poor general health</td>
<td>5.89</td>
<td>4.35–8.01</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Incontinence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>2.27</td>
<td>1.19–4.32</td>
<td>0.013</td>
</tr>
<tr>
<td>Moderate</td>
<td>2.96</td>
<td>1.78–4.90</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Severe</td>
<td>5.94</td>
<td>3.97–8.89</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Use of health checks</td>
<td>0.52</td>
<td>0.24–0.43</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Daily preventive health practices</td>
<td>0.45</td>
<td>0.32–0.65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Medical treatment</td>
<td>1.51</td>
<td>1.05–2.18</td>
<td>0.028</td>
</tr>
<tr>
<td>Participation in social activity</td>
<td>0.35</td>
<td>0.24–0.49</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Life worth living (ikigai)</td>
<td>0.59</td>
<td>0.29–0.52</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.76</td>
<td>0.56–1.03</td>
<td>0.074</td>
</tr>
</tbody>
</table>

HR, hazard ratio; CI, confidence interval.

**Table 4. Hazard ratios for mortality by multivariate analysis, using Cox proportional hazards model**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>HR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male sex</td>
<td>2.26</td>
<td>1.67–3.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age ≥ 75 years</td>
<td>1.74</td>
<td>1.26–2.40</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Poor general health</td>
<td>2.54</td>
<td>1.54–3.57</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Incontinence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor</td>
<td>0.95</td>
<td>0.48–2.02</td>
<td>0.977</td>
</tr>
<tr>
<td>Moderate</td>
<td>1.17</td>
<td>0.67–2.05</td>
<td>0.579</td>
</tr>
<tr>
<td>Severe</td>
<td>1.91</td>
<td>1.15–3.15</td>
<td>0.012</td>
</tr>
<tr>
<td>Use of health checks</td>
<td>0.46</td>
<td>0.34–0.63</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Daily preventive health practices</td>
<td>0.60</td>
<td>0.41–0.87</td>
<td>0.007</td>
</tr>
<tr>
<td>Medical treatment</td>
<td>1.35</td>
<td>0.90–2.02</td>
<td>0.151</td>
</tr>
<tr>
<td>Participation in social activity</td>
<td>0.60</td>
<td>0.40–0.90</td>
<td>0.014</td>
</tr>
<tr>
<td>Life worth living (ikigai)</td>
<td>0.88</td>
<td>0.62–1.24</td>
<td>0.471</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.81</td>
<td>0.59–1.12</td>
<td>0.201</td>
</tr>
</tbody>
</table>

HR, hazard ratio; CI, confidence interval.

Discussion

Donaldson and Jagger [17] reported that the mortality rate for frequently continent elderly people was higher than that for continent elderly people. Similar findings were also reported for several Western countries by Ekelund and Rundgren [4], Campbell et al. [8], Berrios [18] and Goldfarb [16], and for Japan by Koyano [9]. However, none of these studies controlled other risk factors related to mortality to test this hypothesis. When such controls were performed in the multivariate analyses, 2- and 6-year mortality was not significantly associated with incontinence in the studies of Lewis et al. [20] and Herzog et al. [19], respectively. In our study, the estimated survival rates during 42 months decreased with a decline in continence. Univariate hazard ratios for mortality showed that elderly people with minor, moderate and severe incontinence were estimated to be 2.27, 2.96 and 5.94 times as likely as those without incontinence to die within 42 months. Furthermore, severe incontinence remained an increased risk factor for mortality after adjustment for potential confounding factors. Our results indicate that there is an independent and consistent effect of incontinence on mortality in elderly people living at home.

With regard to the statistically non-significant effect of minor and moderate incontinence on mortality in the multivariate analysis, we have to consider two possibilities. First, incontinence is closely related to health conditions and has major psychosocial consequences [5, 8, 11, 14, 25]. The non-significant association between minor and moderate incontinence and mortality may be a result of confounding effects on mortality with respect to other factors, such as health and psychosocial conditions. Secondly, types of incontinence were not distinguished in this study. Those with mild incontinence (e.g. stress incontinence) might comprise many of those with minor and moderate incontinence. Each previous study has limitations in its survey population regarding age, sex, residence or referral that limit the generalizability of the results. It will be important to see whether our findings can be replicated.

Consistent with the previous epidemiological studies [26–33], our study also showed close relationships between mortality and increasing age, male sex, poor general health and psychosocial factors [such as participation in social activities and the presence of particular meaningful aspects of life (ikigai)]. These results suggest that less decline in general health, participation in social activities and identification of particular aspects of life reflect an active physiological and psychological profile and contribute to reducing the mortality of elderly people. In regard to health maintenance, the positive relation between the whole spectrum of physical health and daily good health habits has been demonstrated [34, 35] and the use of health checks is related to reduction in mortality, length of hospitalization and improvement in morale [33, 36–39]. In this study, use of health checks and practices of daily preventive health promotion remained as independent factors associated with survival, with other indicators, such as age, sex, general health status and psychosocial conditions, being controlled.

In conclusion, incontinence in elderly people living at home has appreciable effects on mortality and the mortality rate is increased with the severity of incontinence.
References

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Appendix. Questionnaire for activities of daily living, health management and psychosocial conditions

1. How would you rate your health condition? Please check the most appropriate answer that applies to you.
   N1: Very healthy
   N2: No serious diseases or impairments, living alone
   J1: Some disease or impairment, but hardly any need for any help and ability to go out by bus or train by oneself
   J2: Some disease or impairment, but hardly any need for help and ability to go around the neighbourhood by oneself
   A1: Need for help when going out, but ambulatory during the day
   A2: Ability to go out with help, but going out occurs rarely and staying in bed often even in day time
   B1: Need for help inside the house and mostly staying in bed even in day time, but ability to feed self and use the toilet without help
   B2: Need for help inside the house, mostly staying in bed even during the day, inability to get into and out of a chair, but ability to feed self and use the toilet without help
   C1: Bed-ridden and unable to feed self, use the toilet or dress and undress without help, but ability to turn in bed
   C2: Bed-ridden and unable to feed self, use the toilet, dress and undress or turn in bed without help

2. Have you been watching your diet and/or exercising since you were younger to improve or maintain your health?
   1. No  2. Yes
   If 'Yes', please check at which age you started.
   1. 30–39 or earlier
   2. 40–49
   3. 50–59
   4. 60–69
   5. 70 and after

3. Have you been going for health checks? Please indicate ‘regularly’, ‘sometimes’ or ‘never’ for each age category.
   1. 40–49 or earlier
   2. 60–69
   3. 70 and after

4. Are you receiving medical treatment at present?
   1. No  2. Yes

5. Do you participate in social activities?
   1. No  2. Yes
   If 'Yes', please check all that apply.
   1. I am employed
   2. I am self-employed
   3. I am active in a golden-age club
   4. I am active in a town or women's association
   5. I am active with colleagues and peers
   6. I perform volunteer work
   7. Other (specify)

6. Are there aspects of your life which make it worth living (do you have Ikigai?)
   1. No  2. Yes
   If 'Yes', please check all that apply.
   1. Work
   2. Hobby or study
   3. Sports or recreation
   4. Volunteer activities
   5. Activities with colleagues and peers
   6. Children and grandchildren
   7. Family gatherings
   8. Outing or travel
   9. Shopping
   10. Reading
   11. Watching television
   12. Housekeeping
   13. Religious activities
   14. Other (specify)

7. Do you have worries about the future?
   1. No  2. Yes
   If 'Yes', please check all aspects that you are worried about.
   1. Bed-ridden or frail
   2. Sickness or ill health
   3. Loneliness
   4. Bereavement
   5. Family relationship
   6. Financial condition during old age
   7. Attrition of social activity
   8. Personal care
   9. Housing
   10. Other (specify)