Health Inequalities

Association between chronic diseases and disability in elderly subjects with low and high income: the Leiden 85-plus Study

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Background: Disability in activities of daily living (ADL) might be more prevalent among elderly with low income due to higher prevalence of chronic diseases and impairments, as well as stronger associations of these factors with ADL-disability. Methods: In the Leiden 85-plus Study, we defined disability as being unable to perform one or more basic ADL activities. Presence of chronic diseases was obtained from medical records, impairments were assessed with performance-tests. Results: Elderly with low income had higher prevalence of ADL-disability (23% versus 12%; odds ratio 2.0; 95% confidence interval 1.3–3.2), higher prevalence of impairments and equal prevalence of chronic diseases, except for dementia and co-morbidity. Associations of these factors with ADL-disability were not stronger. Conclusions: We conclude that ADL-disability is more prevalent in elderly with low income. Neither prevalence of chronic diseases nor the association with disability could explain this.

Keywords: chronic diseases, disability, elderly, income

C urrent income level is a good measure for previously experienced cumulative deprivation.¹ Compared with subjects with high income, subjects with low income have more chronic diseases and more disabilities in daily life,²–⁴ and have a shorter life expectancy.⁵ Furthermore, diseased persons with low income tend to present disease at a later and more severe stage,⁶ and have less access to therapeutic interventions.⁷–⁹ All these studies were in carried out in populations under the age of 85 years. In the oldest old, income-related differences are smaller and the income–mortality gradient is less steep than in the working-age population.¹⁰ On the other hand, the oldest old frequently have several diseases and disabilities, and income-related differences might thus have a high impact on the population level. In the Leiden 85-plus Study, a population-based study in the oldest old, we investigated income-related differences in chronic diseases and disability. We hypothesized that among elderly with low income: (i) disability in basic activities of daily living (ADL) is more prevalent; (ii) prevalence of chronic diseases is higher; and (iii) the association between chronic diseases and disability is stronger, compared with individuals with a high income.

Methods

The Leiden 85-plus Study is a population-based follow-up study of 399 subjects aged 85 years. There were no selection criteria on the basis of health or demographic characteristics. Sampling procedure and non-response analysis has been published previously.¹¹ All participants were visited at their place of residence, where face-to-face interviews and performance tests were conducted and an electrocardiogram (ECG) was recorded.

The medical history of all participants was obtained from their general practitioner or treating nursing home physician. Data on medication use were obtained from pharmacies. Cognitive function was assessed with the Mini-Mental State Examination (MMSE).¹² All subjects gave informed consent. In case of a severe cognitive impairment, defined as an MMSE score below 19 points, informed consent and information on income, education and disabilities in daily activities were obtained from a guardian. The Medical Ethical Committee of the Leiden University Medical Center approved the study.

Income

We asked standardized yes/no questions about state pension, other pensions and additional income per month, followed by an open question about the net amount for each category. To make income level of couples equivalent to that of single living persons, we multiplied household income for those living together by 0.7.¹³ Thirteen subjects provided incomplete data on income.

Disability

Disability in basic ADL was measured using the Groningen Activity Restriction Scale (GARS).¹⁴ The GARS assesses restrictions in competence in carrying out ADL. We defined disability as being unable to do any one of the following nine basic ADL independently: walk inside, get up out of bed, get into and out of a chair, visit the toilet, wash hands and face, wash body, dress and undress, eat and drink, and make breakfast.¹⁵

Chronic diseases

Presence of chronic diseases was obtained from subjects’ general practitioners by a semi-structured interview and inspection of medical records. We have previously demonstrated that this method yields highly reliable results.¹⁶ For subjects living in a nursing home, the nursing home physician provided the necessary information. In addition, data on medication use were obtained from pharmacies and coded according to the Anatomical Therapeutic Chemical (ATC) classification.¹⁷
Significant income-related difference in prevalence

A total of 99 participants had suffered a Q-wave myocardial infarction based on Minnesota coding of their ECG; 72 of these were undiagnosed (72/99; 73%). In participants with myocardial infarction on the ECG that was unknown to the subject’s general practitioner or nursing home physician. The association of dementia was significantly lower in those with low income (OR 6.4, 95% CI 3.2–13; versus OR 22.7, 95% CI 7.8–66.4; P for interaction 0.05). None of the remainder of the associations between chronic diseases and disability was significantly different in elderly with low income compared with those with high income. All associations of chronic diseases and disability were similar for women and men (data not shown).

Since neither the prevalence nor the association of chronic diseases with disability explained the two-fold increase in disability in those with low income, we performed various additional analyses. First, we explored whether underdiagnosis of diseases in persons with low income might explain our findings. A total of 99 participants had suffered a Q-wave myocardial infarction based on Minnesota coding of their ECG; 72 of these were undiagnosed (72/99; 73%). In participants with low income, prevalence of undiagnosed myocardial infarction was significantly higher than in participants with high income (16% versus 10%; P = 0.05). Omitting Minnesota code 1-3 as diagnostic for myocardial infarction did not alter these results. Secondly, we excluded persons with severe cognitive impairment (92 participants (16%) with MMSE score <19), because cognition is highly associated with disability. The prevalence of chronic diseases (excluding dementia) and the associations with disability as shown in table 2 were not different. Thirdly, we repeated all analyses for those whose only income was a state pension (96 participants; 16%) compared with those with an additional income (491 participants; 84%). The prevalence of chronic diseases and their association with disability had a similar pattern.

Discussion

Subjects with low income more often had two or more chronic diseases than subjects with high income. Moreover,
multi-morbidity also tended to be related more strongly with disability in subjects with low income, although this study probably lacked the power to demonstrate this statistically. Hence, our findings are in line with others who found that elderly persons with low income have a higher burden of co-morbid conditions, and thus indicate that we adequately dichotomized our subjects in a low and a high income group.

Another explanation for the discrepancy between the prevalence of chronic diseases and disabilities in different income groups is underdiagnosis or unawareness of disease among those with low income. We showed that a clinical diagnosis of myocardial infarction was equally present among those with high and low income, but that the prevalence of undiagnosed Q-wave infarctions was higher in those with low income.

We conclude that among the oldest old, income-related differences in activities of daily living and chronic diseases in a population aged 85 years. Disability in basic activities of daily living was more prevalent in elderly with a low income compared with elderly with a high income.

Neither the prevalence of chronic diseases nor the association with disability could explain this income-related difference.

We suggest that co-morbidity and unawareness of disease among those with low income as likely explanations.

### Table 2  Association between diseases and disability in subjects with low and high income

<table>
<thead>
<tr>
<th>Chronic diseases</th>
<th>Low income (n = 294)</th>
<th>High income (n = 292)</th>
<th>Interaction P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>7.1 (3.2–15.6)</td>
<td>7.1 (3.0–17.1)</td>
<td>0.99</td>
</tr>
<tr>
<td>Myocardial infarct</td>
<td>0.9 (0.4–2.1)</td>
<td>0.3 (0.1–2.0)</td>
<td>0.30</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.3 (0.6–2.6)</td>
<td>1.7 (0.7–4.5)</td>
<td>0.65</td>
</tr>
<tr>
<td>Parkinson</td>
<td>9.1 (1.7–47.9)</td>
<td>8.4 (2.0–35.3)</td>
<td>0.95</td>
</tr>
<tr>
<td>Dementia</td>
<td>6.4 (3.2–13.0)</td>
<td>22.7 (7.8–66.4)</td>
<td>0.05</td>
</tr>
<tr>
<td>Hip fracture</td>
<td>3.9 (1.6–9.5)</td>
<td>2.0 (0.5–7.6)</td>
<td>0.42</td>
</tr>
<tr>
<td>Arthritis</td>
<td>0.8 (0.4–1.4)</td>
<td>0.5 (0.2–1.2)</td>
<td>0.37</td>
</tr>
<tr>
<td>Obstructive lung disease</td>
<td>0.8 (0.3–1.8)</td>
<td>1.1 (0.4–3.3)</td>
<td>0.63</td>
</tr>
</tbody>
</table>

Number of diseases

| None             | 1.0 Reference       | 1.0 Reference       |                |
| One              | 3.8 (1.6–9.1)       | 1.4 (0.6–3.7)       | 0.14             |
| Two or more      | 6.8 (2.8–16.4)      | 4.1 (1.6–10.6)      | 0.45             |

OR = odds ratio; 95% CI = 95% confidence interval

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#### Key points

- We investigated income-related differences in activities of daily living and chronic diseases in a population aged 85 years. Disability in basic activities of daily living was more prevalent in elderly with a low income compared with elderly with a high income.
- Neither the prevalence of chronic diseases nor the association with disability could explain this income-related difference.
- We suggest that co-morbidity and unawareness of disease among those with low income as likely explanations.

#### References


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