The Health Status of Nonparticipants in a Population-based Health Study

The Hordaland Health Study

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The authors aimed to examine whether nonparticipation in a population-based health study was associated with poorer health status; to determine whether specific health problems were overrepresented among nonparticipants; and to explore potential consequences of participation bias on associations between exposures and outcomes. They used data from the Hordaland Health Study (HUSK), conducted in western Norway in 1997–1999. Of 29,400 persons invited, 63.1% participated in the study. Information from HUSK was linked with the Norwegian national registry of disability pensions (DPs), including information about DP diagnosis. The risk of DP receipt was almost twice as high among nonparticipants as participants (relative risk = 1.88, 95% confidence interval: 1.81, 1.95). The association was strongest for DPs received for mental disorders, with a 3-fold increased risk for nonparticipation. Substance abuse, psychotic disorders, and personality disorders were especially overrepresented among nonparticipants. The authors simulated the impact of nonparticipation on associations between exposures and outcomes by excluding HUSK participants with higher symptoms of common mental disorders (exposure) and examining the impact on DP (outcome). This selective exclusion modestly reduced associations between common mental disorders and DP. The authors conclude that nonparticipants have poorer health, but this is disorder-dependent. Participation bias is probably a greater threat to the validity of prevalence studies than to studies of associations between exposures and outcomes.

Abbreviations: DP, disability pension; FD-Trygd, Forløpsdatabasen Trygd; HADS, Hospital Anxiety and Depression Scale; HUSK, Hordaland Health Study; ICD, International Classification of Diseases.
have revealed higher rates of hospitalization (4) and benefit recipiency (3, 11, 16) and higher mortality rates (4, 12, 17–19) among nonparticipants. In general, studies on sociodemographic factors among nonparticipants are usually of high methodological quality. By contrast, studies on health variables associated with nonparticipation have limitations, particularly because they tend to rely on subgroups of nonparticipants to provide information, possibly repeating the same nonparticipation biases. Hospital admission is a relatively rare event and is not of equal relevance across all health problems. The associations between nonparticipation and mortality could be due to severe and advanced stages of pathology preventing participation. Such information might not describe milder and more prevalent health complaints and impairments among nonparticipants. In summary, methodological shortcomings limit our knowledge of the health status of nonparticipants.

Sickness absence and receipt of a disability pension (DP) are reliable indicators of a person’s health and use of health services (21), and these factors are associated with highly prevalent conditions like common mental disorders (22, 23) and musculoskeletal pain (24). Two previous studies on rates of DP recipiency among nonparticipants were cross-sectional, without information on the condition for which the pension was awarded (3, 16). Furthermore, the application process for a DP can take years, and symptom severity increases towards the time of award receipt, followed by a subsequent decrease (25). Therefore, long follow-up periods before and after a health study are an advantage.

Research designs that are independent of active provision of information from nonparticipants should have increased validity. In Norway, data from large population-based health studies can be linked with complete registries of all DPs received in the entire population through individual personal identification numbers (23, 26, 27). This linkage is accessible for both participants and nonparticipants and permits the tracking of DPs awarded several years before and after the health study.

In this study, we used data linkage between the Hordaland Health Study (HUSK) and the Norwegian national registry of DP awards, including primary diagnoses, to compare the health status of nonparticipants with that of participants. First, we explored the general health status of participants and nonparticipants to determine whether there were more health problems (current and future receipt of a DP) among nonparticipants. Second, we examined whether any specific health problems were overrepresented among nonparticipants. Finally, we explored the potential impact of participation bias on associations between exposures and outcomes.

**MATERIALS AND METHODS**

**The Hordaland Health Study**

HUSK was an epidemiologic population-based health study conducted between 1997 and 1999 in Hordaland County in western Norway. The study was originally part of countywise screening for coronary heart disease prevalence and risk factors, conducted among persons in their forties by the Norwegian National Health Screening Service. In collaboration with the University of Bergen and local health services, variables from other health-related areas such as cancer, psychiatric and psychosocial factors, work life, medication use, musculoskeletal symptoms, and general physical conditions were included in the assessment. Participants were invited to attend clinical examinations at locations near their homes. The data were collected via both physical examination at the HUSK premises and various questionnaires.

**Variables**

**Participation and nonparticipation.** All persons born between 1953 and 1957, who were aged 40–46 years at the time, and living in Hordaland County (n = 29,400) received a personal invitation by mail to participate in the health study. Data on the ages, genders, and locations of the persons invited were gathered from the Norwegian national population registry. One reminder was sent to persons who did not visit the examination premises within 3 weeks of the invitation and to those who did not return the questionnaires. “Participation” in the current study was defined as appearing at the examination premises. All of the participants received written feedback on the results of their health examination.

**Receipt of a DP.** Within the Norwegian welfare scheme, a DP can be awarded to anyone who has had his or her earning ability permanently reduced by ≥50% due to an illness, disease, injury, or disability accepted as a medical condition. DPs may be awarded to persons who have never engaged in paid work; however, DPs are not to be given for social problems like unemployment. DPs in Norway are a government responsibility, and all awards are accurately documented in the Norwegian National Insurance Administration registry, Forløpsdatabasen Trygd (FD-Trygd) (28). In the current study, we used information about DPs from FD-Trygd, including the date of award and the primary medicolegal diagnosis. This information is updated annually for each individual and was linked by Statistics Norway to all of the persons invited to participate in HUSK through their personal identification numbers. In this study, we used information on DPs awarded up to December 1, 2004.

**Diagnoses.** The medicolegal diagnoses in FD-Trygd are coded according to the World Health Organization’s *International Classification of Diseases*, Ninth Revision (ICD-9) and Tenth Revision (ICD-10). In the current study, ICD-9 diagnoses were converted to appropriate ICD-10 codes. In Norway, musculoskeletal (M00–M99) and mental (F00–F99) disorders comprise more than two-thirds of all DPs (29), so for the primary analysis of specific health problems, the ICD-10 codes were grouped as “mental and behavioral disorders” (F00–F99), “musculoskeletal disorders” (M00–M99), and “other somatic disorders,” where the latter included all diagnostic categories other than mental and musculoskeletal disorders. Differences in the proportions of specific disorders among nonparticipants and participants were further examined for single 2-digit diagnostic categories (i.e., codes F30–F39). Only categories...
which contained more than 50 persons were included in the tables. Diagnostic information was missing for 40 persons. These persons were included in the “other somatic disorders” group. Further elaboration of the diagnostic information in the DP registry, including the accuracy of this information, is presented in the Discussion.

Indicators used in simulation analyses: anxiety and depression. We also studied the impact of participation bias on estimates of association between exposures (or characteristics) and outcomes (diseases or other). By selectively excluding HUSK participants with symptoms of common mental disorders, we simulated selective nonparticipation of persons with mental health problems. Common mental disorders were assessed in HUSK by employing the Hospital Anxiety and Depression Scale (HADS) (30). HADS has 2 subscales measuring anxiety (HADS-A) and depression (HADS-D), with scores ranging from 0 to 21. A score of ≥8 on either scale is regarded as HADS caseness. Participants were excluded on the basis of progressive symptom scores on either scale, with an intentionally increased exclusion rate at the high-severity end to simulate a likely dose-response association between symptom severity and nonparticipation (more details on the exclusion procedure are given in the table footnotes). The exclusion procedure was conducted twice, with different persons being excluded in the 2 samples. We explored the consequences of this selective exclusion by replicating an analysis from a previously published HUSK study on associations between anxiety/depression and subsequent receipt of a DP (22), in terms of examining how the simulated exclusion affected these associations.

Statistical analyses

The time lag between HUSK and DP award was based on the scheduled date of health study participation. Time trends in the relative risk of a DP award between participants and nonparticipants were analyzed, both for all DPs awarded during the complete follow-up period (“current and future DPs”) and for DPs split between current recipients (DPs awarded before or up to 1 year after the HUSK date) and future recipients (DPs awarded 1–7 years after the HUSK date). SPSS, version 15 (SPSS, Inc., Chicago, Illinois), was used in the analyses.

In the simulation analyses, we used Cox regression to calculate hazard ratios for receipt of a DP due to anxiety and/or depression during 1–7 years of follow-up for the original participants and in the modeled selective nonparticipation samples, adjusting for potentially confounding variables. The design and methods of the analysis on which the simulation was based are described elsewhere (22).

Ethics

The study protocol for HUSK was approved by the regional ethics committee and the Norwegian Data Inspectorate. Written informed consent was gathered from all participants. For the nonparticipants, only registry data were used; in principle, this is public information and is made available for research purposes through application to the Norwegian Data Inspectorate.

RESULTS

Information on the HUSK participation rate, general sociodemographic characteristics, and the prevalence of HADS caseness among HUSK participants is given in Table 1. Of the 29,400 persons invited to enter HUSK, 18,565 (63.1%) participated. More than half (59.7%) of the nonparticipants were men. Of the entire study population invited, 10.0% (n = 2,942) were awarded DPs during the study period.

General health status, measured as the rate of DP receipt, was poorer among the nonparticipants in the health study than among the participants. Both the current DP recipients (those receiving DPs at the time of the health study) and the future DP recipients (those receiving DPs in the years after the health study) had elevated rates of nonparticipation, but the risk was higher for the current DP recipients (Table 2). There were no significant gender differences in these associations (Table 2).

With regard to disorder differences, the association between nonparticipation and DP receipt was strongest among persons awarded DPs for mental disorders. Compared with those not awarded a DP, this group had a 3-fold increased risk of nonparticipation (Table 3). Fewer than 2 out of 5 persons receiving a DP for mental disorders participated in HUSK (Table 3). Beyond mental and musculoskeletal...

### Table 1. Participation Rates and General Characteristics of Participants in the Hordaland Health Study, Hordaland, Norway, 1997–1999

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (29,400 invited)</td>
<td>18,565</td>
<td>63.1b</td>
</tr>
<tr>
<td>Men (15,051 invited)</td>
<td>8,585</td>
<td>57.0b</td>
</tr>
<tr>
<td>Women (14,349 invited)</td>
<td>9,980</td>
<td>69.6b</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>9,980</td>
<td>53.8</td>
</tr>
<tr>
<td>Marital status (married)</td>
<td>13,730</td>
<td>74.0</td>
</tr>
<tr>
<td>Disability pension award</td>
<td>1,403</td>
<td>7.6</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compulsory education only</td>
<td>3,588</td>
<td>19.3</td>
</tr>
<tr>
<td>High school</td>
<td>8,508</td>
<td>45.8</td>
</tr>
<tr>
<td>Higher education (college and university)</td>
<td>6,469</td>
<td>34.8</td>
</tr>
<tr>
<td>Valid HADS score</td>
<td>15,963</td>
<td>86.0</td>
</tr>
<tr>
<td>Reference group (&lt;8)</td>
<td>12,522</td>
<td>67.4</td>
</tr>
<tr>
<td>Anxiety only</td>
<td>1,876</td>
<td>10.1</td>
</tr>
<tr>
<td>Depression only</td>
<td>554</td>
<td>3.0</td>
</tr>
<tr>
<td>Comorbid anxiety and depression</td>
<td>1,011</td>
<td>5.4</td>
</tr>
</tbody>
</table>

Abbreviation: HADS, Hospital Anxiety and Depression Scale.

*a Age at participation in the health screening was 40–46 years.

*b Percentage of the persons invited to participate.
disorders, the diagnostic category “other somatic disorders” was moderately associated with nonparticipation (Table 3). Persons given a DP for musculoskeletal disorders, as a group, had only a slightly lower participation rate than the general population (Tables 1 and 3).

For both musculoskeletal disorders and other somatic disorders, nonparticipation was higher for current DP than for future DP (Table 3). For mental disorders, however, the association was almost equally strong for both current and future DP receipt (Table 3). There were differences in associations between nonparticipation and specific diagnostic groups. Within DPs awarded for mental disorders, participation rates were lowest among persons with substance abuse (ICD-10 codes F10–F19), psychotic disorders (codes F20–F29), and personality disorders (codes F60–F69) (Table 4). Despite differences in the strength of associations, all diagnostic categories within this group were associated with increased nonparticipation. In the group awarded DPs for musculoskeletal disorders, there were weak associations between dorsopathies (i.e., back and spine disorders; ICD-10 codes M40–M54) and nonparticipation but no associations with other specific conditions (Table 4). Among persons awarded DPs for diagnoses beyond mental and musculoskeletal disorders, the strongest associations with nonparticipation were found for endocrine diseases (ICD-10 codes E00–E90), circulatory diseases (codes I00–I99), cancer (codes C00–D48), and external injuries (codes S00–T98) (Table 4).

The simulation of nonparticipation according to participants’ common mental disorder symptom severity moderately reduced the effect sizes of the associations between anxiety and depression and subsequent DP awards in comparison with those found in the previous study (22), where no such simulation was done (Table 5), and also decreased the precision of the estimates through widening of the confidence intervals. The size of the effect on comorbid anxiety and depression was more reduced than the effect size of either anxiety or depression alone (Table 5).

**DISCUSSION**

The health status of nonparticipants was generally poorer (more DPs awarded) than that of participants. This association was strongest for mental disorders, moderate for “other somatic disorders,” and absent for most musculoskeletal disorders. Substance abuse, psychotic disorders, and personality disorders were particularly overrepresented among nonparticipants; however, significant associations were found for every category of mental disorder. The simulated selective exclusion of participants with high levels of anxiety and depression symptoms modestly reduced the effect of common mental disorders as risk factors for a subsequent DP.

**Strengths and limitations**

The most important strength of this study was the linkage between data from a population-based health study and data from a complete national registry of DPs, providing objective information on the DP status and diagnosis of both participants and nonparticipants. No person was lost in terms of the outcome of interest, and the validity of the measurement outcome was high. Data from the DP registry also provided information on conditions prevalent in
a working-age population, which is not easily accessible in studies based on hospitalization or mortality registries. The use of a registry-based outcome also provided us with information on health status several years after HUSK. The latter is of particular relevance for follow-up studies. To the best of our knowledge, this was the first study to obtain information about nonparticipation bias using a longitudinal design.

There were also some limitations to our study. First, persons who are awarded a DP will, in most cases, have severe health problems, often with poor response to treatment and a poor prognosis (31). Therefore, use of this outcome will only provide information on severe illnesses or cases of illnesses with severe impairment, while less severe cases or illnesses might be even more frequent in nonparticipants. Second, except for gender, other possible confounding factors for nonparticipation, like socioeconomic status, were not controlled for. Third, there was no available information on reasons for nonparticipation. Nonparticipation might be caused by factors beyond health, such as a busy schedule (9), not having received or read the invitation, absence during the time of health screening, or being in an institution like a hospital or prison. Finally, some might question the generalizability of the findings. The study was carried out in 1 particular county and country among participants aged 40–46 years. However, HUSK was conducted with procedures similar to those used in other population-based studies both in Norway and elsewhere, and a satisfactory participation rate (63.1%) was attained. In areas with more social deprivation, there might be even greater differential nonparticipation among persons with mental disorders.

The use of diagnostic information from the DP registry provides both advantages and challenges when interpreting the results. The main advantage is that the DP registry, compared with self-reported information, objectively states whether a person has been awarded a DP and for which main diagnostic cause. However, it is not certain that the diagnosis in the DP registry reflects the true health problems leading to the DP for each person. Where the diagnosis indicates a severe disorder like cancer or schizophrenia or a stigmatizing disorder like alcohol dependence, the diagnostic information should accurately describe a key health problem, while accuracy may be lower for disorders characterized by symptoms rather than organic findings, such as musculoskeletal disorders or milder mental disorders. High comorbidity rates between common somatic and psychiatric symptoms pose further challenges for the accuracy of the diagnosis given.

**Interpretation and importance of the findings**

Interventions used to encourage participation in studies include information campaigns (32) and financial incentives (33, 34). A high participation rate is important for generalizability and validity, but extensive efforts to increase participation may also have their drawbacks. An important

<table>
<thead>
<tr>
<th>Diagnosis Group</th>
<th>No. of Participants</th>
<th>No. of Nonparticipants</th>
<th>Association Between Diagnosis and Nonparticipation</th>
<th>% of Cases Who Participated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Relative Risk 95% CI % 95% CI</td>
<td></td>
</tr>
<tr>
<td>Current and future DP</td>
<td></td>
<td></td>
<td>Relative Risk 95% CI % 95% CI</td>
<td></td>
</tr>
<tr>
<td>No DP awarded</td>
<td>17,162</td>
<td>9,296</td>
<td>1.00 Referent</td>
<td></td>
</tr>
<tr>
<td>Mental disorders</td>
<td>447</td>
<td>761</td>
<td>2.98 2.87, 3.10</td>
<td>37.0 34.3, 39.7</td>
</tr>
<tr>
<td>Musculoskeletal disorders</td>
<td>448</td>
<td>299</td>
<td>1.22 1.08, 1.37</td>
<td>60.0 56.5, 63.5</td>
</tr>
<tr>
<td>Other somatic disorders</td>
<td>508</td>
<td>479</td>
<td>1.70 1.58, 1.83</td>
<td>51.5 48.4, 54.6</td>
</tr>
<tr>
<td>Mental disorders</td>
<td>279</td>
<td>493</td>
<td>3.15 3.00, 3.29</td>
<td>36.1 32.8, 39.5</td>
</tr>
<tr>
<td>Musculoskeletal disorders</td>
<td>143</td>
<td>120</td>
<td>1.54 1.30, 1.78</td>
<td>54.4 48.4, 60.4</td>
</tr>
<tr>
<td>Other somatic disorders</td>
<td>253</td>
<td>259</td>
<td>1.87 1.69, 2.04</td>
<td>49.4 45.1, 53.7</td>
</tr>
<tr>
<td>Current DP</td>
<td></td>
<td></td>
<td>Relative Risk 95% CI % 95% CI</td>
<td></td>
</tr>
<tr>
<td>No DP awarded</td>
<td>17,162</td>
<td>9,296</td>
<td>1.00 Referent</td>
<td></td>
</tr>
<tr>
<td>Mental disorders</td>
<td>168</td>
<td>268</td>
<td>2.89 2.70, 3.08</td>
<td>38.5 34.0, 43.1</td>
</tr>
<tr>
<td>Musculoskeletal disorders</td>
<td>305</td>
<td>179</td>
<td>1.08 0.90, 1.26</td>
<td>63.0 58.7, 67.3</td>
</tr>
<tr>
<td>Other somatic disorders</td>
<td>255</td>
<td>220</td>
<td>1.58 1.40, 1.76</td>
<td>53.7 49.2, 58.2</td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; DP, disability pension; HUSK, Hordaland Health Study.

* Information from Forlopsdatabasen Trygd on DPs awarded up to December 1, 2004.

* Disorders other than mental and musculoskeletal disorders, including missing data on diagnosis (n = 82).

* DP awarded before or up to 1 year after the HUSK date.

* DP awarded 1–7 years after the HUSK date.

* Persons who received a DP before or up to 1 year after the HUSK date were removed from the analyses.
principle is that participation in research projects is voluntary, and repeated approaches will at some point become an ethical issue. Nonparticipants are likely to be a heterogeneous group, and efforts to increase participation may improve the recruitment of persons who are healthy without improving the participation of persons with mental disorders, who may be harder to locate and contact than the general population, even when the mental disorder is not severe (35). In studies where increased recruitment effort has increased participation rates, no significant differences between early and late participants have been found (6). Other studies have found that late participants are healthier than the average participant but may be more careless when completing questionnaires, thus increasing potential measurement errors (36, 37). Since bias due to nonparticipation of persons with severe mental disorders may be hard to avoid, efforts to increase the participation rate from 60% to 80% might paradoxically make the sample look healthier.

In a 2007 review, Galea and Tracy concluded that the available empirical findings showed "little evidence for..."
substantial bias as a result of nonparticipation” (1, p. 648). However, 2 of the 4 studies supporting this conclusion did not examine health variables (38, 39); 1 used longitudinal data in retrospect and analyzed selective attrition after baseline (40); and investigators in the fourth study, like those analyzing nonparticipation in the Netherlands Mental Health Survey and Incidence Study (NEMESIS) (34) and the National Comorbidity Survey Replication (41), based their conclusions of no substantial bias from nonparticipation on questionnaires administered among subsamples of initial nonparticipants (6). Thus, previous studies may have underestimated the importance of nonparticipation bias. The excess of health problems detected among nonparticipants in HUSK is concerning. While a general nonparticipation bias was found, whereby persons who received a DP were less likely to take part in the health study, this effect seems to be particularly strong for disorders characterized by disorganized and disordered lifestyles, like substance abuse and psychosis. The results suggest that for chronic illnesses as a whole, but particularly for mental disorders, prevalence may be dramatically underestimated, which has major implications for policy-makers and funders of services for these vulnerable groups. When population-based health studies are used as a basis for prevalence estimates, results should be supplemented with information from alternative data sources, like case registries, if possible. Many of the Scandinavian population-based health studies, including HUSK, have unique identifiers for nonparticipants, which in some cases allows for linkage with official registries on other topics—for instance, receipt of disability benefits, hospital admissions, or criminal convictions. This may be helpful in estimating the prevalence or incidence of severe disorders. In settings where such data are not available, knowledge from studies of nonparticipants could assist in the interpretation of the results.

In terms of studies of associations between exposures and outcomes, a previous study suggested that nonparticipation does not have any strong implications for the results (36). We found that a simulated selective exclusion of participants with mental health problems led to a moderate reduction of the effect sizes. However, we suggest that the implications of nonparticipation may be less severe for studies analyzing the association between exposures or characteristics and diseases or other outcomes than for studies analyzing the prevalence of diseases and characteristics.

In summary, nonparticipation in population-based health studies has implications for prevalence studies, particularly (though not exclusively) for mental disorders, where there is evidence of considerable underascertainment of the disorders. The impact of nonparticipation may be less marked for other topics—for instance, receipt of disability benefits, hospital admissions, or criminal convictions. This may be helpful in estimating the prevalence or incidence of severe disorders. In settings where such data are not available, knowledge from studies of nonparticipants could assist in the interpretation of the results.

Table 5. Effect of Simulated Selective Nonparticipation Due to High Symptom Levels of Common Mental Disorders on Associations Between Anxiety and/or Depression and Subsequent Receipt of a Disability Pension, Hordaland Health Study, Hordaland, Norway, 1997–1999

<table>
<thead>
<tr>
<th>Simulated nonparticipation</th>
<th>Original sample</th>
<th>First sampling</th>
<th>Second sampling</th>
<th>Fully adjusted HR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15,288</td>
<td>14,517</td>
<td>14,501</td>
<td></td>
</tr>
<tr>
<td>Unadjusted HR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety Onlya</td>
<td>2.02 1.59, 2.56</td>
<td>1.74 1.32, 2.29</td>
<td>1.99 1.54, 2.59</td>
<td></td>
</tr>
<tr>
<td>Depression Onlyb</td>
<td>2.19 1.49, 3.23</td>
<td>2.02 1.31, 3.11</td>
<td>2.09 1.36, 3.22</td>
<td></td>
</tr>
<tr>
<td>Comorbid Anxiety a and Depressionc</td>
<td>4.90 3.92, 6.13</td>
<td>4.04 3.02, 5.41</td>
<td>3.36 2.43, 4.64</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: CI, confidence interval; HADS, Hospital Anxiety and Depression Scale; HR, hazard ratio.

" Selective exclusion of persons with increasing symptom levels as measured by the HADS (30) anxiety (HADS-A) and depression (HADS-D) subscales (exclusion of 10% of persons with a HADS score of 8–10, 50% of persons with a HADS score of 11–14, and 90% of persons with a HADS score of 15–21 on either subscale).

A Anxiety and depression as risk factors for receipt of a disability pension during 1–7 years of follow-up in Cox regression analysis. Information from Forhedsregisteret Trygd on disability pensions awarded up to December 1, 2004, was used.

c Scores of ≥8 on both HADS-A and HADS-D.

A Anxiety and depression as risk factors for receipt of a disability pension during 1–7 years of follow-up in Cox regression analysis. Information from Forhedsregisteret Trygd on disability pensions awarded up to December 1, 2004, was used.

f Analyses from the article by Knudsen et al. (22).

G Adjusted for gender, sociodemographic factors (income, education, and marital status), health-related behavior (physical exercise, smoking, and alcohol consumption), physical measures (body mass index, waist:hip ratio, cholesterol level, blood pressure, and pulse), and physical conditions (myocardial infarction, stroke, asthma, angina pectoris, diabetes, multiple sclerosis, upper and lower back pain, fibromyalgia, and conditions being treated pharmacologically).
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REFERENCES


