Chronic diseases in elderly men: underreporting and underdiagnosis

Morten Frost1, Kristian Wraae1, Claire Gudex1, Torben Nielsen1, Kim Brixen1, Claus Hagen2, Marianne Andersen1

1Department of Endocrinology, Odense University Hospital, Odense C DK-5000, Denmark
2Department of Endocrinology, Bispebjerg Hospital, Copenhagen 2400, Denmark

Address correspondence to: M. Frost. Tel: +45 6541 3536; Fax: +45 6611 3371. Email: frostnielsen@yahoo.com

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Abstract

Objective: prevalence estimates for chronic diseases and associated risk factors are needed for priority setting and disease prevention strategies. The aim of this cross-sectional study was to estimate the self-reported and clinical prevalence of common chronic disorders in elderly men.

Study design and setting: a questionnaire was sent to a random sample of 4,975 men aged 60–74 years. An age-stratified randomised sample (n = 1,845) of those with complete questionnaires was invited to participate in a telephone interview (n = 864), followed by physical examination (n = 600). Self-reported data on risk factors and disease prevalence were compared with data from hospital medical records.

Results: physical inactivity, smoking and excessive alcohol intake were reported by 27, 22 and 17% of the study population, respectively. Except for diabetes, all the chronic diseases investigated, including hypertension, musculoskeletal and respiratory diseases were underreported by study participants. Erectile dysfunction and hypogonadism were substantially underreported in the study population even though these diseases were found to affect 48 and 21% of the participants, respectively.

Conclusions: the study showed a high prevalence of detrimental lifestyle factors including smoking, excessive alcohol consumption and physical inactivity in elderly Danish men. Except for diabetes and respiratory disease, chronic diseases were underreported and in particular erectile dysfunction and osteoporosis were underdiagnosed in the study population, underlining the importance of awareness of chronic diseases among both the general population and physicians.

Keywords: chronic disease, underreporting, underdiagnosis, men, population-based, elderly

Introduction

Chronic diseases are a major public health issue. In high-income countries, chronic diseases account for the majority of deaths [1] and evidence suggests that 80% of premature heart disease and diabetes cases are preventable [2]. While smoking and high blood pressure cause the largest number of deaths in the USA, other modifiable risk factors such as obesity and physical inactivity are also significant causes of mortality [3]. Preventive measures are central as the incidence of chronic disease, especially heart disease and type II diabetes, is increasing [4].

Mortality can be reduced through the reduction in risk factors and prevention of chronic disease. In Finland, decreasing use of tobacco and lowering of cholesterol and blood pressure levels have substantially reduced cardiovascular mortality [5]. Increased physical activity has been found to decrease all-cause mortality [6], even if first commenced in middle age [7], and ex-smokers can eventually experience the same mortality as non-smokers [8].

Although the effects of risk factors on morbidity appear to be similar in different populations [9], the prevalence of common chronic diseases differs between countries [10]. The distribution of lifestyle factors may influence morbidity in otherwise comparable countries. Thus, while life expectancy used to be similar in Denmark and Sweden, lifespan has stagnated in Denmark primarily due to smoking and other risk factors related to lifestyle [11].

Precise prevalence estimates both of risk factors for chronic disease and of chronic diseases themselves are needed for the development of disease prevention strategies and priority setting. Greater focus on chronic diseases could also improve the awareness of both patients and physicians of less commonly diagnosed disorders.

We performed a cross-sectional population-based study on 600 Danish men aged 60–74 years to evaluate the prevalence of chronic disease and associated risk factors. The study had two specific aims:

• to compare self-reported information on chronic disease among elderly men with diagnostic information from medical records and physical examination;
• to assess the prevalence in older Danish men of common chronic diseases or disease groups and their associated risk factors.

Subjects and methods

Subjects

On the basis of a random sample of unique personal identification numbers from the Danish Civil Registration System, 4,975 men aged 60–74 years received a postal questionnaire. Non-responders were contacted a second time. In all, 75.2% returned a completed questionnaire. Non-responders were contacted a second time. In all, 75.2% returned a completed questionnaire. Among those of Caucasian origin who returned a complete questionnaire and were still alive, 1,845 individuals in an age-stratified randomised sample comprising 15 age strata (of 1-year intervals) were invited to further participation. After a second letter was issued to non-responders, 946 men agreed to a telephone interview, which was achieved with 864 men. Of these, 697 agreed to take part in a clinical follow-up (106 declined participation, 5 had since died and 56 were excluded due to illness preventing them from
attending our clinic). Inclusion was stopped when 600 men had attended for clinical assessment.

All participants consented in writing to participate in the study. The local ethics committee approved the study (clinicaltrials.gov: NCT00155961).

Questionnaires
The initial postal questionnaire enquired about height and weight, lifestyle, socioeconomic status, medical history and current treatments. The second questionnaire covered medical history and lifestyle factors, the third enquired about physical activity including specific forms of sports, intensity and frequency and the fourth related to sexual function. These questionnaires were administered to the 600 men participating in the study.

Physical activity
The level of participation in sports activities was recorded on the basis of questionnaires and interview. Weekly mean energy expenditure was calculated as the time engaged in an activity multiplied by the MET value of the activity and by body weight (METS) [12]. Sedentary living was defined as a METS score less than 4 [13].

Smoking and alcohol
Smoking was classified as either present smoker or non-smoker (including ex-smoker). Alcohol intake was classified according to weekly units. Excessive consumption was defined as intake exceeding 21 units per week.

Clinical assessment
The men attending for clinical assessment underwent a physical medical examination, blood tests and measurement of bone mineral density (BMD). Morning (8–10 am) fasting venous blood was collected, centrifuged and stored at −80°C. Plasma glucose was determined using a hexokinase-based method (Integra 700, Roche, Germany), while total serum cholesterol, low density lipoprotein (LDL) and high density lipoprotein (HDL) were assessed using a homogenous enzymatic colorimetric method (Modular, Roche, Germany). The enzymatic endpoint colorimetric method was used for the measurement of serum triglycerides (Modular, Roche, Germany). Total testosterone was measured using an in-house RIA after extraction and chromatography [14].

Validation of self-reported data
Self-reported data were compared against hospital medical records. In the case of inconsistency, the participant’s general practitioner was consulted.

Disease classification
Cardiovascular disease
Heart disease was classified as either ischaemic or congestive in origin. Hypertension was defined by a diagnosis of hypertension or treatment with anti-hypertensive medication. Individuals with blood pressure exceeding 140/90 measured in a sitting position after 20 min of rest were classified as potentially having hypertension. Dyslipidaemia was defined by diagnosis with the condition or treatment with lipid-lowering drugs. Participants with inappropriate lipid levels defined as either total fasting cholesterol or LDL above 4.5 or 2.5 mmol/l, respectively, or triglycerides exceeding 1.7 mmol/l or HDL <0.9 mmol/l, were classified as potentially having dyslipidaemia [15] (Tables 1 and 2).

Diabetes
Diabetes was defined by diagnosis of type II diabetes or treatment with anti-diabetic medication. Fasting plasma glucose was measured once, and men with a level exceeding seven were classified as possible diabetics.

Obesity
Men were weighed in light clothes (SECA, Hamburg, Germany) and height was measured to the nearest tenth of a centimetre using a stadiometer (Harpenden, Holtain, UK). Obesity was defined as body mass index (BMI; weight divided by height squared) exceeding 30 kg/m².

Table 1. Characteristics of the study population: males aged 60–74 years

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Study population, (n = 600)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>68.7 (65.0–72.1)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>81.6 (72.3–90.4)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>173.9 (169.1–178.0)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.8 (24.3–29.2)</td>
</tr>
<tr>
<td>Plasma glucose (mmol/l)</td>
<td>6.1 (5.7–6.7)</td>
</tr>
<tr>
<td>Total cholesterol (mmol/l)</td>
<td>5.6 (4.9–6.3)</td>
</tr>
<tr>
<td>LDL</td>
<td>3.2 (2.5–3.9)</td>
</tr>
<tr>
<td>HDL</td>
<td>1.7 (1.4–2.0)</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>1.2 (0.9–1.7)</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>140 (128–150)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>80 (78–90)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>22.4%</td>
</tr>
<tr>
<td>Ex-smoker (&gt;6 months prior to inclusion)</td>
<td>66.5%</td>
</tr>
<tr>
<td>Alcohol intake: &gt;21 units/week</td>
<td>17.3%</td>
</tr>
<tr>
<td>Physical activity (METS)</td>
<td>15.0 (2.8–35.0)</td>
</tr>
<tr>
<td>Sedentary living: METS &lt;4</td>
<td>26.7%</td>
</tr>
<tr>
<td>Total testosterone (nmol/l)</td>
<td>18.6 (14.8–23.8)</td>
</tr>
</tbody>
</table>

Data presented as median (quartiles) or prevalence of study population (%).

*One unit equals 12 g of alcohol.
Erectile dysfunction

Erectile dysfunction (ED) was defined as an inability to achieve or maintain adequate erection during intercourse or masturbation [16].

Hypogonadism

As recommended by Vermeulen [17], hypogonadism was defined as total testosterone 2.5 standard deviations below the mean normal in young adults. The Danish reference value 12.5 mmol/l was used [18].

Osteoporosis

Osteoporosis was defined by diagnosis of osteoporosis or current treatment with bisphosphonates (no participants were on bisphosphonates for prevention of bone loss due to steroid use). Participants underwent BMD assessment at the total hip and lumbar spine using dual X-ray absorptiometry (H4500, Hologic, Inc., Waltham, MA, USA). Osteoporosis was defined as a T-score at the total hip, femoral neck or the lumbar spine of ≤−2.5.

Other chronic diseases

Respiratory disease included asthma and chronic obstructive pulmonary disease or was defined by treatment with specific respiratory medication. Musculoskeletal diseases were defined by self-report of osteoarthritis, rheumatoid arthritis or any other musculoskeletal disease with the exception of osteoporosis. Gastrointestinal and neurological conditions were grouped into two separate variables. Thyroid disease was defined as thyrotoxicosis, myxoedema or non-toxic goitre or treatment with thyroid-specific medication.

Statistics

All analyses were performed using Stata version 10 (Stata Corp, College Station, TX, USA). Data are presented as medians (quartiles) or means (SD) as appropriate.

The 4,975 men invited to complete the questionnaire were compared with the sex- and age-matched background population using Student’s t-test or Chi-square test. Sociodemographic data and health status those attending physical examination were compared with data from the 3,143 men who only completed the questionnaire. Comparisons between self-reported health and actual disease were made using Chi-square tests.

Results

Study population

The general characteristics of the study population are presented in Table 1. Of the 600 men aged 60–74 years, 22% were smokers, 17% had a weekly alcohol intake of more than 21 units and 26.7% were physically inactive. Study participants were more likely to have attended high school and finished an advanced study (26.7 versus 24.2%, P < 0.01), to live with a partner (87.9 versus 79.8%, P < 0.001) and to participate in sports (23.7 versus 11.7%, P < 0.001) but less likely to be current smokers (22.4 versus 33.2%, P < 0.001). The groups were comparable with regard to prevalence of obesity and self-reported prevalence of chronic disease, although respiratory disease was less prevalent in the study population (6.1 and 9.6%, P = 0.019).

Prevalence of chronic disease

In all, 47.6% reported no chronic disease. Clinical assessment revealed that only 30.2% had none of the chronic diseases investigated (Table 3). While 12.6% of the men reported chronic heart disease, medical records and medication data suggested that 20% had heart disease. Hypertension was reported by 22.1% of the men but data revealed a prevalence of 36.7%. Dyslipidaemia was reported by 7.3% of participants, but data suggested an actual prevalence of 17.7%. On the basis of lipid measurements, 38.2% had dyslipidaemia due to high triglycerides or low HDL, whereas 92.3% were potentially dyslipidaemic due to high total cholesterol or LDL in a single measurement. Gastrointestinal disease was found in 10.8% of the participants, although only 5.2% mentioned this in the postal questionnaire. In all, 14.9% of the men reported obesity, whereas clinical assessment showed a

Table 2. Classification of chronic disease based on self-report information

<table>
<thead>
<tr>
<th>Diagnosis (ICD-10) reported by study participants</th>
<th>Medication (ATC) reported by study participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type II diabetes E10, E11, E14</td>
<td>A10, A10B</td>
</tr>
<tr>
<td>Hypertension I10, I12</td>
<td>C02, C03, C05, C07, CO8, CO9</td>
</tr>
<tr>
<td>Hyperlipidaemia E78</td>
<td>C10</td>
</tr>
<tr>
<td>Chronic heart disease I50, I51, I20–I25</td>
<td>C01</td>
</tr>
<tr>
<td>Respiratory disease J42, J43, J44, J45, J61, J62, J64, J96</td>
<td>R03</td>
</tr>
<tr>
<td>Neurological disease G10, G20, G25, G30, G31, G35, G40, G43, G44, G46, G47, G71, G80, G81, G92</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal disease K21, K22, K25, K27, K29, K40, K44, K50, K51, K58, K59, K73, K74, K76, K80, K86</td>
<td>A02, A03, A06, A07, A09</td>
</tr>
<tr>
<td>Musculoskeletal disease M02, M05, M07, M10, M13, M15, M16, M17, M19, M21, M23, M25, M30, M31, M35, M42, M45, M47, M50, M51, M53, M54, M72, M75, M77, M79, M86</td>
<td>M05B, M06, N02A, N02B, N03</td>
</tr>
<tr>
<td>Osteoporosis M81</td>
<td></td>
</tr>
<tr>
<td>Thyroid disease E03, E05, E07</td>
<td>H03</td>
</tr>
</tbody>
</table>
prevalence of 20.7%. None of the study participants reported or was known to be hypogonadal. Nonetheless, 20.8% had low total testosterone levels.

ED was reported infrequently by the participants in the postal questionnaire. The interview at the visit to the clinic suggested, however, that 48% had ED. Almost none of the participants was known to be osteoporotic, but bone scan showed that 10.2% of the participants had osteoporosis. Thyroid disease was reported by 0.5% of the men but had been diagnosed in 2.2% of the participants. While 6.5% of the men reported diabetes, medical records showed that 7.2% had diabetes and a further 66 men had increased fasting plasma glucose levels. While 6.3% of the men reported current respiratory disease in the postal questionnaire, 9.2% had in fact a respiratory disease. The differences in self-reported prevalence of diabetes and respiratory disease were, however, not significantly different from the clinical assessment (Table 3).

**Self-reported versus interview data**

Knowledge on diabetes was consistent, whereas obesity, hypertension, dyslipidemia and chronic heart disease were underreported in the postal questionnaire by 6.2, 14.5, 10.3 and 7.5% of the participants, respectively (all $P < 0.005$).

<table>
<thead>
<tr>
<th>Table 3. Prevalence of chronic disease in study population: self-report and clinical assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-reported data</strong></td>
</tr>
<tr>
<td>Heart disease</td>
</tr>
<tr>
<td>Hypertension</td>
</tr>
<tr>
<td>Known to have hypertension or BP $&gt;$140/90$^c$</td>
</tr>
<tr>
<td>Dyslipidaemia</td>
</tr>
<tr>
<td>Lipid-lowering drugs or TG $&gt;$1.7 mmol/l or HDL $&lt;$0.9 mmol/l$^a$</td>
</tr>
<tr>
<td>Lipid-lowering drugs or CL $&gt;$4.5 mmol/l or LDL $&gt;$2.5 mmol/l$^b$</td>
</tr>
<tr>
<td>Diabetes</td>
</tr>
<tr>
<td>Known to have type II diabetes or GLUC $&gt;$7.0 mmol/l$^b$</td>
</tr>
<tr>
<td>Obesity (BMI $&gt;$30)</td>
</tr>
<tr>
<td>Erectile dysfunction</td>
</tr>
<tr>
<td>Hypogonadism</td>
</tr>
<tr>
<td>Total testosterone $&lt;$12.5 mmol/l$^b$</td>
</tr>
<tr>
<td>Osteoporosis$^d$</td>
</tr>
<tr>
<td>Thyroid disease</td>
</tr>
<tr>
<td>Respiratory disease</td>
</tr>
<tr>
<td>Gastrointestinal disease</td>
</tr>
<tr>
<td>Musculoskeletal disease</td>
</tr>
</tbody>
</table>

na, not applicable; TG, triglycerides; HDL, high density lipoproteins; CL, total cholesterol; LDL, low density lipoproteins; GLUC, fasting plasma glucose; BMI, body mass index.

$^c$Single blood pressure (BP) measurement.

$^d$Based on results of laboratory tests.

$^e$Defined as a T-score ≤−2.5 in total hip, femoral neck or lumbar spine (Danish reference population).

Comparison by Fisher’s exact test.

$^*P < 0.05$.

$^{**}P < 0.01$.

Musculoskeletal and gastrointestinal diseases included a variety of diagnoses, but the overall impression was of significant underreporting in the postal questionnaire (13.0 and 5.7%, respectively). A limited number of participants were diagnosed with osteoporosis, and even fewer with ED and hypogonadism, making it impossible to evaluate the level of consistency of the questionnaire data.

**Discussion**

There are two major findings from this study. First, with the exception of diabetes we found significant disagreement between self-reported postal questionnaire information on prevalence of major chronic diseases and the information obtained during a clinical interview and physical examination. Second, clinical evaluation revealed inadequate diagnosis of several chronic diseases. Hypogonadism and ED were highly prevalent in this study population of Danish men aged 60–74 years, but were typically neither evaluated nor diagnosed. We could assess important risk factors of morbidity including smoking, excessive alcohol intake and sedentary lifestyle.

The study population differed from the age- and sex-matched Danish population in terms of socioeconomic status but was similar in terms of BMI. The inclusion procedures as well as the comparability in BMI and prevalence of self-reported diseases suggest that the study population was representative of Danish man aged 60–74 years. Furthermore, the expected representativeness of the study population is underlined by a Danish survey from 2005 showing the prevalence of hypertension and diabetes to be 31.5 and 9.9%, respectively, in men aged +65 years, both comparable with our findings [19].

The methods used for collecting data on disease prevalence can influence the resulting estimates. Self-reported information could be inaccurate due to limited knowledge of disease, problems of recollection or reluctance to report illness or symptoms and time since the person’s most recent health assessment [20]. Reports on the concordance between self-reported data and medical records have shown reliability with regard to diabetes [21] and hypertension, whereas significant level of disagreement was found in surveys of musculoskeletal conditions [22]. We found discrepancies between self-reported information on chronic disease and data obtained through clinical interview/exam and registers. It is not known whether this was due to limited knowledge about or recollection of the disease, but it emphasises the disadvantages of relying on self-reported data on prevalence of chronic disease.

Osteoporosis was reported by few participants but clinical evaluation revealed a prevalence of 10% in the study population. The low prevalence of self-reported osteoporosis is similar to the 1.4% observed in a 2005 national Danish survey based on personal interview and questionnaires [19] and may be due to a lack of awareness of the disease among patients less frequent use of bone scanning in men compared with women [23].
There was a considerable lack of awareness about—or at least a failure to report—hypogonadism and ED. This may reflect the absence of well-defined criteria for hypogonadism; however, hypogonadism is not diagnosed on the basis of biochemical tests alone, nor is treatment recommended unless relevant symptoms or other diseases are present [24]. The lack of consensus with regard to the definition of hypogonadism is likely to reduce the awareness of the disease among patients and physicians. In contrast, there is a well-defined definition of ED [16]. Patients consult medical professionals only infrequently for ED [25] and while few reported the disability, almost half of the participants had ED. The importance of increasing the general population’s awareness about ED is supported by studies showing that the condition is predictive all-cause mortality [26].

As in previous studies [27], our study participants underestimated body weight. Several countries show a trend of increasing prevalence of obesity, including Denmark [28]. As obesity is one of the leading preventable causes of deaths [3], preventive measures are needed. It has been recommended that adults are physically active for at least 30 min on most days of the week, but about one-quarter of our study participants had a sedentary lifestyle.

Our study has a number of weaknesses. There was some selection bias due to the participants having higher education and a more active life-style than non-participants, and recall bias may have affected the self-reported information on alcohol consumption and physical activity. We did not repeat or follow-up on biochemical tests or blood pressure measurements, and thus these data provide only circumstantial evidence of underdiagnosis. Although we could account for several factors related to lifestyle, we did not have information on diet. The study has some advantages. First, it is a population-based study. Second, we were able to evaluate risk factors and diseases often not accounted for in surveys including ED and osteoporosis.

In conclusion, this population-based study in men aged 60–74 years shows that self-reported prevalence of chronic disease significantly underestimates the actual prevalence, and some diseases are underdiagnosed in men. A considerable proportion had unhealthy lifestyles, and in order to reduce the risk of chronic disease and premature mortality, health promotion programmes need to encompass a broader perspective of male health, promote physical activity and consider identification of men who need bone mass evaluation.

Key points

- High prevalence of chronic diseases in elderly men.
- Chronic diseases are underreported and underdiagnosed.
- Some are rarely diagnosed, in particular erectile dysfunction and osteoporosis.

Conflicts of interest

None declared.

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Relation between depressed mood, somatic comorbidities and health service utilisation in older adults: results from the KORA-Age study

MARIA ELENA LACRUZ1, REBECCA THWING EMENY1, SYBILLE HAEFFNER1, ANJA KERSTIN ZIMMERMANN1, BIRGIT LINKOHRL, ROLF HOLLE2, KARL-HEINZ LADWIG1,3

1Institute of Epidemiology II, Helmholtz Zentrum München, German Research Center for Environmental Health, Ingolstädter Landstr. 1, 85764 Neuherberg, Germany
2Institute of Health Economy and Health Care Management, Helmholtz Zentrum München, German Research Center for Environmental Health, Ingolstädter Landstr. 1, 85764 Neuherberg, Germany
3Department of Psychosomatic Medicine and Psychotherapy, Klinikum rechts der Isar, Technische Universität München, Munich, Germany

Address correspondence to: K.-H. Ladwig. Tel: (+49) 89 3187 3623; Fax: (+49) 89 3187 3667. Email: ladwig@helmholtz-muenchen.de