Dementia and mild cognitive impairment in older people in Trøndelag

ORIGINAL ARTICLE

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BACKGROUND

The number of people with dementia is expected to triple by 2050. We present figures showing the prevalence of dementia and mild cognitive impairment in Trondheim, and show how weighting for non-response and nursing home residency affects these figures when comparing Trondheim with Nord-Trøndelag.

MATERIAL AND METHOD

In the fourth data collection in the Trøndelag Health Study (HUNT4) in the Norwegian county of Trøndelag, people aged 70 and over in Trondheim were invited to participate in HUNT4 Trondheim 70+. The participants were interviewed and underwent cognitive testing. A diagnostic team diagnosed dementia and mild cognitive impairment. Weights adjusting for non-response bias were used in the comparison of Trondheim and Nord-Trøndelag.

RESULTS

The prevalence of dementia in Trondheim was estimated at 16.2 % for the age group 70 years and over, after weighting for non-response bias with regard to age, sex, education and proportion of nursing home residents. Unadjusted dementia prevalence was 21.0 % in Trondheim and 15.7 % in Nord-Trøndelag. After weighting, the prevalence was almost identical in the two samples.

INTERPRETATION

Weighting for non-response is crucial for obtaining representative figures in prevalence studies of dementia.

Main findings

The prevalence of dementia and mild cognitive impairment in people aged 70 and over in Trondheim was estimated at 16.2 % and 35.6 %, respectively.

Unadjusted prevalence of dementia was 21.0 % for Trondheim and 15.7 % for Nord-Trøndelag, but after weighting to control for non-response bias according to age, sex, education and nursing home residency, the prevalence was almost identical in the two samples.

Dementia is a chronic condition characterised by reduced cognitive function and changed behaviour to such an extent that it leads to a reduced ability to perform activities of daily living. The most common cause is Alzheimer's disease (1). Mild cognitive impairment can be a precursor to dementia. In mild cognitive impairment, cognitive functions have changed from previous levels, but not to the extent that they affect daily life functions (2). Over 55 million people in the world have dementia, and this number is expected to triple by 2050 (3).

Systematic reviews have shown that the prevalence of dementia doubles for every five-year age group from the age of 65 and upwards, and most studies have found a higher prevalence in women (4). In several studies, a lower prevalence is associated with a higher level of education (5, 6). One study based on eleven prevalence studies from Europe found a dementia prevalence that varied from 0.2 % to 2 % in the 60–65 age group and from 14.7 % to 41.7 % in those over 90 (7). Differences in prevalence between the studies may be due to differences in methodology, design, sample characteristics, size and response

rate, test battery and which diagnostic criteria are applied (8). Many of the studies of dementia prevalence have not included the oldest age groups or nursing home patients (9).

From the fourth Trøndelag Health Study (HUNT4 70+), carried out in the geographical area that was formerly the county of Nord-Trøndelag, we have estimated the prevalence of dementia at 14.6 % and mild cognitive impairment at 35.3 % for people aged 70 years or over in Norway (10). HUNT4 Trondheim 70+ was conducted because prevalence figures in city populations can differ from those in small towns and rural populations (11). Trondheim has not been included in previous HUNT studies. The purpose of this article is to present the prevalence figures for dementia and mild cognitive impairment in Trondheim, to compare the prevalence figures from Trondheim with the figures from Nord-Trøndelag, and to show how weighting for non-response and nursing home residency affects these figures.

Material and method

Participants and design

HUNT4 70+ was carried out in Nord-Trøndelag in the period 2017–19. Everyone aged 70 or older and domiciled in the catchment area were invited to participate (12). People aged 70 or older living in one of the four districts in Trondheim were invited to participate in HUNT4 Trondheim 70+ (2018 - 2019). For nursing home patients, they or their next of kin were contacted with the help of health personnel and invited to participate.

The data were collected in Trondheim and Nord-Trøndelag by health personnel and nursing students, who received two days of standardised training in dementia assessment. The assessment was identical in the two studies and consisted of questions and tests relating to cognition, daily life functioning, neuropsychiatric symptoms, subjective cognitive impairment, possible onset of symptoms and development of dementia symptoms. The Montreal Cognitive Assessment (MoCA) test was used to test cognition. This gives a score from 0 to 30, with a higher score indicating better cognitive functioning (13). The Word List Memory Test, which tests immediate and delayed recall, was used to obtain information about mild memory problems in those with ≥ 22 points on the MoCA test (14). Participants who themselves reported subjective cognitive decline or who scored below an age-adjusted threshold value in the cognitive tests were asked if we could conduct a semi-structured telephone interview with their next of kin. The participant decided who we should interview. For those with reduced capacity to consent, the person giving consent on their behalf was interviewed. The interviewers were health personnel with experience of dementia assessment. They were all given two hours of training and had the opportunity to discuss how to do the scoring in completed questionnaires during the data collection. The interview with the next of kin included questions about changes in the participant's cognition, functional level

and behaviour, and about whether the participant had been assessed for or diagnosed with dementia. All nursing home patients were asked if we could interview their next of kin.

Out of 5163 people invited to participate, 1745 (33.8 %) took part in Trondheim. We excluded 24 participants because the information on them was insufficient to classify cognitive status, and two were excluded due to a lack of information about their education. A total of 1719 people were included in the analyses. Those who were excluded were significantly older than those who were included (82.8 years compared to 78.6 years). For the prevalence figures in Nord-Trøndelag, education was self-reported (10). In this article, register-based education level is used for both samples. Education level was obtained from Statistics Norway's National Education Database and divided into three categories, where primary/lower secondary school represents those with the least education (≤ 10 years), upper secondary school those with 11–13 years of education and university/college those with the highest level of education (≥ 14 years) (15).

Diagnosing dementia and mild cognitive impairment

A diagnostic team of nine doctors with experience in research and clinical work in geriatrics, old-age psychiatry and neurology provided diagnoses for dementia and mild cognitive impairment using the diagnostic criteria in DSM-5 (16). Prior to commencement, a start-up seminar was held to provide information and calibrate scoring within the group. People who were difficult to classify were discussed as necessary. No fixed threshold values were set for defining impairment based on the cognitive tests, as this varies across studies and is influenced by a person's age and education. However, to guide the diagnostic process, standard scores were calculated based on normative data for the MoCA test and the Word List Memory Test, which the doctors had access to (17–20). All available information from each participant was reviewed by two doctors independently. The participants were categorised into three groups: no cognitive impairment, mild cognitive impairment and dementia.

Calculation of prevalence figures

The prevalence of dementia and mild cognitive impairment was calculated by dividing the number of persons with dementia and mild cognitive impairment respectively by the total number of persons in the sample. The results are reported for the entire sample and distributed by sex, age group, education and nursing home residency.

Weighting to adjust for non-response

Inverse probability weighting was used to correct for non-response bias with regard to age, sex, education and nursing home residency (21). The weights were estimated in two steps. First, the probability of participation in the study (propensity score) was estimated using a logistic regression model, where participation (yes/no) was the dependent variable, and the independent variables were sex, age and education. We did not have information on whether all of those invited to participate lived in a nursing home or not, so this could not be included in the regression model. Therefore, the probability weights

from the model were further adjusted so that the sample reflected the proportion of people over 70 living in nursing homes in Trondheim municipality (6.2 % compared to 14.8 % in the sample) and Nord-Trøndelag (5.1 % compared to 6.2 % in the sample) in 2019. The participation weights were multiplied by 0.062 / 0.148 = 0.4189 for nursing home residents and by (1 − 0.062) / (1 − 0.148) = 1.1009 for those living at home in Trondheim. In Nord-Trøndelag, the weights were multiplied by 0.051 / 0.062 = 0.8226 for nursing home residents and by (1 − 0.051) / (1 − 0.062) = 1.0117 for those living at home. Each participant was then assigned a weight equal to the inverse expected probability of participation (1 / probability of participation).

The separate and combined probability weights for HUNT4 70+ and HUNT4 Trondheim 70+ can be found in Appendix 1 (at tidsskriftet.no). The analyses were performed in STATA 17.

Ethics and personal data protection

Participation in the HUNT studies was based on informed consent. For persons with reduced capacity to consent, written consent was obtained from the next of kin. This study was approved by the Regional Committee for Medical and Health Research Ethics (REC South-East 82985) and the Norwegian Centre for Research Data (NSD 791342).

Results

The proportion of women, the proportion of nursing home residents, level of education, MoCA test scores and mean age were all higher in Trondheim than in Nord-Trøndelag (Table 1).

Table 1

Socio-demographic data and test results from the Montreal Cognitive Assessment (MoCA) test (17) for participants in HUNT4 Trondheim 70+ and HUNT4 70+ in Nord-Trøndelag. SD = standard deviation.

Variable	Trondheim (n = 1 719)	Nord-Trøndelag (n = 9 744)
Age in years, mean (SD)	78.6 (7.0)	78.0 (6.5)
Women, n (%)	993 (57.8)	5 299 (54.4)
Age group		
70–79 years, n (%)	1 122 (65.3)	6 616 (68.0)
80–89 years, n (%)	436 (25.4)	2 501 (25.7)
≥ 90 years, n (%)	161 (9.4)	627 (6.4)
Education level		
Primary/lower secondary school, n (%)	290 (16.9)	2 507 (25.7)
Upper secondary school, n (%)	772 (44.9)	5 234 (53.7)

Variable	Trondheim (n = 1 719)	Nord-Trøndelag (n = 9 744)
University/university college, n (%)	657 (38.2)	2 003 (20.6)
Site of participation		
Field station, n (%)	1 285 (74.8)	8 412 (86.3)
Own home, n (%)	179 (10.4)	724 (7.4)
Nursing home, n (%)	255 (14.8)	608 (6.2)
MoCA test score, mean (SD)[1]	22.9 (4.9)	22.5 (4.9)

[1]The MoCA test was not performed for participants in nursing homes with a known moderate to severe degree of dementia. The number of test participants was 1524 (88.7 %) in Trondheim and 9262 (95.1 %) in Nord-Trøndelag.

Unadjusted dementia prevalence was 21.0 % in Trondheim and 15.7 % in Nord-Trøndelag (Figure 1). When weighting for non-response with regard to age, sex and education, the prevalence increased to 24.2 % and 17.3 %, respectively. With weighting for the proportion of nursing home residency in the sample, the prevalence of dementia was 16.2 % (95 % confidence interval 14.5 to 18.1) in Trondheim and 16.4 % (95 % confidence interval 15.6 to 17.2) in Nord-Trøndelag.
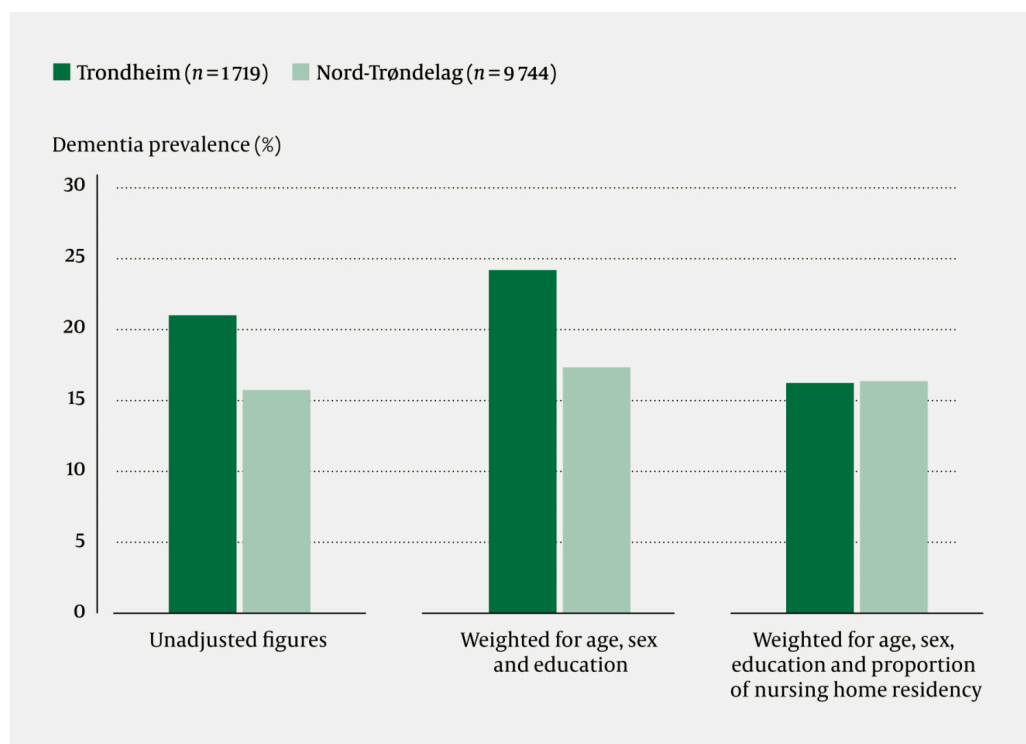
Figure 1 Comparison of unadjusted and weighted prevalence of dementia in people aged 70 and over in Trondheim and Nord-Trøndelag.

After weighting for age, sex, education and nursing home residency, the prevalence of dementia was 8.5 % among 70–79-year-olds and 60.5 % among those over 90 in Trondheim (Table 2). The prevalence was 18.6 % among women and 13.1 % among men. In those with a primary/lower secondary

education, the prevalence was 35.5 %, and in those with a university or university college education it was 5.9 %. Among people living at home, the prevalence was 10.4 %, and among nursing home residents it was 92.1 %.

Table 2

Prevalence of dementia in Trondheim and Nord-Trøndelag. CI = confidence interval.

Group	Unadjusted figures		Weighted for age, sex, education and nursing home residency			
	Trondheim	Nord-Trøndelag	Trondheim	95 % CI	Nord-Trøndelag	95 % CI
All	21.0 %	15.7 %	16.2 %	(14.5 to 18.1)	16.4 %	(15.6 to 17.2)
70–79 years	8.9 %	7.7 %	8.5 %	(6.9 to 10.5)	7.9 %	(7.3 to 8.6)
80–89 years	33.7 %	26.5 %	25.1 %	(21.2 to 29.5)	26.6 %	(24.9 to 28.5)
≥ 90 years	70.8 %	55.9 %	60.5 %	(51.2 to 69.0)	55.4 %	(51.5 to 59.4)
Women	24.9 %	17.0 %	18.6 %	(16.2 to 21.2)	17.8 %	(16.7 to 18.8)
Men	15.7 %	14.1 %	13.1 %	(10.7 to 15.9)	14.8 %	(13.7 to 15.9)
Primary/lower secondary school	47.9 %	26.9 %	35.5 %	(29.9 to 41.2)	26.1 %	(24.4 to 27.9)
Upper secondary school	20.7 %	13.2 %	13.6 %	(11.4 to 16.0)	12.8 %	(11.9 to 13.7)
University/university college	9.4 %	8.0 %	5.9 %	(4.5 to 7.8)	7.7 %	(6.6 to 8.9)
Living at home	8.6 %	11.0 %	10.4 %	(8.8 to 12.3)	12.1 %	(11.4 to 12.9)
Nursing home residents	92.2 %	86.0 %	92.1 %	(87.9 to 95.0)	86.1 %	(83.1 to 88.7)

After weighting for age, sex, education and nursing home residency, the prevalence of dementia among those with a primary/lower secondary education in Trondheim was 35.5 %, and for the same education group in Nord-Trøndelag, it was 26.1 %.

The unadjusted prevalence of mild cognitive impairment was 32.7 % in Trondheim and 34.9 % in Nord-Trøndelag. After weighting for age, sex, education and nursing home residency, the prevalence was 35.6 % in Trondheim and 35.8 % in Nord-Trøndelag (Table 3). Among those with a higher education, the proportion with mild cognitive impairment was 35.2 % in Trondheim and 28.4 % in Nord-Trøndelag.

Table 3

Prevalence of mild cognitive impairment in Trondheim and Nord-Trøndelag. CI = confidence interval.

Group	Unadjusted figures		Weighted for age, sex, education and nursing home residency			
	Trondheim	Nord-Trøndelag	Trondheim	95 % CI	Nord-Trøndelag	95 % CI
All	32.7 %	34.9 %	35.6 %	(33.2 to 38.1)	35.8 %	(34.8 to 36.8)
70–79 years	36.8 %	36.3 %	37.6 %	(34.6 to 40.6)	37.2 %	(36.1 to 38.4)
80–89 years	28.2 %	32.4 %	33.7 %	(29.0 to 38.8)	33.5 %	(31.6 to 35.4)
≥ 90 years	16.1 %	30.6 %	22.5 %	(15.5 to 31.6)	31.0 %	(27.5 to 34.8)
Women	31.8 %	32.8 %	35.3 %	(32.1 to 38.6)	33.5 %	(32.2 to 34.8)
Men	33.9 %	37.5 %	36.0 %	(32.4 to 39.8)	38.5 %	(37.0 to 39.9)
Primary/lower secondary school	30.3 %	38.4 %	37.3 %	(31.4 to 43.6)	39.0 %	(37.1 to 40.9)
Upper secondary school	32.2 %	35.8 %	35.0 %	(31.6 to 38.6)	36.0 %	(34.7 to 37.3)
University/university college	34.2 %	28.2 %	35.2 %	(31.6 to 39.1)	28.4 %	(26.4 to 30.4)
Living at home	37.4 %	36.4 %	37.8 %	(35.3 to 40.5)	37.2 %	(36.2 to 38.2)
Nursing home residents	5.9 %	12.2 %	6.2 %	(3.7 to 10.2)	12.1 %	(9.7 to 15.0)

Discussion

The prevalence of dementia in Trondheim was estimated at 16.2 % for people in the age group 70 years and over after weighting for non-response with regard to age, sex, education and proportion of nursing home residency. The prevalence of dementia was higher among women than men, and was lowest among those with the highest education. The weighted prevalence of mild cognitive

impairment was 35.6 %. A higher prevalence of dementia in those with the lowest level of education has been reported in several previous studies, and education is included among modifiable risk factors for dementia (5, 6).

The unadjusted dementia prevalence was higher in Trondheim than in Nord-Trøndelag, despite having the same study design, test battery and set of diagnostic criteria, and even though the same specialists carried out the diagnostics. This may seem counterintuitive, as both the level of education and the MoCA test scores were higher in Trondheim than in Nord-Trøndelag. Part of the explanation is that the proportion of nursing home residents included in Trondheim was more than twice as high as in Nord-Trøndelag. When we adjusted for sex, age and education, the prevalence figures increased by 3.2 % for Trondheim and by 1.6 % for Nord-Trøndelag. Further adjustment for nursing home residency led to a decrease of 0.9 % in Nord-Trøndelag. In Trondheim, the same adjustment resulted in a decrease of 8.0 %, highlighting the importance of adjusting for the high proportion of nursing home residents. The procedure for including nursing home residents in the two studies was the same, but we reached far more people in Trondheim. After weighting for non-response with regard to age, sex, education and nursing home residency, the prevalence was almost identical in the two samples.

The prevalence of dementia in Trondheim and Nord-Trøndelag is higher than that reported in several other studies in recent years (4–22). We used the criteria in DSM-5, which can result in a higher dementia prevalence compared to the criteria in ICD-10 (23, 24). There are also studies with comparable figures to ours, such as two studies from Sweden and Finland, respectively (25, 26). Comparing studies is often difficult due to the inclusion of different age groups and varying degrees of inclusion of frail older adults (9). In our studies, many were offered the opportunity to participate through home visits and assessments at nursing homes. Norway has one of the highest life expectancies in the world and good dementia care throughout all phases of the disease (27). Our prevalence figures may reflect this, as the prevalence of dementia increases with age, and good dementia care probably contributes to longer life expectancy with dementia.

Our figures for the prevalence of mild cognitive impairment are higher than in several other studies. However, a recently published review article that included our figures from Nord-Trøndelag found that the prevalence of mild cognitive impairment varied from 1.2 % to as much as 87.4 % in the included studies, with a mean prevalence of 19.3 % for people aged 70–79 (28). Differences in diagnostic criteria and study design can lead to variations in prevalence figures between studies (8).

One of the strengths of our study is that it was conducted in a representative population-based sample where the participants represent the entire spectrum from normal cognition to severe dementia. Another strength is the comprehensive cognitive testing and interviews conducted of participants and their next of kin to establish dementia diagnoses. A weakness is that we only included people from the Østbyen district in Trondheim, which may have affected the representativeness. Another weakness is the low participation rate of 33.8 % in Trondheim (compared to 51.2 % in Nord-Trøndelag), which may

have resulted in selection bias, as those who participated may differ from those who did not (10, 29). Older people with functional impairments are sometimes underrepresented in research studies, and to counteract this, participants were offered the opportunity to participate through home visits if necessary and in nursing homes with an adapted study protocol. In Nord-Trøndelag, the HUNT study is well known as it has been going since the 1980s. This was the first time the HUNT study was conducted in Trondheim, and we cannot exclude the possibility that the Trondheim participants differed from those in Nord-Trøndelag in relation to factors that we were unable to capture. However, by weighting for the proportion of nursing home residency and non-response with regard to age, sex and education, we likely approach the true prevalence figure for Trondheim.

This article has been peer-reviewed.

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