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Differences in risk factors for voluntary early retirement and disability pension -a 15 year follow-up in a cohort of nurses' aides

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ABSTRACT

Objective: To examine risk factors for voluntary early retirement and disability pension in a cohort of nurses' aides.

Design: Register study with a follow up period of 15 years

Setting: Nurses' aides working in nursery homes, homecare or hospitals.

Participants: 3332 gainfully employed nurses' aides at the time of inclusion in the study.

Outcome: Disability pension or early voluntary retirement

Results: 16.2% of the population was granted disability pension and 27.1% entered early voluntary retirement in the follow up period representing 11,186 lost working years with a direct cost in transfer payment amounting about 410 million Euro.

Health related risk factors for disability pension was long lasting Low Back Pain (Hazard ratio (HR) 2.27(95 % CI 1.55 to 3.34), sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11), and inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)). Of non health-related factors, low education, workers compensation case, evening work and high rated perceived exertion at work all were minor risk factors for disability pension. The primary risk factor for early voluntary retirement was low education (HR 3.19 (95 % CI 2.65 to 3.85)).

Conclusion: 43.3% of nurses aides gainfully employed in 1993 was granted disability pension or chose early voluntary retirement in the follow up period. The number of persons and the amount of lost working years underscores the need of a more active counselling towards maintaining employment especially among those with persistent musculoskeletal disorders.

ARTICLE SUMMARY

Article focus

High prevalence's of low back pain and sick leave are found among healthcare workers in many countries

Predictors of negative vocational prognosis for healthcare workers are unknown.

Key messages

Musculoskeletal complaints at baseline predicted disability pension but not voluntary early retirement. Work related factors played a minor role as risk factors for both disability pension and voluntary early retirement.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI

Our results point at secondary prevention managing especially musculoskeletal claims at an early state in preventing disability pension.

Strength and limitations

Study strengths are a follow up time of 15 years in a national register with a high accuracy and completeness and the possibility to compare risk factors for two different types of early retirement. Study limitations are that data on prognostic factors were self reported and assessed at one point only.

INTRODUCTION

10% of the European workforce is occupied in the health care sector¹. Several, mainly cross sectional studies have reported adverse health effects among health care workers especially nurses' aides and home care workers. Most of the studies comprise low back pain (LBP)²⁻⁵ and other musculoskeletal disorders⁶. Also risks of affective and stress related disorders⁷⁻⁸ and hand eczema⁹ has been discussed.

High prevalence's of sick leave are found among nurses, nurses aides and homecare workers in many countries^{10;11}. There are only few studies of predictors of early retirement among health care workers¹² or leaving nursing care¹³. Lack of nursing personnel are thought to be a serious problem in many countries in the future due aging of the actual workforce and population, a rapid job turnover and problems with recruitment^{1;13}. To face these problems there is a need of studies of predictors of early

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4 retirement in the profession to be able to strengthen the prevention of negative vocational
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6 outcomes being of benefit for both the nursing personnel and the society.
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10 **Objectives**

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12 To examine and compare predictors of two different types of early retirement: voluntary
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14 early retirement and disability pension in a cohort of occupational employed nurse's aides
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16 in a follow up period of 15 years.
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20 **METHODS**

21
22 A prospective register study of predictors of early retirement in a fixed cohort including
23
24 all nurses' aides registered in 1992 in the county of Aarhus with 15 years of follow up.
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30 **Study population and data sources**

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32 The cohort was identified by data from an insurance fund (Danish acronym PENSAM)
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34 including all former and current persons registered as nurses' aides for minimum one year
35
36 in 1992 in the county of Aarhus. 74% of the cohort (n= 4,616) completed a questionnaire
37
38 including demographic, lifestyle, physical and psychological workload and disease
39
40 related factors in 1993³. The part of this population gainfully employed as a nurse's aides
41
42 n=3,332 in 1993 comprised the study cohort for the present study. The Danish civil
43
44 personal registration number (CPR) was used to link questionnaire data with person
45
46 specific data from the Danish National Register on Public Transfer Payments (Danish
47
48 acronym DREAM)¹⁴ from 1991-2008 (both years inclusive). Information of permanent
49
50 transfer income were available from the start of the register in 1991 while information's
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52 of non-permanent transfer payments as sick leave and unemployment benefit first were
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54 available from 1997. The follow up data included data from the DREAM register with
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56 weekly registration of public transfer payment at individual level in the follow up period.
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4 We recoded the originally 104 different transfer payment codes from the DREAM register
5 into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other non
6 permanent transfer payment as vocational rehabilitation and social assistance, 5)
7 disability pension and flex job a health dependent half time pension and 6) voluntary
8 early retirement. The register is thought to be near to complete based on the economically
9 incentive for the employer to report to public authorities. The cohort was followed in the
10 DREAM register until 2008 providing a follow up time of 15 years.
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21 **Assessment of main outcome**

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23 The main outcome was permanent early retirement in the follow up period as disability
24 pension or early voluntary retirement. Obtaining disability pension require an evaluation
25 of work ability which is to be reduced to a minimum while early voluntary retirement are
26 independent of health status. Voluntary early retirement is available from the age of 60
27 years if the persons have achieved 25 years of membership of an unemployment benefit
28 fund for a period of 30 years. For each patient, disability pension and voluntary early
29 retirement was estimated, including time and the person's age at the time of achievement
30 of early retirement. Disability pension includes flex job, which was introduced in the year
31 2000 as a health dependent half time pension achieved in the same legislation context as
32 disability pension, based on a permanent health dependent condition. According to the
33 rules of achievement of early voluntary retirement it is not possible to change from
34 disability pension to early voluntary retirement. If a person have changed from early
35 voluntary retirement to disability pension she is classified with the outcome disability
36 pension (n= 8). The register gives no information of reason for achieving early retirement.
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56 **Sample characteristics**

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58 Baseline data was obtained from a self administered questionnaire completed in 1993.
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4 Demographic and background variables included age, gender, education, vocational status
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6 of spouse, marital status and workers compensation case. Physical Work factors were
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8 assessed by questions of: Working hour's day, evening or night, working place hospital or
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10 eldercare, index describing heaviness of care where heavy care was defined by a
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12 combination of having more than 2/3 of the daily patients needing full care together with
13
14 more than 10 handlings of persons per day. Rated Perceived Exertion (RPE) was assessed
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16 from a modified Borg scale range 0-14¹⁵ anchored 1=very very light and 13=very very
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18 strenuous, values ≥ 8 was defined as high RPE.

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21 Psychosocial Work factors was assessed using a Danish version¹⁶ of Karasek's Job
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23 Content Questionnaire (JCQ) which is shown to have acceptable internal consistency in
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25 the health care sector¹⁷. The 3 items in the demand score were time pressure, perceived
26
27 strain and tiredness returning from work. The range in the demand index score was 5-15,
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29 low demand were defined by values lower or equal to 9. The 3 items in the decision
30
31 latitude score were possibilities of decision of work pace, how the work was carried out
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33 and work disposition. The range in the decision latitude index score was 5-15. High
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35 decision latitude was defined by values lower or equal than 9. Violence at work assessed
36
37 by 5 items: never, seldom, sometimes, often and very often. Upper and lower extremities
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39 symptoms was assessed using Nordic questionnaire¹⁸, and serious upper extremity
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41 complaints was defined as sick leave > 30 days for at least one region within the last year,
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43 serious lower extremity complaints was defined as sick leave > 30 days for at least one
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45 region within the last year. LBP was assessed by pain drawing including level of radiating
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47 pain combined with 0-10 point Visual Analog Scale (VAS) describing level of usual pain,
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49 and duration of pain was assessed by a and a question asking : "For how long have you
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51 altogether had low back pain the last year, with the response alternatives 0 days, 1-7 days,
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53 8-30 days, 31-90 days, more than 90 days" and a question asking "Have you ever had
54
55 acute LBP in relation to person handling or other work tasks". Knowledge of health
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parameters as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro intestinal diseases and rheumatologic inflammatory diseases was obtained from a list of question in the questionnaire “Have our physician ever told you that you have one or more of the following diseases”. Lung disease included asthma, chronic bronchitis and pneumonia, nervous diseases included nervous disease, skin disease included eczema and cardiovascular disease included elevated blood pressure, angina pectoris, unsteady hearth, coronary infarction and arteriosclerosis. Gastro intestinal diseases included colon irritable and duodenal ulcers and rheumatologic inflammatory included rheumatoid arthritis and inflammatory connective tissue disease. Lifestyle variables comprised body mass index (BMI) dichotomized ≥ 30 =high versus BMI < 30 , actual smoking yes/no, physical activity 8 items dichotomized: moderate physical activity more than 3 times a week or more versus less or no activity. For the part of the population achieving early retirement after 1998 pattern and cumulated sick leave the two year before early retirement were estimated from register data.

Statistical analysis

After linking data from the PENSAM register including all nurses’ aides in the geographical area of interest and the DREAM register by CPR numbers, the vocational record in the 15 years follow up for each person was established.

We used Cox proportional hazards models to examine the longitudinal association between the outcome measure and the full set of predictor variables.

The hazard ratio of achieving disability pension or early voluntary pension was estimated with 95% confidence intervals (95 % CI). The analyses were made separately for disability pension and voluntary early retirement where the reference group for both groups was the part of the population receiving neither disability pension nor voluntary early retirement. SAS version 9.1.3 (SAS Institute Cary, NC, USA) and STATA 11.0 were

used to perform data management and statistical analyses.

RESULTS

Study population

The invited population in 1993 comprised all nurses aides (N= 6,231) in the county of Aarhus with at least one years seniority as nurse's aides work in the preceding 5 year representing about 200 different working sites. The response rate in 1993 was 74%. Table 1 shows a register based non response analysis.

Table 1.
Non response analyses, including all nurses aides in the county of Aarhus 1993 with more than 1 years of nursing aides work the last five years n=6231

Register data DREAM	Questionnaire respondents 1993 n=4616	Questionnaire non-respondents 1993 n=1615
Age 1.7.1993 mean (SD)	42.7 (9.4)	44.3 (11.0)
Years working as nurses aides 1.7.1993 mean (SD)	10.9 (7.1)	11.2 (7.4)
Gender woman %	98.1	97.1
Ethnicity other than Danish %	2.3	3.4
Dead in the follow up period %	2.5	3.0
Granted disability pension in the follow up period %	16.2	14.8
Voluntary early retirement in the follow up period %	18.2	19.3

There were only minor differences between the responders and the non responders concerning the two outcome measures and population characteristics.

The response rate among people with foreign ethnicity was lower than the non foreign group, probably because of language problems. In the questionnaire response 3,332 participants stated that they were working as nurse's aides at the time they completed the questionnaire. Those 3332 comprised the study population in the present paper.

The baseline characteristics of the 3,332 respondents are shown in table 2. The population is mainly female with a mean age of 41.9 years, experienced in nursing care with a mean of 13.0 years seniority and low educated. 69.5 % was working in homecare or at nursery homes and 30.5% in hospitals in accordance with figures for Denmark as a whole at that time¹⁹. The prevalence of having more than 90 days of back pain was 13.6%, 44.4% scored their rated perceived exertion more than or equal to 8 (strenuous), 48.7% experienced high job demands and 24.1 % low decision latitude according to the Karasek model. A minor part, 5.9 % reported violence at work often or very often and 15.9% was physical active with at least one time a week with strenuous physical activity.

Table 2.
Baseline characteristics among the study population of nurse's aides working in hospital or nursery home/homecare at the time of baseline registration

Baseline characteristics	Study population n= 3332	No early retirement in the follow up period n=1888	Voluntary early pension in the follow up period n=904	Disability pension in the follow up period n=540
Age, mean(SD)	41.9(8.2)	37.3(5.4)	51.3(5.1)	42.4(6.8)
Age obtaining early retirement mean (SD)			60.7 (1.9)*	50.7(6.0)
Years occupied in health care work, mean(SD)	13.0(6.5)	11.8(5.9)	15.6(7.0)	13.1(6.5)
Gender %				
Male	1.7	1.9	1.5	1.3
Female	98.3	98.1	98.5	98.7
Education/grade %				
-7 -9 years primary school	29.3	22.9	36.3	39.4
-10 years primary school or basic vocational course	41.6	41.3	46.4	35.0
-Secondary school	29.1	35.8	17.3	25.6
Vocational status spouse %				
-paid work	73.2	79.2	63.6	67.8

-transfer income	26.8	20.8	36.4	32.8
Marital status %				
Married/live in partner	82.6	84.5	81.6	76.7
Workers compensation case %	19.1	15.2	19.5	31.7
Workplace %				
- hospital	30.5	29.8	32.2	30.0
- nursery home/homecare	69.5	70.2	67.8	70.0
Work hours %				
- mainly day work	43.4	44.0	44.0	40.2
- mainly evening work	24.8	24.4	23.7	28.5
- mainly night work	10.5	9.8	11.4	11.7
- mixed	21.3	21.9	20.9	19.6
Heaviness of care duties index %				
high	11.0	11.4	9.3	12.6
RPE \times (range 0-14)%				
high ≥ 8	44.4	43.5	41.6	53.3
Violence at work %				
Never	42.8	38.8	45.2	44.8
Seldom	23.8	25.3	24.0	21.3
On and of	27.6	29.9	25.3	27.2
Often	4.3	4.4	4.4	4.4
Very often	1.6	1.7	1.1	2.2
Decision latitude -low %	24.1	23.4	25.3	24.6
Demand -high %	48.7	47.5	49.5	51.3
Number of days LBP the last 12 month altogether %				
0 days	32.9	31.8	39.9	24.4
1-7 days	25.4	27.8	23.0	21.9
8-30 days	20.3	22.3	17.5	18.0
31-90 days	7.8	9.0	5.5	7.4
More than 90 days	13.6	9.1	14.0	28.3

Usual back pain %				
Radiation below knee level	15.9	13.6	15.1	25.4
Ever acute LBP in relation to patient handling or other work tasks %	58.8	57.2	56.1	69.3
More than 30 days of sick leave the last year because of upper limb disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limb disorder %	4.7	2.5	5.2	11.9
Cardiovascular disease %	14.5	10.9	20.5	17.2
Lung diseases %	23.2	22.8	21.1	28.2
Skin diseases%	16.7	18.2	11.7	19.4
Gastro intestinal diseases %	12.6	10.0	14.9	18.2
Rheumatologic inflammatory diseases %	2.8	1.3	4.0	6.1
Nervous disorder %	4.1	3.1	4.4	7.6
Current Smoking, %	47.0	47.4	41.9	54.4
BMI, mean(SD)	23.4(3.8)	23.0(3.5)	24.0(3.5)	23.9(5.0)
BMI severe overweight > 30	5.1	4.7	5.9	5.7
Physical activity# High %	15.3	17.5	11.7	12.8

* 60 years is the lower limit for voluntary early retirement

^ Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity high: at least one time a week strenuous physical activity

Early retirement and lost working years

As seen from the flow chart figure 1, 540 persons (16.2%) were granted disability pension and 904 persons (27.1 %) obtained voluntary early retirement, in the follow up period all together 43.3%.

The total number of lost working years in the population presuming that all persons who retired early had remained at work until the normal pension age is 7,472 years for the 540

persons granted disability pension and 3,714 years for the 904 persons obtaining early

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4 retirement, altogether 11,186 years amounting about 410 million Euro in direct costs from
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6 early retirement transfer payments.
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9 Figure 2 shows an increasing number of participants who choose early voluntary
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11 retirement during the follow up period, whereas the number per year being granted
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13 disability pension is stable until 2002 with a rise the following years until 2007 where a
14
15 decline is seen. At that time there is a corresponding rise in voluntary early retirement.
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18 This pattern could be explained by a change in the interpretation of the disability pension
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20 legislation. The mean age of those granted disability pension is stable between 50 and 55
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22 years over the 15 year follow up period. The minimum age obtaining early voluntary
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24 pension is 60 years. The drop below 60 years in 1995 is explained by a temporary change
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26 in the legislation. Altogether 344 persons chose to postpone the early voluntary retirement
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28 after having got their early voluntary pension certificate: 55 to the age of 61 year, 166 to
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30 the age of 62, 12 to the age of 65 and 6 to the age of 66 year.
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32
33 Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit and
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35 other nonpermanent transfer incomes every week the 2 years preceding the granting of
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37 disability pension respectively early voluntary retirement. The population is restricted to
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39 person changing to early retirement from 1999 as we only have data on sick leave from
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41 1997 in the DREAM register.
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43
44 Figure 3_a reveals that disability pension is preceded of a decline in work presence from
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46 about 60% two years prior to the week of disability pension to about 20%, 12 weeks
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48 before. During the 2 years preceding disability pension there is an increase other transfer
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50 incomes with a lower benefit properly because sick leave by Danish legislation is
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52 restricted to 52 weeks. The Danish legislation offers the possibility to be sick listed as
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54 unemployed which can explain the decline in number receiving unemployment benefit.
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57 As see from figure 3_a and 3_b the pattern of vocational status the 2 years preceding the
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59 time of early retirement differs completely between disability pension and voluntary early
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4 retirement. Contrasting the transfer income pattern seen the two years preceding the time
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6 of disability pension there is no change in the part of the population working or receiving
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8 non permanent transfer income two years before starting early voluntary retirement. A
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10 bigger proportion compared to the part of the population granted disability pension is
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12 receiving unemployment benefit with an increasing number over the 2 years.
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14

15 16 17 **Risk factors for early retirement** 18

19 Table 3 shows adjusted risk factors of being granted disability pension or choosing early
20
21 voluntary retirement in the follow up period.
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23 Health related risk factors for disability pension was more than 90 days of LBP the last 12
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25 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave because of upper
26
27 extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30 days of sick leave
28
29 because of lower extremity disorders (HR 1.51 (95%CI 1.08 to 2.11)), inflammatory
30
31 rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro intestinal disorders (HR
32
33 1.39 (CI 1.10 to 1.76)). Of non health factors low education (HR 1.27 (95 % CI 1.02 to
34
35 1.57)), workers compensation case (HR 1.51 (95 % CI 1.23 to 1.87)), evening work (HR
36
37 1.29 (95 % CI 1.03 to 1.60)) and high rated perceived exertion at work (HR 1.23 (95% CI
38
39 1.00 1.51)) were independent risk factors. Risk factors for early voluntary retirement
40
41 were: low education (HR 3.19 (95 % CI 2.65 to 3.85), high job demands (HR 1.28 (95 %
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43 CI 1.09 1.50)), inflammatory rheumatic disease (HR 1.76 (95 % CI 1.25 to 2.48)), cardio
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45 vascular disease (HR 1.47 (95 % CI 1.27 to 1.69)) and gastro intestinal disorders (HR
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47 1.39(95 % CI 1.10 to 1.76)).
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52 Apart from low education, gastro intestinal disorders and inflammatory rheumatic
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54 diseases, the two types of early retirement do not share any prognostic factors for the two
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56 types of early retirement. Life style factors as BMI, smoking and physical activity did not
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58 show associations with either of the two outcomes. Living alone protected against
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voluntary retirement, but showed up as a risk factor for disability pension.

Table 3.
Hazard Ratio of obtaining voluntary early pension or disability pension in the study period according to baseline information's

Risk factors	Voluntary early pension n= 904		Disability pension n=540	
	HR	95% CI	HR	95% CI
Education grade				
-Secondary school	1		1	
-10 years primary school or basic vocational course	0.83	0.65 to 1.06	0.92	0.71 to 1.18
-7 -9 years primary school	3.19	2.65 to 3.85	1.27	1.02 to 1.57
Vocational status spouse				
-transfer income versus paid work	0.55	0.46 to 0.67	1.11	0.85 to 1.45
Marital status				
- Living alone versus live in partner	0.64	0.51 to 0.80	1.54	1.14 to 2.09
Workers compensation case	1.02	0.84 to 1.23	1.51	1.23 to 1.87
Workplace				
- nursery home/homecare versus Hospital	1.04	0.88 to 1.23	1.08	0.87 to 1.35
Work hours				
- mainly day work	1		1	
- mainly evening work	1.03	0.86 to 1.23	1.29	1.03 to 1.60
- mainly night work	1.16	0.92 to 1.46	1.18	0.87 to 1.61
- mixed	0.90	0.74 to 1.11	0.97	0.74 to 1.27
Heaviness of care duties				
Index " high	0.79	0.62 to 1.01	0.98	0.74 - 1.29
RPE _x (range 0-14)				
high >=8	0.96	0.82 to 1.13	1.23	1.00 to 1.51
Decision latitude -low	1.09	0.92 to 1.28	0.90	0.72 to 1.12
Demand -high %	1.28	1.09 to 1.50	0.92	0.75 to 1.13
Number of days LBP the last 12 month				

altogether				
0 days	0.98	0.77 to 1.24	1.36	0.93 to 1.26
1-7 days	0.71	0.56 to 0.89	1.34	0.94 to 1.92
8-30 days	0.71	0.55 to 0.91	1.35	0.92 to 1.97
31-90 days	0.58	0.40 to 0.82	1.29	0.81 to 2.05
More than 90 days	0.72	0.54 to 0.97	2.27	1.55 to 3.34
Usual back pain :				
Radiation below knee level	0.90	0.73 to 1.10	1.18	0.05 to 1.48
Ever acute LBP in relation to patient handling or other work tasks	1.07	0.89 to 1.27	1.01	0.80 to 1.28
More than 30 days of sick leave the last year because of upper limb disorder	1.04	0.72 to 1.50	2.18	1.57 to 3.01
More than 30 days of sick leave the last year because of lower limb disorder	0.91	0.63 to 1.31	1.51	1.08 to 2.11
Cardiovascular disease	1.47	1.27 to 1.69	1.14	0.94 to 1.38
Lung diseases	0.88	0.75 to 1.05	1.14	0.93 to 1.39
Skin diseases	0.61	0.49 to 0.75	1.13	0.90 to 1.42
Gastro intestinal diseases	1.21	1.00 to 1.47	1.39	1.10 to 1.76
Rheumatologic inflammatory diseases	1.76	1.25 to 2.48	2.42	1.67 to 3.52
Nervous disorder	0.87	0.62 to 1.24	1.31	0.92 to 1.87
Current Smoking	0.80	0.69 to 0.93	1.20	0.98 to 1.45
BMI				
severe overweight > 30	0.87	0.64 to 1.17	0.85	0.57 to 1.26
Physical activity# low	0.87	0.74 to 1.02	0.94	0.77 to 1.15

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity low: less than "at least one time a week strenuous physical activity"

DISCUSSION

This study compared risk factors for two different types of early retirement and thereby

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3
4 contribute to the discussion of the disability process and how to prevent disability and
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6 social exclusion²⁰⁻²². The study document a high number of early retirement in a cohort
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8 with an earlier strong connection to the labour market with an enormous number of lost
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10 productive years and money in direct costs from disability pension, voluntary early
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12 retirement. Risk factors for disability pension were mainly health related factors in
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14 accordance with the fact that health related reduction of the working capacity is the most
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16 important criteria for granting disability pension. HR above 2 for disability pension were
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18 low back pain more than 90 days the last year, more than 30 of sick leave the last year and
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20 known rheumatologic inflammatory disease at baseline registration in 1993. A workers
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22 compensation case was an independent risk factor with a (HR of 1.51(1.23-1.83)), which
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24 has been found in other studies^{23;24}. This finding could result from residual confounding
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26 as it is possible that the persons notified for a workers compensation case have more
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28 serious health problems than the persons not notified. In this study the introduction in the
29
30 model of interaction variables between compensation status and pain variables decreased
31
32 the HR, and is in favour of more serious health problems among compensation cases.
33
34 Another explanation could stem from accelerating a disability process by the way the
35
36 compensation system works and impacts on the worker, and we cannot exclude that this
37
38 could play a role. This study could not corroborate that physical or psychosocial workload
39
40 found in other studies^{12;21;25-27} played a major role as targets for primary prevention. Rated
41
42 Perceived exertion at work, but not the heaviness of clients assessed from an index based
43
44 on number of clients needing full care in combination with number of person handlings a
45
46 day, was a risk factor (HR 1.23 (1.00 to 1.51)) The finding of an elevated risk (HR 1.34
47
48 (CI 1.02-1.75)) of evening work are in accordance with a Danish register study focusing
49
50 on shift work in all sectors and disability²⁸ the only work related factor with an elevated
51
52 risk of choosing early voluntary retirement was high demands at work. The interaction
53
54 term job strain did not contribute to the models (results not shown). In a study from the
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4 Finnish public service sector²¹ it is argued that job strain are to be evaluated on job unit
5
6 level, in this study we have information of 200 different work sites. But as the nursery
7
8 homes, home care units or hospitals in the actual study are rather different in size we do
9
10 not have the possibility to make valid work site aggregated measures of exposure.

11
12 Many studies report associations between sick leave and disability pension²⁹. To our
13
14 knowledge no other studies have investigated risk factors of early voluntary retirement.

15
16 Early voluntary retirement at the age of 60 years was mainly associated with low
17
18 educational level, and the protective effect of spouse being on income transfer and living
19
20 alone is consistent with primarily economic imperatives for choosing early voluntary
21
22 retirement. In this study we found no strong argument for health related factors as being
23
24 important in the decision to retire voluntary, except for small effects from cardiovascular
25
26 and gastrointestinal disease.
27
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29
30 For both outcomes we found no associations with smoking, low physical leisure activity
31
32 or BMI, and this finding questions ongoing activity at the work site for making individual
33
34 life style factors the main suspects for intervention in order to stay active in work for
35
36 more years³⁰.

37
38 The finding that voluntary early retirement and disability pension only has
39
40 few mutual prognostic factors, challenges common notions of a retirement process driven
41
42 by work related or health related factors.
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44

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46 The pattern of vocational status the 2 years preceding the time of early retirement differs
47
48 completely between disability pension and voluntary early retirement.
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51 Different legislation obviously play a role but it is although surprising that health and
52
53 work related factors seem to be without importance for people choosing voluntary early
54
55 retirement in a profession which in many investigations are found to be physical and
56
57 psychological demanding²⁻⁵.
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59
60 A major strength in the present study is the prospective design and number of

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4 observations of both of the two outcomes of early retirement.

5
6 In this study early retirement - both disability pension and early voluntary retirement -
7
8 was assessed from a national register, including weekly registration of all types of transfer
9
10 income from the social system. The registers are time accurate and complete concerning
11
12 disability pension and early voluntary retirement because it is a part of the payment
13
14 system. Another strength of this study was the opportunity to look at a population early
15
16 retired without a legislative requirement of disability.
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19 Exploring risk factors for disability pension in an uniform population have the advantages
20
21 that the results are less dependent on residual confounding as underlying socio
22
23 economical factors which are known to be strong predictors of disability³¹. The data on
24
25 prognostic factors was self reported and assessed at one point only.
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29 The information about the non musculoskeletal symptoms was limited to a question
30
31 “Have our physician ever told you that you have one or more of the following diseases”.

32
33 The register gives no information of the diagnostic reasons/basis/foundation of the
34
35 disability pension and the lacking information of sick leave before 2007 rule out the
36
37 inclusion of sick leave data in the prognostic model for both outcomes.
38

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40 The study have a high external validity concerning the Danish health and eldercare as the
41
42 study population comprises a total population of nurses' aides in a well defined
43
44 geographical area representative for the rest of Denmark including a loss to follow up
45
46 analyses which support the representativeness of the study population. As membership of
47
48 a pension fund and trade union is mandatory the original register of nurses' aides are
49
50 thought to be near to complete. The working conditions as perceived exertion in care
51
52 duties, part of very care needing clients use of helping equipment in the eldercare in 1993
53
54 are comparable with working conditions reported in 2003 and 2005^{1;32}. As to
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56 generalisability to other countries both differences in legislation across countries and
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58 differences in standard of equipment and working procedures are to be taken in account.
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Conclusion

In conclusion we find an alarming high proportion of early retirement from an area of growing importance for society in the years to come. The lack of shared risk factors for the two types of early retirement was unexpected in a population sharing social and working characteristics, but also points to the importance of being aware of underlying legislation when translating data partly driven on legislation. Work related factors at baseline in 1993 only seemed to play a minor prognostic role for early retirement of both kinds, and individual factors as smoking, BMI and physical activity at baseline were not associated with early retirement at all. Risk factors for disability pension were mainly health related factors while economical factors as income of spouse and unemployment seemed to influence the decision to choose early voluntary retirement.

Our results point at secondary prevention managing especially musculoskeletal claims at an early state in preventing disability pension with the aim to stay occupied despite musculoskeletal symptoms.

Policy implications

The huge numbers of lost working years in a population with an initially strong connection to the labour market call for action, where the finding that musculoskeletal symptoms up to 15 years before disability pension are prognostic factors points at a more active counselling and help to restore connection to the labour market among those with musculoskeletal problems

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Competing interest declaration.

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Ethics approval

The study has been notified to and authorized by the Danish Data Protection Agency J.nr. 2007-41-0667. and notified to the local ethic and scientific committee J.nr. 1992-1110-892.

Contributorship

lone dobæk jensen, pia ryom and johan hviid andersen designed the study and made the analyses. michael christensen performed the data management , all 4 authors approved the final manuscript.

Data Sharing

We have no additional data from this study.

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10 **Headings. Figure 1 to figure 3**

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13 Figure 1.

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15 Flow chart, selection and course of study population

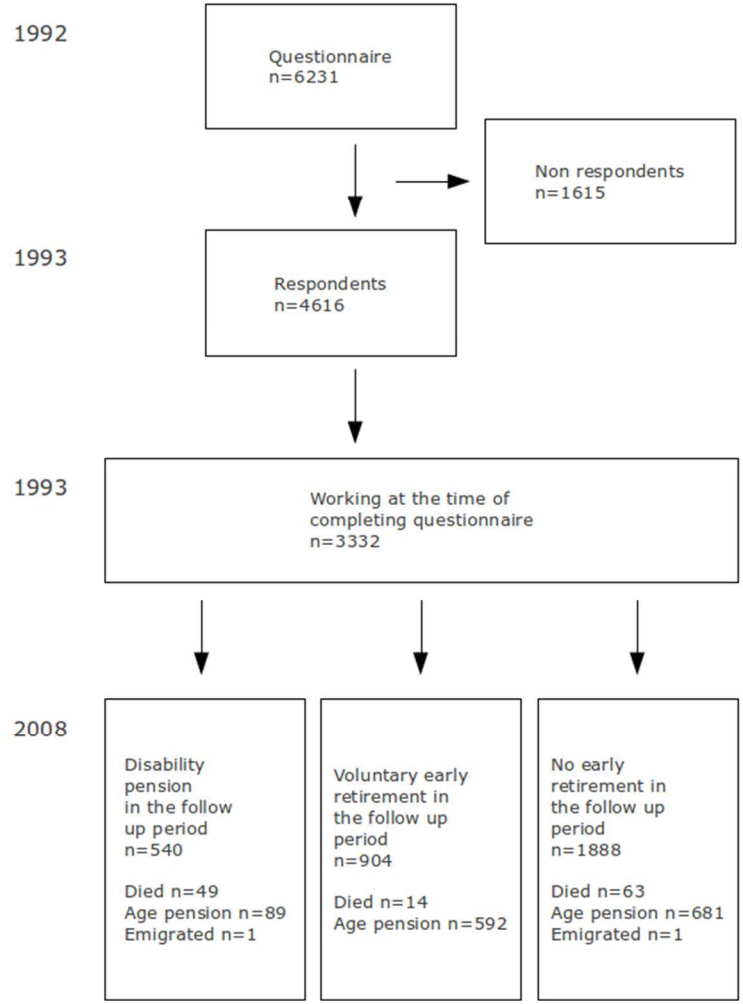
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18 Figure 2.

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20 Time trends in number and mean age of persons obtaining early retirement from
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22 1993-2008

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26 Figure 3.

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28 Vocational status, sick leave and other transfer incomes 104 weeks before start of
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30 disability pension or voluntary early retirement the period 1999-2008 .Zero on the x-
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32 axis indicates the week the person started getting disability pension or early voluntary
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34 retirement
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Differences in risk factors for voluntary early retirement and disability pension -a 15 year follow-up in a cohort of nurses' aides

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Differences in risk factors for voluntary early retirement and disability pension - a 15 year follow-up in a cohort of nurses' aides

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Auxiliary nurses, labour market, cohort study, early retirement

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ABSTRACT

Objective: To estimate the extent of early retirement and examine risk factors for voluntary early retirement and disability pension in a cohort of nurses' aides

Design: Register study including baseline questionnaire and register data covering all transfer incomes from 1991 to 2008 in a cohort of nurses aides established in 1993 with a follow up period of 15 years

Setting: Nurses' aides working in nursery homes, homecare or hospitals.

Participants: 3332 gainfully employed nurses' aides at the time of inclusion in the study.

Outcome: Disability pension or early voluntary retirement

Results: 16.2% of the population was granted disability pension and 27.1% entered early voluntary retirement in the follow up period representing 11,186 lost working years with a direct cost in transfer payment amounting about 410 million Euro.

Health related risk factors for disability pension was long lasting Low Back Pain (Hazard ratio (HR) 2.27(95 % CI 1.55 to 3.34), sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11), and inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)). Of non health-related factors, low education, workers compensation case, evening work and high rated perceived exertion at work all were minor risk factors for disability pension. The primary risk factor for early voluntary retirement was low education (HR 3.19 (95 % CI 2.65 to 3.85)).

Conclusion: 43.3% of nurses aides gainfully employed in 1993 retired before due time during the follow up period. Work related factors at baseline only seemed to play a minor prognostic role. Risk factors for disability pension were mainly health related factors while economical factors seemed to influence the decision to choose early voluntary retirement. The number of persons and the amount of lost working years

underscores the need of a more active counselling towards maintaining employment especially among those with persistent musculoskeletal disorders.

ARTICLE SUMMERY

Article focus

High prevalence's of low back pain and sick leave are found among healthcare workers in many countries

Predictors of negative vocational prognosis for healthcare workers are unknown.

Key messages

Musculoskeletal complaints at baseline predicted disability pension but not voluntary early retirement. Work related factors played a minor role as risk factors for both disability pension and voluntary early retirement.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI

Our results point at secondary prevention managing especially musculoskeletal claims at an early state in preventing disability pension.

Strength and limitations

Study strengths are a follow up time of 15 years in a national register with a high accuracy and completeness and the possibility to compare risk factors for two different types of early retirement. Study limitations are that data on prognostic factors were self reported and assessed at one point only.

INTRODUCTION

10% of the European workforce is occupied in the health care sector¹. Several, mainly cross sectional studies have reported adverse health effects among health care workers especially nurses' aides and home care workers. Most of the studies comprise low back pain (LBP)²⁻⁵ and other musculoskeletal disorders⁶. Also risks of affective and stress related disorders⁷⁻⁸ and hand eczema⁹ has been discussed.

High prevalence's of sick leave are found among nurses, nurses aides and homecare workers in many countries^{10;11}. There are only few studies of predictors of early retirement among health care workers¹² or leaving nursing care¹³. Disability pension is shown to be associated with increased mortality¹⁴ but also with better health¹⁵ dependent of socioeconomically class^{16;17}.

Lack of nursing personnel are thought to be a serious problem in many countries in the future due aging of the actual workforce and population, a rapid job turnover and problems with recruitment^{1;13}. To face these problems there is a need of studies of predictors of early retirement in the profession to be able to strengthen the prevention of negative vocational outcomes being of benefit for both the nursing personnel and the society.

Objectives

To estimate the extent of early retirement and examine and compare predictors of two different types of early retirement: voluntary early retirement and disability pension in a cohort of occupational employed nurse's aides in a follow up period of 15 years.

METHODS

A prospective register study of predictors of early retirement in a fixed cohort including all nurses' aides registered in 1992 in the county of Aarhus with 15 years of

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8 **Study population and data sources**

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10 The cohort was identified by data from an insurance fund (Danish acronym
11 PENSAM) including all former and current persons registered as nurses' aides for
12 minimum one year in 1992 in the county of Aarhus. 74% of the cohort (n= 4,616)
13 completed a questionnaire including demographic, lifestyle, physical and
14 psychological workload and disease related factors in 1993³. The part of this
15 population gainfully employed as a nurse's aides n=3,332 in 1993 comprised the
16 study cohort for the present study. The Danish civil personal registration number
17 (CPR) was used to link questionnaire data with person specific data from the Danish
18 National Register on Public Transfer Payments (Danish acronym DREAM)¹⁸ from
19 1991-2008 (both years inclusive). Information of permanent transfer income were
20 available from the start of the register in 1991 while information's of non-permanent
21 transfer payments as sick leave and unemployment benefit first were available from
22 1997. The follow up data included data from the DREAM register with weekly
23 registration of public transfer payment at individual level in the follow up period. We
24 recoded the originally 104 different transfer payment codes from the DREAM register
25 into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other
26 non permanent transfer payment as vocational rehabilitation and social assistance, 5)
27 disability pension and flex job a health dependent half time pension and 6) voluntary
28 early retirement. The register is thought to be near to complete based on the
29 economically incentive for the employer to report to public authorities. The cohort
30 was followed in the DREAM register until 2008 providing a follow up time of 15
31 years.
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Assessment of main outcome

The main outcome was permanent early retirement in the follow up period as disability pension or early voluntary retirement. Lost working years were calculated by extracting the person age at the year of early retirement from 65 which is the year of old age pension in Denmark. Obtaining disability pension require an evaluation of work ability which is to be reduced to a minimum while early voluntary retirement are independent of health status. Voluntary early retirement is available from the age of 60 years if the persons have achieved 25 years of membership of an unemployment benefit fund for a period of 30 years. For each patient, disability pension and voluntary early retirement was estimated, including time and the person's age at the time of achievement of early retirement. Disability pension includes flex job, which was introduced in the year 2000 as a health dependent half time pension achieved in the same legislation context as disability pension, based on a permanent health dependent condition. According to the rules of achievement of early voluntary retirement it is not possible to change from disability pension to early voluntary retirement. If a person have changed from early voluntary retirement to disability pension she is classified with the outcome disability pension (n= 8). The register gives no information of reason for achieving early retirement.

Sample characteristics

Baseline data was obtained from a self administered questionnaire completed in 1993. Demographic and background variables included age register based age at January 1993, gender, education divided in education up to 9 years primary school, 10 years primary school or basic vocational course or secondary school , vocational status of spouse dichotomised in paid work or transfer income, marital status, Live in with partner (yes or no) and workers compensation case dichotomized into yes

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3 or no. A positive answer includes both ongoing and confirmed cases. Physical Work
4 factors were assessed by questions of: Working hour's day, evening or night, working
5 place hospital or eldercare, index describing heaviness of care where heavy care was
6 defined by a combination of having more than 2/3 of the daily patients needing full
7 care together with more than 10 handlings of persons per day. Rated Perceived
8 Exertion (RPE) was assessed from a modified Borg scale range 0-14¹⁹ anchored
9 1=very very light and 13=very very strenuous, values ≥ 8 was defined as high RPE.
10 Psychosocial Work factors were assessed using a Danish version²⁰ of Karasek's Job
11 Content Questionnaire (JCQ) which is shown to have acceptable internal consistency
12 in the health care sector²¹. The 3 items in the demand score were time pressure,
13 perceived strain and tiredness returning from work. The range in the demand index
14 score was 5-15, low demand were defined by values lower or equal to 9. The 3 items
15 in the decision latitude score were possibilities of decision of work pace, how the
16 work was carried out and work disposition. The range in the decision latitude index
17 score was 5-15. High decision latitude was defined by values lower or equal than 9.
18 Violence at work assessed by 5 items: never, seldom, sometimes, often and very
19 often. Upper and lower extremities symptoms was assessed using Nordic
20 questionnaire²², and serious upper extremity complaints was defined as sick leave >
21 30 days for at least one region within the last year, serious lower extremity complaints
22 was defined as sick leave > 30 days for at least one region within the last year. LBP
23 was assessed by pain drawing including level of radiating pain combined with 0-10
24 point Visual Analogue Scale (VAS) describing level of usual pain, and duration of
25 pain was assessed by a and a question asking : "For how long have you altogether had
26 low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days,
27 31-90 days, more than 90 days" and a question asking "Have you ever had acute LBP
28 in relation to person handling or other work tasks". Knowledge of health parameters
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3 as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro
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5 intestinal diseases and rheumatologic inflammatory diseases was obtained from a list
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7 of questions in the questionnaire “Have our physician ever told you that you have one
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9 or more of the following diseases”. Lung disease included asthma, chronic bronchitis
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11 and pneumonia, nervous diseases included nervous disease, skin disease included
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13 eczema and cardiovascular disease included elevated blood pressure, angina pectoris,
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15 unsteady hearth, coronary infarction and arteriosclerosis. Gastro intestinal diseases
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17 included colon irritable and duodenal ulcers and rheumatologic inflammatory
18
19 included rheumatoid arthritis and inflammatory connective tissue disease. Lifestyle
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21 variables comprised body mass index (BMI) dichotomized ≥ 30 =high versus BMI
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23 < 30 , actual smoking yes/no, physical activity 8 items dichotomized: moderate
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25 physical activity more than 3 times a week or more versus less or no activity. For the
26
27 part of the population achieving early retirement after 1998 pattern and cumulated
28
29 sick leave the two year before early retirement were estimated from register data.
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36 **Statistical analysis**

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38 After linking data from the PENSAM register including all nurses’ aides in the
39
40 geographical area of interest and the DREAM register by CPR numbers, the
41
42 vocational record in the 15 years follow up for each person was established. Relevant
43
44 covariates were tested for colinearity which was not found. We used Cox proportional
45
46 hazards models to examine the longitudinal association between the outcome measure
47
48 and the full set of predictor variables. The hazard ratio of achieving disability pension
49
50 or early voluntary pension was estimated with 95% confidence intervals (95 % CI).
51
52
53 The analyses were made separately for disability pension and voluntary early
54
55 retirement where the reference group for both groups was the part of the population
56
57 receiving neither disability pension nor voluntary early retirement. SAS version 9.1.3
58
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60

(SAS Institute Cary, NC, USA) and STATA 11.0 were used to perform data management and statistical analyses.

RESULTS

Study population

The invited population in 1993 comprised all nurses aides (N= 6,231) in the county of Aarhus with at least one years seniority as nurse's aides work in the preceding 5 year representing about 200 different working sites. The response rate in 1993 was 74%.

Table 1 shows a register based non response analysis.

Table 1.
Non response analyses, including all nurses aides in the county of Aarhus 1993 with more than 1 years of nursing aides work the last five years n=6231

Register data DREAM	Questionnaire respondents 1993 n=4616	Questionnaire non-respondents 1993 n=1615
Age 1.7.1993 mean (SD)	42.7 (9.4)	44.3 (11.0)
Years working as nurses aides 1.7.1993 mean (SD)	10.9 (7.1)	11.2 (7.4)
Gender woman %	98.1	97.1
Ethnicity other than Danish %	2.3	3.4
Dead in the follow up period %	2.5	3.0
Granted disability pension in the follow up period %	16.2	14.8
Voluntary early retirement in the follow up period %	18.2	19.3

There were only minor differences between the responders and the non responders concerning the two outcome measures and population characteristics.

The response rate among people with foreign ethnicity was lower than the non foreign group, probably because of language problems. In the questionnaire response 3,332 participants stated that they were working as nurse's aides at the time they completed

the questionnaire. Those 3332 comprised the study population in the present paper. The baseline characteristics of the 3,332 respondents are shown in table 2. The population is mainly female with a mean age of 41.9 years, 70% with education below secondary school and experienced in nursing care with a mean of 13.0 years seniority. 69.5 % was working in homecare or at nursery homes and 30.5% in hospitals in accordance with figures for Denmark as a whole at that time²³. The prevalence of having more than 90 days of back pain was 13.6%, 44.4% scored their rated perceived exertion more than or equal to 8 (strenuous), 48.7% experienced high job demands and 24.1 % low decision latitude according to the Karasek model. A minor part, 5.9 % reported violence at work often or very often and 15.9% was physical active with at least one time a week with strenuous physical activity.

Table 2.
Baseline characteristics among the study population of nurse's aides working in hospital or nursery home/homecare at the time of baseline registration

Baseline characteristics	Study population	No early retirement in the follow up period	Voluntary early pension in the follow up period	Disability pension in the follow up period
	n= 3332	n=1888	n=904	n=540
Age, mean(SD)	41.9(8.2)	37.3(5.4)	51.3(5.1)	42.4(6.8)
Age obtaining early retirement mean (SD)			60.7 (1.9)*	50.7(6.0)
Years occupied in health care work, mean(SD)	13.0(6.5)	11.8(5.9)	15.6(7.0)	13.1(6.5)
Gender %				
Male	1.7	1.9	1.5	1.3
Female	98.3	98.1	98.5	98.7
Education/grade %				
-7 -9 years primary school	29.3	22.9	36.3	39.4
-10 years primary school or basic vocational course	41.6	41.3	46.4	35.0

-Secondary school	29.1	35.8	17.3	25.6
Vocational status spouse %				
-paid work	73.2	79.2	63.6	67.8
-transfer income	26.8	20.8	36.4	32.8
Marital status %				
Married/live in partner	82.6	84.5	81.6	76.7
Workers compensation case %	19.1	15.2	19.5	31.7
Workplace %				
- hospital	30.5	29.8	32.2	30.0
- nursery home/homecare	69.5	70.2	67.8	70.0
Work hours %				
- mainly day work	43.4	44.0	44.0	40.2
- mainly evening work	24.8	24.4	23.7	28.5
- mainly night work	10.5	9.8	11.4	11.7
- mixed	21.3	21.9	20.9	19.6
Heaviness of care duties index %				
high	11.0	11.4	9.3	12.6
RPE \times (range 0-14)%				
high ≥ 8	44.4	43.5	41.6	53.3
Violence at work %				
Never	42.8	38.8	45.2	44.8
Seldom	23.8	25.3	24.0	21.3
On and of	27.6	29.9	25.3	27.2
Often	4.3	4.4	4.4	4.4
Very often	1.6	1.7	1.1	2.2
Decision latitude -low %	24.1	23.4	25.3	24.6
Demand -high %	48.7	47.5	49.5	51.3
Number of days LBP the last 12 month altogether %				
0 days	32.9	31.8	39.9	24.4
1-7 days	25.4	27.8	23.0	21.9

8-30 days	20.3	22.3	17.5	18.0
31-90 days	7.8	9.0	5.5	7.4
More than 90 days	13.6	9.1	14.0	28.3
Usual back pain %				
Radiation below knee level	15.9	13.6	15.1	25.4
Ever acute LBP in relation to patient handling or other work tasks %	58.8	57.2	56.1	69.3
More than 30 days of sick leave the last year because of upper limb disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limb disorder %	4.7	2.5	5.2	11.9
Cardiovascular disease %	14.5	10.9	20.5	17.2
Lung diseases %	23.2	22.8	21.1	28.2
Skin diseases%	16.7	18.2	11.7	19.4
Gastro intestinal diseases %	12.6	10.0	14.9	18.2
Rheumatologic inflammatory diseases %	2.8	1.3	4.0	6.1
Nervous disorder %	4.1	3.1	4.4	7.6
Current Smoking, %	47.0	47.4	41.9	54.4
BMI, mean(SD)	23.4(3.8)	23.0(3.5)	24.0(3.5)	23.9(5.0)
BMI				
severe overweight > 30	5.1	4.7	5.9	5.7
Physical activity# High %	15.3	17.5	11.7	12.8

* 60 years is the lower limit for voluntary early retirement

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity high: at least one time a week strenuous physical activity²⁴

Early retirement and lost working years

As seen from the flow chart figure 1, 540 persons (16.2%) were granted disability pension and 904 persons (27.1 %) obtained voluntary early retirement, in the follow up period all together 43.3%.

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3 The total number of lost working years in the population presuming that all persons
4 who retired early had remained at work until the normal pension age is 7,472 years
5 for the 540 persons granted disability pension and 3,714 years for the 904 persons
6 obtaining early retirement, altogether 11,186 years amounting about 410 million Euro
7 in direct costs from early retirement transfer payments.
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14 Figure 2 shows an increasing number of participants who choose early voluntary
15 retirement during the follow up period, whereas the number per year being granted
16 disability pension is stable until 2002 with a rise the following years until 2007 where
17 a decline is seen. At that time there is a corresponding rise in voluntary early
18 retirement. This pattern could be explained by a change in the interpretation of the
19 disability pension legislation. The mean age of those granted disability pension is
20 stable between 50 and 55 years over the 15 year follow up period. The minimum age
21 obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is
22 explained by a temporary change in the legislation. Altogether 344 persons chose to
23 postpone the early voluntary retirement after having got their early voluntary pension
24 certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to
25 the age of 66 year.
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41 Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit
42 and other non permanent transfer incomes every week the 2 years preceding the
43 granting of disability pension respectively early voluntary retirement. The population
44 is restricted to persons changing to early retirement from 1999 as we only have data
45 on sick leave from 1997 in the DREAM register.
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52 Figure 3_a reveals that disability pension is preceded of a decline in work presence
53 from about 60% two years prior to the week of disability pension to about 20% 12
54 weeks before. During the 2 years preceding disability pension there is an increase
55 other transfer incomes with a lower benefit properly because sick leave by Danish
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3 legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be
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5 sick listed as unemployed which can explain the decline in number receiving
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7 unemployment benefit.
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10 As see from figure 3_a and 3_b the pattern of vocational status the 2 years preceding
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12 the time of early retirement differs completely between disability pension and
13
14 voluntary early retirement. Contrasting the transfer income pattern seen the two years
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16 proceeding the time of disability pension there is no change in the part of the
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18 population working or receiving non permanent transfer income two years before
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20 starting early voluntary retirement. A bigger proportion compared to the part of the
21
22 population granted disability pension is receiving unemployment benefit with an
23
24 increasing number over the 2 years.
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30 **Risk factors for early retirement**

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32 Table 3 shows adjusted risk factors of being granted disability pension or choosing
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34 early voluntary retirement in the follow up period.
35

36 Health related risk factors for disability pension was more than 90 days of LBP the
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38 last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave
39
40 because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30
41
42 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to
43
44 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro
45
46 intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education
47
48 (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI
49
50 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated
51
52 perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk
53
54 factors. Risk factors for early voluntary retirement were: low education (HR 3.19 (95
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56 % CI 2.65 to 3.85), high job demands (HR 1.28 (95 % CI 1.09 1.50)), inflammatory
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rheumatic disease (HR 1.76 (95 % CI 1.25 to 2.48)), cardio vascular disease (HR 1.47 (95 % CI 1.27 to 1.69)) and gastro intestinal disorders (HR 1.39(95 % CI 1.10 to 1.76)).

Apart from low education, gastro intestinal disorders and inflammatory rheumatic diseases, the two types of early retirement do not share any prognostic factors for the two types of early retirement. Life style factors as BMI, smoking and physical activity did not show associations with either of the two outcomes. Living alone protected against voluntary retirement, but showed up as a risk factor for disability pension.

Table 3.
Hazard Ratio of obtaining voluntary early pension or disability pension in the study period according to baseline information's

Risk factors	Voluntary early pension n= 904		Disability pension n=540	
	HR	95% CI	HR	95% CI
Education grade				
-Secondary school	1		1	
-10 years primary school or basic vocational course	0.83	0.65 to 1.06	0.92	0.71 to 1.18
-7 -9 years primary school	3.19	2.65 to 3.85	1.27	1.02 to 1.57
Vocational status spouse				
-transfer income versus paid work	0.55	0.46 to 0.67	1.11	0.85 to 1.45
Marital status				
- Living alone versus live in partner	0.64	0.51 to 0.80	1.54	1.14 to 2.09
Workers compensation				
case	1.02	0.84 to 1.23	1.51	1.23 to 1.87
Workplace				
- nursery home/homecare versus Hospital	1.04	0.88 to 1.23	1.08	0.87 to 1.35
Work hours				
- mainly day work	1		1	
- mainly evening work	1.03	0.86 to 1.23	1.29	1.03 to 1.60

- mainly night work	1.16	0.92 to 1.46	1.18	0.87 to 1.61
- mixed	0.90	0.74 to 1.11	0.97	0.74 to 1.27
Heaviness of care duties				
Index " high	0.79	0.62 to 1.01	0.98	0.74 – 1.29
RPE ^x (range 0-14)				
high >=8	0.96	0.82 to 1.13	1.23	1.00 to 1.51
Decision latitude -low	1.09	0.92 to 1.28	0.90	0.72 to 1.12
Demand -high %	1.28	1.09 to 1.50	0.92	0.75 to 1.13
Number of days LBP the last 12 month altogether				
0 days	0.98	0.77 to 1.24	1.36	0.93 to 1.26
1-7 days	0.71	0.56 to 0.89	1.34	0.94 to 1.92
8-30 days	0.71	0,55 to 0.91	1.35	0.92 to 1.97
31-90 days	0.58	0.40 to 0.82	1.29	0.81 to 2.05
More than 90 days	0.72	0.54 to 0.97	2.27	1.55 to 3.34
Usual back pain :				
Radiation below knee level	0.90	0.73 to 1.10	1.18	0.05 to 1.48
Ever acute LBP in relation to patient handling or other work tasks	1.07	0.89 to 1.27	1.01	0.80 to 1.28
More than 30 days of sick leave the last year because of upper limb disorder	1.04	0.72 to 1.50	2.18	1.57 to 3.01
More than 30 days of sick leave the last year because of lower limb disorder	0.91	0.63 to 1.31	1.51	1.08 to 2.11
Cardiovascular disease	1.47	1.27 to 1.69	1.14	0.94 to 1.38
Lung diseases	0.88	0.75 to 1.05	1.14	0.93 to 1.39
Skin diseases	0.61	0.49 to 0.75	1.13	0.90 to 1.42
Gastro intestinal diseases	1.21	1.00 to 1.47	1.39	1.10 to 1.76
Rheumatologic inflammatory diseases	1.76	1.25 to 2.48	2.42	1.67 to 3.52
Nervous disorder	0.87	0.62 to 1.24	1.31	0.92 to 1.87
Current Smoking	0.80	0.69 to 0.93	1.20	0.98 to 1.45

BMI				
severe overweight > 30	0.87	0.64 to 1.17	0.85	0.57 to 1.26
Physical activity# low	0.87	0.74 to 1.02	0.94	0.77 to 1.15

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity low: less than "at least one time a week strenuous physical activity"

DISCUSSION

This study compared risk factors for two different types of early retirement and thereby contribute to the discussion of the disability process and how to prevent disability and social exclusion^{15;25;26}. The study document a high number of early retirement in a cohort with an earlier strong connection to the labour market with an enormous number of lost productive years and money in direct costs from disability pension, voluntary early retirement. Risk factors for disability pension were mainly health related factors in accordance with the fact that health related reduction of the working capacity is the most important criteria for granting disability pension. HR above 2 for disability pension were low back pain more than 90 days the last year, more than 30 of sick leave the last year and known rheumatologic inflammatory disease at baseline registration in 1993. A workers compensation case was an independent risk factor, which has been found in other studies^{27;28}. This finding could result from residual confounding as it is possible that the persons notified for a workers compensation case have more serious health problems than the persons not notified. In this study the introduction in the model of interaction variables between compensation status and pain variables decreased the HR, and is in favour of more serious health problems among compensation cases. Another explanation could stem from accelerating a disability process by the way the compensation system works and impacts on the worker, and we cannot exclude that this could play a role. This study

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3 could not corroborate that physical or psychosocial workload found in other
4 studies^{12;26;29-31} played a major role as targets for primary prevention. Rated Perceived
5 exertion at work, but not the heaviness of clients assessed from an index based on
6 number of clients needing full care in combination with number of person handlings a
7 day, was a risk factor. The finding of an elevated risk of evening work are in
8 accordance with a Danish register study focusing on shift work in all sectors and
9 disability³² the only work related factor with an elevated risk of choosing early
10 voluntary retirement was high demands at work. The interaction term job strain did
11 not contribute to the models (results not shown). In a study from the Finnish public
12 service sector²⁶ it is argued that job strain are to be evaluated on job unit level, in this
13 study we have information of 200 different work sites. But as the nursery homes,
14 home care units or hospitals in the actual study are rather different in size we do not
15 have the possibility to make valid work site aggregated measures of exposure.
16 Many studies report associations between sick leave and disability pension³³. To our
17 knowledge no other studies have investigated risk factors of early voluntary
18 retirement. Early voluntary retirement at the age of 60 years was mainly associated
19 with low educational level, and the protective effect of spouse being on income
20 transfer and living alone is consistent with primarily economic imperatives for
21 choosing early voluntary retirement. In this study we found no strong argument for
22 health related factors as being important in the decision to retire voluntary, except for
23 small effects from cardiovascular, rheumatologic inflammatory diseases and
24 gastrointestinal disease.
25
26 For both outcomes we found no associations with smoking, low physical leisure
27 activity or BMI, and this finding questions ongoing activity at the work site for
28 making individual life style factors the main suspects for intervention in order to stay
29 active in work for more years³⁴.

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3 The finding that voluntary early retirement and disability pension only has
4 few mutual prognostic factors, challenges common notions of a retirement process
5 driven by work related or health related factors.
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10 The pattern of vocational status the 2 years preceding the time of early retirement
11 differs completely between disability pension and voluntary early retirement.
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14 Different legislation obviously play a role but it is although surprising that health and
15 work related factors seem to be without importance for people choosing voluntary
16 early retirement in a profession which in many investigations are found to be physical
17 and psychological demanding²⁻⁵.
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21 A major strength in the present study is the prospective design and number of
22 observations of both of the two outcomes of early retirement.
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25 In this study early retirement - both disability pension and early voluntary retirement -
26 was assessed from a national register, including weekly registration of all types of
27 transfer income from the social system. The registers are time accurate and complete
28 concerning disability pension and early voluntary retirement because it is a part of the
29 payment system. Another strength of this study was the opportunity to look at a
30 population early retired without a legislative requirement of disability.
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34 Exploring risk factors for disability pension in an uniform population have the
35 advantages that the results are less dependent on residual confounding as underlying
36 socio economical factors which are known to be strong predictors of disability³⁵. The
37 data on prognostic factors was self reported and assessed at one point only.
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41 The information about the non musculoskeletal symptoms was limited to a question
42 “Have our physician ever told you that you have one or more of the following
43 diseases?”. The register gives no information of the diagnostic
44 reasons/basis/foundation of the disability pension and the lacking information of sick
45 leave before 2007 rule out the inclusion of sick leave data in the prognostic model for
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3 both outcomes. The study have a high external validity concerning the Danish health
4 and eldercare as the study population comprises a total population of nurses' aides in a
5 well defined geographical area representative for the rest of Denmark including a loss
6 to follow up analyses which support the representativeness of the study population. As
7 membership of a pension fund and trade union is mandatory the original register of
8 nurses' aides are thought to be near to complete. We assume that the working
9 conditions as perceived exertion in care duties, part of very care needing client's use
10 of helping equipment in the eldercare in 1993 are comparable with working
11 conditions during the follow up period. There had been a tendency towards heavier
12 clients and lesser time per client but on the other hand a growing use of helping
13 devices. Our assumption is supported by description of working conditions in studies
14 from 2003, 2004 and 2005^{1;11;36}. As to generalisability to other countries both
15 differences in legislation across countries and differences in standard of equipment
16 and working procedures are to be taken in account.

33 34 **Conclusion**

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36 In conclusion we find an alarming high proportion of early retirement from an area of
37 growing importance for society in the years to come. The lack of shared risk factors
38 for the two types of early retirement was unexpected in a population sharing social
39 and working characteristics, but also points to the importance of being aware of
40 underlying legislation when translating data partly driven on legislation. Work related
41 factors at baseline in 1993 only seemed to play a minor prognostic role for early
42 retirement of both kinds, and individual factors as smoking, BMI and physical activity
43 at baseline were not associated with early retirement at all. Risk factors for disability
44 pension were mainly health related factors while economical factors as income of
45 spouse and unemployment seemed to influence the decision to choose early voluntary
46 retirement.

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3 Our results point at secondary prevention managing especially musculoskeletal claims
4 at an early state in preventing disability pension with the aim to stay occupied despite
5 musculoskeletal symptoms.
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10 11 **Policy implications**

12 The huge numbers of lost working years in a population with an initially strong
13 connection to the labour market call for action, where the finding that musculoskeletal
14 symptoms up to 15 years before disability pension are prognostic factors points at a
15 more active counselling and help to restore connection to the labour market among
16 those with musculoskeletal problems
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26
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28

29 **Licence statement**

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43 **Competing interest declaration.**

44 All authors have completed the Unified Competing interest form at
45 www.icmje.org/coi_disclosure and declare that none of the authors have financial
46 interests that may be relevant to the submitted work to declare.
47
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51 **Ethics approval**

52 The study has been notified to and authorized by the Danish Data Protection Agency
53 J.nr. 2007-41-0667. and notified to the local ethic and scientific committee J.nr. 1992-
54 1110-892.
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3 **Headings. Figure 1 to figure 3**
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6 Figure 1.

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8 Flow chart, selection and course of study population
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12 Figure 2.

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14 Time trends in number and mean age of persons obtaining early retirement from
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16 1993-2008
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20 Figure 3.

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22 Vocational status, sick leave and other transfer incomes 104 weeks before start of
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24 disability pension or voluntary early retirement the period 1999-2008 .Zero on the x-
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26 axis indicates the week the person started getting disability pension or early voluntary
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28 retirement
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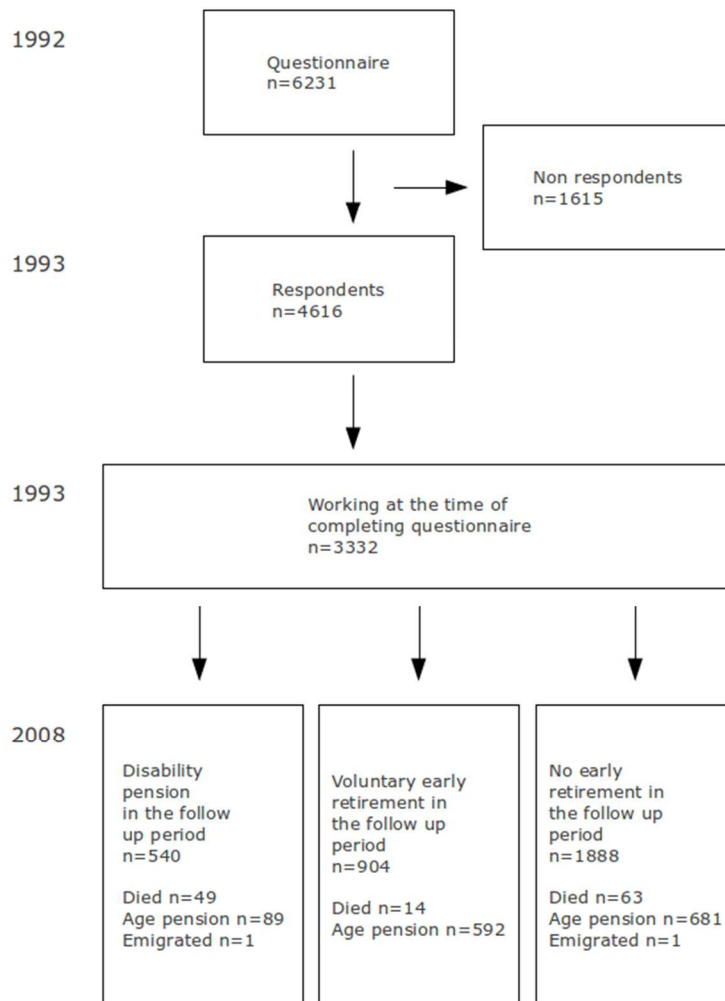
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50 and risk of cause-specific disability pension: the Finnish Public Sector Study.
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57 work and disability pension. *Occup Environ Med* 2008; 65(4):283-285.
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4 Norwegian working population: the prognostic role of diagnoses and
5 socioeconomic status: a prospective study of sickness absence and transition
6 to disability pension. *Spine (Phila Pa 1976)* 2009; 34(14):1519-1525.
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13 patients with musculoskeletal disorders. *J Rehabil Med* 2005; 37(5):281-285.
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19 occupational class - the impact of work-related factors: the Hordaland Health
20 Study Cohort. *BMC Public Health* 2011; 11:406.
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27 eldercare workers: randomized controlled work site trial. *Spine (Phila Pa*
28 *1976)* 2006; 31(16):1761-1769.
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Point to point letter with our response to the issues raised by the referees

Additions are **bold** and deletions have a ~~strike~~ through

Comments are given in italics.

Reviewer 1: Monica Löfvander

Answers relating to 9 specific comments - Reviewer 1

1) The research question differ between the abstract and the main text. Nowhere is the lost working years mentioned. The methods are not presented.

We agree in this point and have made additions in the abstract and the objective (page 4: line 27)

Abstract objective:

To **estimate the extent of early retirement** and examine risk factors for voluntary early retirement and disability pension in a cohort of nurses' aides.

MS objectives:

To **estimate the extent of early retirement** and examine and compare predictors of two different types of early retirement: voluntary early retirement and disability pension in a cohort of occupational employed nurse's aides in a follow up period of 15 years.

2) In the main text, the method section does not include a way about calculating lost working years. Further, define low education, age groups etc.

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6 *We agree we have added the following in the methods section(page 6:*
7 *line 26.)*
8
9

10 Assessment of main outcome

11
12 The main outcome was permanent early retirement in the follow up
13 period as disability pension or early voluntary retirement. **Lost working**
14 **years was calculated by extracting the person age at the year of early**
15 **retirement from 65 which is the year of old age pension in Denmark.**
16
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19

20 Obtaining disability pension require an evaluation of work ability.
21
22

23
24
25 *The information on education, vocational status spouse, marital status*
26 *and workers compensations case stem from the baseline questionnaire*
27 *while The information on age are register based. To define the variables*
28 *we have added the following on page 7: line 2*
29
30

31 Baseline data was obtained from a self administered questionnaire
32 completed in 1993. Demographic and background variables included age
33 **register based age at January 1993**, gender, education **divided in**
34 **education up to 9 years primary school, 10 years primary school or**
35 **basic vocational course or secondary school** , vocational status of
36 spouse **dichotomised in paid work or transfer income**, marital status,
37 **Live in with partner (yes or no)** and workers compensation case
38 **dichotomized into yes or no. A positive answer includes both ongoing**
39 **and confirmed cases .**
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52 *As the term low education page 10 line 18 is imprecise it is changed to*
53 *the following:*
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6 The population is mainly female with a mean age of 41.9 years, **70%**
7
8 **with education below secondary school** and experienced in nursing care
9
10 with a mean of 13.0 years seniority and ~~low educated~~.

11
12
13 3) The conclusion contains information that was not in the aims for the
14 study.

15
16 *After correcting the aims we assume the conclusion is acceptable.*
17 *We conclude on the extent of early retirement, the risk factors and the*
18 *differences in risk factors, as we only found small effects of factors*
19 *suitable for primary prevention we think it is appropriate to point at*
20 *secondary prevention aiming at musculoskeletal complaints which was*
21 *major risk factors concerning disability pension.*
22
23

24
25 4) What is the reason for the many sick leave groups? and all the disease
26 groups?

27
28 *As mentioned page 6 line 1, the Danish DREAM register have a very*
29 *detailed set of information on the weekly status of any transfer payment,*
30 *we have recoded the non permanent transfer types of payment in 3 main*
31 *categories' because both legislation, payment and time span for these*
32 *payments differs.*
33
34

35 *As the literature about health problems contain several adverse health*
36 *effects we find it relevant both to include health effect which are*
37 *discussed as related to the occupational exposures (musculoskeletal*
38 *disorders, mental disorder and skin disorders)together with chronic*
39 *diseases as cardiovascular and, rheumatological diseases known as*
40 *general risk factors of early retirement and as that relevant confounders.*
41
42

43 5) There are Nordic references that have explored similar questions.

44
45 Br J Ind Med. 1988 Jun;45(6):387-95.
46 Back pain, back abnormalities, and competing medical, psychological,
47 and social factors as predictors of sick leave, early retirement,
48 unemployment, labour turnover and mortality: a 22 year follow up of
49 male employees in a Swedish pulp and paper company. Astrand NE,
50 Isacson SO.
51
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53 Wallman T, Wedel H, Johansson S, Rosengren A, Eriksson H, Welin L,
54 Svärdsudd K.
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6 The prognosis for individuals on disability retirement. An 18-year
7 mortality follow-up study of 6887 men and women sampled from the
8 general population.
9

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11 *As the first publication although interesting have a limited number of*
12 *cases, we did not include this in our manuscript.*
13

14 *The second publication adds to the knowledge of the impact of disability*
15 *pension. It is an important topic with consequences for both the person*
16 *and society. As the actual knowledge is conflicting we have included 3*
17 *other publications the introduction page 4: line 50-54*
18

19
20 There are only few studies of predictors of early retirement among health
21 care workers¹² or leaving nursing care¹³. **Disability pension is shown to**
22 **be associated with increased mortality** (wallman 2006)but also with
23
24 **better health** (westerlund bmj 2010=ref 22) dependent of
25
26 socioeconomical class (main 2003, brockmann 2009)
27
28

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32
33 6) The result section provides a surplus of information at the start.

34
35 *We think the non response analyses is natural and relevant*
36 *in the characterisation of the population and important in discussion of*
37 *the bias and external validity of the study*
38

39
40 7) The tables are too long, contain too many decimals. Why not present a
41 final model instead?
42

43 *We find it important to give the crude numbers at baseline both to make*
44 *comparisons of the two different types of early retirement and to allow*
45 *comparison with other studies from the health care sector.*
46

47 *The figures have 1 decimal which we find appropriate*
48

49
50 *We find that table 2 is important interpreting the final model in table 3*
51

52
53 8) The discussion section contains many numbers that are presented
54 earlier in the MS.
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6 *We have deleted the figures with the precise Hazard Ratios and*
7 *confidence intervals*
8

9
10 9) Relevant references from Europe on early retirement could be
11 presented as to fulfil the early retirement discussion as well as the
12 limitations of the health related data 15 years before.
13

14 *We find we have included number of key references concerning specific*
15 *risks of different exposures and disorders (12,13,21,24,25,27,28)*
16 *together with publications covering general aspects of early retirement*
17 *(20,22, 26,29,31) in the discussion of extent and predictors of early*
18 *retirement ,*
19

20
21 *As the health data from baseline is analysed as predictors the time span*
22 *is not a limitation. The self report of health with a lack of clinical data*
23 *Is mentioned in the discussion section page19:..line 24*
24

25
26 Reviewer 2: Jenny Hubertsson
27 Answers relating to 8 specific comments - Reviewer 2
28

29 1)Abstract:

30 The description of the design is very brief. There is no information on
31 data sources or how and when baseline data was obtained.
32

33
34 *We agree and have added the following*
35

36 Abstract design:

37
38 Register study including **baseline questionnaire and register data**
39

40 **covering all transfer incomes from 1991 to 2008 in a cohort of nurses**
41

42 **aides established in 1993** with a follow up period of 15 years
43
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46 2) I find the conclusion in the abstract somewhat misleading as it refers to
47 those being granted disability pension and those choosing voluntary
48 retirement as one group while in the conclusion of the article text the lack
49 of shared risk factors for the two types of early retirement is pointed out. I
50 think the conclusion of the article text is more accurate to the findings of
51 the study.
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6 *We agree that the conclusion is unclear and do not fully cover the results*
7 *of the study. The conclusion is changed to the following:*
8

9
10 **Conclusion:** 43.3% of nurses aides gainfully employed in 1993 was
11 ~~granted disability pension or chose early voluntary retirement in~~ **retired**
12 **before due time during** the follow up period. **Work related factors at**
13 **baseline only seemed to play a minor prognostic role. Risk factors for**
14 **disability pension were mainly health related factors while**
15 **economical factors seemed to influence the decision to choose early**
16 **voluntary retirement.** The number of persons and the amount of lost
17 working years underscores the need of a more active counselling towards
18 maintaining employment especially among those with persistent
19 musculoskeletal disorders.
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35 Concerning the interpretation of the results:

36 3) I miss a more explicit description and discussion around how different
37 variables are adjusted for in the model and how this might affect the
38 results. This should also be mentioned in the methods section.
39

40 *All relevant covariates was tested for colinearity which was not found*
41 *The following is added page8:line 44-46 in the methods section:*
42
43
44

45 ..the vocational record in the 15 years follow up for each person was
46 established. **Relevant covariates were tested for colinearity which was**
47 **not found.** We used Cox proportional hazards models to examine the
48 longitudinal association between the outcome measure
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6 4)I would like to see a discussion around why BMI and physical activity
7 are dichotomized and how this might affect the results for these variables.
8 Could it have been done differently?
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11 *BMI was analysed as a continuous variable where we found a linear*
12 *association, leading to the choice to dichotomise to limit the number of*
13 *freedom degrees.*
14

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16
17 *The question concerning physical activity are translated from the*
18 *Stockholm Music 1 manual and have 12 answer categories from nearly*
19 *no physical activity to the level of elite sport and are dichotomised*
20 *between 7 and 8. A reference to the music study are added in the footnote*
21 *in table 2*
22

23
24 5)I also lack a more explicit discussion around the fact that for some of
25 these subjects the predictive variables was measured several years (up to
26 15) prior to the outcome. Variables like lifestyle variables and work
27 related factors have probably changed in the meantime.
28

29
30 *We agree that it is a limitation and a potential problem we only have*
31 *one measure of lifestyle and working conditions(mentioned in the*
32 *discussion section page19 line34-31*
33

34
35 *Concerning lifestyle especially BMI, we think that BMI in 1993 reflects*
36 *the BMI at older ages as the middle aged population*
37 *in 1993 mean(SD): 41.9(8.2) probably don't change much.*
38

39
40 *Concerning changing in exposure over time there is a tendency in*
41 *Denmark towards heavier clients and lesser time per client. In 1993*
42 *hoist and other helping devices was introduced in many places, but the*
43 *use of helping devices had grown during the follow up time.*

44 | *A Study from Sweden (hornej 2004) report slight higher RPE at work*
45 *compared to our study but support that the working conditions reported*
46 *in 1993 are still relevant and not due to major changes in the follow up*
47 *period.*
48

49 *We have added the following in the discussion section(page 19 line: 50-*
50 *56)*
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6 **We assume that** the working conditions as perceived exertion in care
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8 duties, part of very care needing client's use of helping equipment in the
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10 eldercare in 1993 are comparable with working conditions **during the**
11
12 **follow up period. There had been a tendency towards heavier clients**
13
14 **and lesser time per client but on the other hand a growing use of**
15
16 **helping devices. Our assumption is supported by description of**
17
18 **working conditions in studies from 2003, 2004 and 2005^{1;32+} (hornej 2004) .**
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25 6)According to for example the STROBE Statement the discussion
26 should address limitations, taking into account eventual imprecision's of
27 the study results. As reflected in my comments above I think a discussion
28 around this is lacking.
29

30 We agree in the importance of discussion of limitations and potential
31 imprecision's.
32

33
34 *We have after the revision addressed the following limitations:*

35
36 *Possibly residual confounding concerning the elevated risk for people*
37 *with a workers compensation case(page 17: line26-37)*
38

39
40 *Limitations in the measure of job strain: But as the nursery homes, home*
41 *care units or hospitals in the actual study are rather different in size we*
42 *do not have the possibility to make valid work site aggregated measures*
43 *of exposure(page 18: line 6-13)*
44

45
46 *As to generalisability to other countries both differences in legislation*
47 *across countries and differences in standard of equipment and working*
48 *procedures are to be taken in account. Page19: line55-60*
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50
51 *The register gives no information of the diagnostic*
52 *reasons/basis/foundation of the disability pension and the lacking*
53 *information of sick leave before 2007 rule out the inclusion of sick leave*
54 *data in the prognostic model for both outcomes(page 19: line 33-37).*
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6 *The data on prognostic factors was self reported and assessed at one*
7 *point only. The information about the non musculoskeletal symptoms was*
8 *limited to a question “Have our physician ever told you that you have one*
9 *or more of the following diseases”. The register gives no information of*
10 *the diagnostic reasons/basis/foundation of the disability pension and the*
11 *lacking information of sick...(page 19: line24-31)*
12
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14
15 Other minor comments:
16

17
18 7)Page 18, row 24-28, concerning risk factors for early voluntary
19 retirement the authors point out that “In this study we found no strong
20 argument for health related factors... except for small effects from
21 cardiovascular and gastrointestinal disease.” I think rheumatologic
22 inflammatory diseases should also be mentioned here (with a HR of
23 1.76).
24

25
26 *You are right the rheumatologic diseased is included(page 18: line26)*
27

28 In this study we found no strong argument for health related factors as
29 being important in the decision to retire voluntary, except for small
30 effects from cardiovascular, **rheumatologic inflammatory diseases** and
31 gastrointestinal disease.
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38 8)Figure 3_a and 3_b is a bit unclear. Should it say -104 weeks at both
39 points?
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42 *You are right, the figure has been corrected*
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11 **DET OPRINDELIGE MANUSCRIPT RETTELSENE IKKE FØRT**
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13 **MANUS**

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16 **MANUSCRIPT WITH CORRECTIONS , A CLEAN**
17 **MANUSCRIPT IS UPLOADED**

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20
21 **Differences in risk factors for voluntary early retirement and**
22 **disability pension -a 15 year follow-up in a cohort of nurses' aides**

23
24
25
26 *Lone Donbæk Jensen¹, Pia Ryom², Michael Victor Christensen¹, Johan Hviid*
27 *Andersen³*

28
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46
47 **Keywords**

48
49 Auxiliary nurses, labour market, cohort study, early retirement

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54 Word count:

1
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6 Abstract: 243

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8 Manuscript: 3678
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24 ABSTRACT

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28 **Objective:** To estimate the extent of early retirement and examine risk factors for
29 voluntary early retirement and disability pension in a cohort of nurses' aides
30

31
32 **Design:** ~~Register study with a follow up period of 15 years~~

33
34 Register study including **baseline questionnaire and register data covering all**
35
36 **transfer incomes from 1991 to 2008 in a cohort of nurses aides established in**
37
38 **1993** with a follow up period of 15 years
39

40
41
42 **Setting:** Nurses' aides working in nursery homes, homecare or hospitals.

43
44 **Participants:** 3332 gainfully employed nurses' aides at the time of inclusion in the
45
46 study.
47

48 **Outcome:** Disability pension or early voluntary retirement

49
50 **Results:** 16.2% of the population was granted disability pension and 27.1% entered
51
52 early voluntary retirement in the follow up period representing 11,186 lost working
53
54 years with a direct cost in transfer payment amounting about 410 million Euro.
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6 Health related risk factors for disability pension was long lasting Low Back Pain
7
8 (Hazard ratio (HR) 2.27(95 % CI 1.55 to 3.34), sick leave because of upper extremity
9
10 disorders (HR 2.18 (95 % CI 1.08 to 2.11), and inflammatory rheumatic disease (HR
11
12 2.42 (95 % CI 1.67 to 3.52)). Of non health-related factors, low education, workers
13
14 compensation case, evening work and high rated perceived exertion at work all were
15
16 minor risk factors for disability pension. The primary risk factor for early voluntary
17
18 retirement was low education (HR 3.19 (95 % CI 2.65 to 3.85)).
19

20 **Conclusion:**

21 **Conclusion:** 43.3% of nurses aides gainfully employed in 1993 ~~was granted~~
22 ~~disability pension or chose early voluntary retirement in~~ **retired before due time**
23 **during** the follow up period. **Work related factors at baseline only seemed to play**
24 **a minor prognostic role. Risk factors for disability pension were mainly health**
25 **related factors while economical factors seemed to influence the decision to**
26 **choose early voluntary retirement.** The number of persons and the amount of lost
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28 working years underscores the need of a more active counselling towards maintaining
29
30 employment especially among those with persistent musculoskeletal disorders.
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40 **.ARTICLE SUMMERY**

41 **Article focus**

42
43 High prevalence's of low back pain and sick leave are found among healthcare
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45 workers in many countries
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49 Predictors of negative vocational prognosis for healthcare workers are unknown.
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52 **Key messages**

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6 Musculoskeletal complaints at baseline predicted disability pension but not voluntary
7 early retirement. Work related factors played a minor role as risk factors for both
8 disability pension and voluntary early retirement.
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14 For both outcomes we found no associations with smoking, low physical leisure
15 activity or BMI
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20 Our results point at secondary prevention managing especially musculoskeletal claims
21 at an early state in preventing disability pension.
22
23

24 25 26 27 28 **Strength and limitations**

29
30 Study strengths are a follow up time of 15 years in a national register with a high
31 accuracy and completeness and the possibility to compare risk factors for two
32 different types of early retirement. Study limitations are that data on prognostic
33 factors were self reported and assessed at one point only.
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INTRODUCTION

10% of the European workforce is occupied in the health care sector¹. Several, mainly cross sectional studies have reported adverse health effects among health care workers especially nurses' aides and home care workers. Most of the studies comprise low back pain (LBP)²⁻⁵ and other musculoskeletal disorders⁶. Also risks of affective and stress related disorders⁷⁻⁸ and hand eczema⁹ has been discussed.

High prevalence's of sick leave are found among nurses, nurses aides and homecare workers in many countries^{10;11}. There are only few studies of predictors of early retirement among health care workers¹² or leaving nursing care¹³ **Disability pension is shown to be associated with increased mortality** (wallman 2006)but also with better health (westerlund bmj 2010=ref 22) dependent of socioeconomical class (main 2003, brockmann 2009)

Lack of nursing personnel are thought to be a serious problem in many countries in the future due aging of the actual workforce and population, a rapid job turnover and problems with recruitment^{1;13}. To face these problems there is a need of studies of predictors of early retirement in the profession to be able to strengthen the prevention of negative vocational outcomes being of benefit for both the nursing personnel and the society.

Objectives

To **estimate the extent of early retirement** and examine and compare predictors of two different types of early retirement: voluntary early retirement and disability pension in a cohort of occupational employed nurse's aides in a follow up period of 15 years.

METHODS

A prospective register study of predictors of early retirement in a fixed cohort including all nurses' aides registered in 1992 in the county of Aarhus with 15 years of follow up.

Study population and data sources

The cohort was identified by data from an insurance fund (Danish acronym PENSAM) including all former and current persons registered as nurses' aides for minimum one year in 1992 in the county of Aarhus. 74% of the cohort (n= 4,616) completed a questionnaire including demographic, lifestyle, physical and psychological workload and disease related factors in 1993³. The part of this population gainfully employed as a nurse's aides n=3,332 in 1993 comprised the study cohort for the present study. The Danish civil personal registration number (CPR) was used to link questionnaire data with person specific data from the Danish National Register on Public Transfer Payments (Danish acronym DREAM)¹⁴ from 1991-2008 (both years inclusive). Information of permanent transfer income were available from the start of the register in 1991 while information's of non-permanent transfer payments as sick leave and unemployment benefit first were available from

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6 1997. The follow up data included data from the DREAM register with weekly
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8 registration of public transfer payment at individual level in the follow up period. We
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10 recoded the originally 104 different transfer payment codes from the DREAM register
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12 into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other
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14 non permanent transfer payment as vocational rehabilitation and social assistance, 5)
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16 disability pension and flex job a health dependent half time pension and 6) voluntary
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18 early retirement. The register is thought to be near to complete based on the
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20 economically incentive for the employer to report to public authorities. The cohort
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22 was followed in the DREAM register until 2008 providing a follow up time of 15
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24 years.

25 26 27 28 **Assessment of main outcome**

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30 The main outcome was permanent early retirement in the follow up period as
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32 disability pension or early voluntary retirement. **Lost working years was calculated**
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34 **by extracting the person age at the year of early retirement from 65 which is the**
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36 **year of old age pension in Denmark.** Obtaining disability pension require an
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38 evaluation of work ability which is to be reduced to a minimum while early voluntary
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40 retirement are independent of health status. Voluntary early retirement is available
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42 from the age of 60 years if the persons have achieved 25 years of membership of an
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44 unemployment benefit fund for a period of 30 years. For each patient, disability
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46 pension and voluntary early retirement was estimated, including time and the person's
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48 age at the time of achievement of early retirement. Disability pension includes flex
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50 job, which was introduced in the year 2000 as a health dependent half time pension
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52 achieved in the same legislation context as disability pension, based on a permanent
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54 health dependent condition. According to the rules of achievement of early voluntary
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6 retirement it is not possible to change from disability pension to early voluntary
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8 retirement. If a person have changed from early voluntary retirement to disability
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10 pension she is classified with the outcome disability pension (n= 8). The register gives
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12 no information of reason for achieving early retirement.
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14 15 16 **Sample characteristics**

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18 Baseline data was obtained from a self administered questionnaire completed in 1993.
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20 Demographic and background variables included age **register based age at January**
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22 **1993**, gender, education **divided in education up to 9 years primary school, 10**
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24 **years primary school or basic vocational course or secondary school** , vocational
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26 status of spouse **dichotomised in paid work or transfer income**, marital status,
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28 **Live in with partner (yes or no)** and workers compensation case **dichotomized into**
29
30 **yes or no. A positive answer includes both ongoing and confirmed cases .**
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32 ~~Demographic and background variables included age, gender, education, vocational~~
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34 ~~status of spouse, marital status and workers compensation case.~~ Physical Work factors
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36 were assessed by questions of: Working hour's day, evening or night, working place
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38 hospital or eldercare, index describing heaviness of care where heavy care was
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40 defined by a combination of having more than 2/3 of the daily patients needing full
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42 care together with more than 10 handlings of persons per day. Rated Perceived
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44 Exertion (RPE) was assessed from a modified Borg scale range 0-14¹⁵ anchored
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46 1=very very light and 13=very very strenuous, values ≥ 8 was defined as high RPE.
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48 Psychosocial Work factors was assessed using a Danish version¹⁶ of Karasek's Job
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50 Content Questionnaire (JCQ) which is shown to have acceptable internal consistency
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52 in the health care sector¹⁷. The 3 items in the demand score were time pressure,
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54 perceived strain and tiredness returning from work. The range in the demand index
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6 score was 5-15, low demand were defined by values lower or equal to 9. The 3 items
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8 in the decision latitude score were possibilities of decision of work pace, how the
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10 work was carried out and work disposition. The range in the decision latitude index
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12 score was 5-15. High decision latitude was defined by values lower or equal than 9.
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14 Violence at work assessed by 5 items: never, seldom, sometimes, often and very
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16 often. Upper and lower extremities symptoms was assessed using Nordic
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18 questionnaire¹⁸, and serious upper extremity complaints was defined as sick leave >
19
20 30 days for at least one region within the last year, serious lower extremity complaints
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22 was defined as sick leave > 30 days for at least one region within the last year. LBP
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24 was assessed by pain drawing including level of radiating pain combined with 0-10
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26 point Visual Analog Scale (VAS) describing level of usual pain, and duration of pain
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28 was assessed by a and a question asking : “For how long have you altogether had low
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30 back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days, 31-
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32 90 days, more than 90 days” and a question asking “Have you ever had acute LBP in
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34 relation to person handling or other work tasks”. Knowledge of health parameters as
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36 lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro intestinal
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38 diseases and rheumatologic inflammatory diseases was obtained from a list of
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40 question in the questionnaire “Have our physician ever told you that you have one or
41
42 more of the following diseases”. Lung disease included asthma, chronic bronchitis
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44 and pneumonia, nervous diseases included nervous disease, skin disease included
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46 eczema and cardiovascular disease included elevated blood pressure, angina pectoris,
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48 unsteady hearth, coronary infarction and arteriosclerosis. Gastro intestinal diseases
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50 included colon irritable and duodenal ulcers and rheumatologic inflammatory
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52 included rheumatoid arthritis and inflammatory connective tissue disease. Lifestyle
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54 variables comprised body mass index (BMI) dichotomized ≥ 30 =high versus BMI
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6 <30, actual smoking yes/no, physical activity 8 items dichotomized: moderate
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8 physical activity more than 3 times a week or more versus less or no activity. For the
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10 part of the population achieving early retirement after 1998 pattern and cumulated
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12 sick leave the two year before early retirement were estimated from register data.
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14 15 16 **Statistical analysis**

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18 After linking data from the PENSAM register including all nurses' aides in the
19
20 geographical area of interest and the DREAM register by CPR numbers, the
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22 vocational record in the 15 years follow up for each person was established. **Relevant**
23
24 **covariates were tested for colinearity which was not found.** We used Cox
25
26 proportional hazards models to examine the longitudinal association between the
27
28 outcome measure and the full set of predictor variables. The hazard ratio of achieving
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30 disability pension or early voluntary pension was estimated with 95% confidence
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32 intervals (95 % CI). The analyses were made separately for disability pension and
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34 voluntary early retirement where the reference group for both groups was the part of
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36 the population receiving neither disability pension nor voluntary early retirement.
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38 SAS version 9.1.3 (SAS Institute Cary, NC, USA) and STATA 11.0 were used to
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40 perform data management and statistical analyses.
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43 44 **RESULTS**

45 46 **Study population**

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48 The invited population in 1993 comprised all nurses aides (N= 6,231) in the county of
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50 Aarhus with at least one years seniority as nurse's aides work in the preceding 5 year
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52 representing about 200 different working sites. The response rate in 1993 was 74%.

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54 Table 1 shows a register based non response analysis.
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Table 1.
Non response analyses, including all nurses aides in the county of Aarhus 1993 with more than 1 years of nursing aides work the last five years n=6231

Register data DREAM	Questionnaire respondents 1993 n=4616	Questionnaire non-respondents 1993 n=1615
Age 1.7.1993 mean (SD)	42.7 (9.4)	44.3 (11.0)
Years working as nurses aides 1.7.1993 mean (SD)	10.9 (7.1)	11.2 (7.4)
Gender woman %	98.1	97.1
Ethnicity other than Danish %	2.3	3.4
Dead in the follow up period %	2.5	3.0
Granted disability pension in the follow up period %	16.2	14.8
Voluntary early retirement in the follow up period %	18.2	19.3

There were only minor differences between the responders and the non responders concerning the two outcome measures and population characteristics.

The response rate among people with foreign ethnicity was lower than the non foreign group, probably because of language problems. In the questionnaire response 3,332 participants stated that they were working as nurse's aides at the time they completed the questionnaire. Those 3332 comprised the study population in the present paper.

The baseline characteristics of the 3,332 respondents are shown in table 2. ~~The population is mainly female with a mean age of 41.9 years, experienced in nursing care with a mean of 13.0 years seniority and low educated.~~ The population is mainly female with a mean age of 41.9 years, **70% with education below secondary school** and experienced in nursing care with a mean of 13.0 years seniority. 69.5 % was working in homecare or at nursery homes and 30.5% in hospitals in accordance with figures for Denmark as a whole at that time¹⁹. The prevalence of having more than 90

days of back pain was 13.6%, 44.4% scored their rated perceived exertion more than or equal to 8 (strenuous), 48.7% experienced high job demands and 24.1 % low decision latitude according to the Karasek model. A minor part, 5.9 % reported violence at work often or very often and 15.9% was physical active with at least one time a week with strenuous physical activity.

Table 2.
Baseline characteristics among the study population of nurse's aides working in hospital or nursery home/homecare at the time of baseline registration

Baseline characteristics	Study population n= 3332	No early retirement in the follow up period n=1888	Voluntary early pension in the follow up period n=904	Disability pension in the follow up period n=540
Age, mean(SD)	41.9(8.2)	37.3(5.4)	51.3(5.1)	42.4(6.8)
Age obtaining early retirement mean (SD)			60.7 (1.9)*	50.7(6.0)
Years occupied in health care work, mean(SD)	13.0(6.5)	11.8(5.9)	15.6(7.0)	13.1(6.5)
Gender %				
Male	1.7	1.9	1.5	1.3
Female	98.3	98.1	98.5	98.7
Education/grade %				
-7 -9 years primary school	29.3	22.9	36.3	39.4
-10 years primary school or basic vocational course	41.6	41.3	46.4	35.0
-Secondary school	29.1	35.8	17.3	25.6
Vocational status spouse %				
-paid work	73.2	79.2	63.6	67.8
-transfer income	26.8	20.8	36.4	32.8
Marital status %				
Married/live in partner	82.6	84.5	81.6	76.7
Workers compensation				

case %	19.1	15.2	19.5	31.7
Workplace %				
- hospital	30.5	29.8	32.2	30.0
- nursery home/homecare	69.5	70.2	67.8	70.0
Work hours %				
- mainly day work	43.4	44.0	44.0	40.2
- mainly evening work	24.8	24.4	23.7	28.5
- mainly night work	10.5	9.8	11.4	11.7
- mixed	21.3	21.9	20.9	19.6
Heaviness of care duties index %				
high	11.0	11.4	9.3	12.6
RPE ×(range 0-14)%				
high >=8	44.4	43.5	41.6	53.3
Violence at work %				
Never	42.8	38.8	45.2	44.8
Seldom	23.8	25.3	24.0	21.3
On and of	27.6	29.9	25.3	27.2
Often	4.3	4.4	4.4	4.4
Very often	1.6	1.7	1.1	2.2
Decision latitude -low %	24.1	23.4	25.3	24.6
Demand -high %	48.7	47.5	49.5	51.3
Number of days LBP the last 12 month altogether %				
0 days	32.9	31.8	39.9	24.4
1-7 days	25.4	27.8	23.0	21.9
8-30 days	20.3	22.3	17.5	18.0
31-90 days	7.8	9.0	5.5	7.4
More than 90 days	13.6	9.1	14.0	28.3
Usual back pain %				
Radiation below knee level	15.9	13.6	15.1	25.4
Ever acute LBP in relation to patient				

handling or other work tasks %	58.8	57.2	56.1	69.3
More than 30 days of sick leave the last year because of upper limb disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limb disorder %	4.7	2.5	5.2	11.9
Cardiovascular disease %	14.5	10.9	20.5	17.2
Lung diseases %	23.2	22.8	21.1	28.2
Skin diseases%	16.7	18.2	11.7	19.4
Gastro intestinal diseases %	12.6	10.0	14.9	18.2
Rheumatologic inflammatory diseases %	2.8	1.3	4.0	6.1
Nervous disorder %	4.1	3.1	4.4	7.6
Current Smoking, %	47.0	47.4	41.9	54.4
BMI, mean(SD)	23.4(3.8)	23.0(3.5)	24.0(3.5)	23.9(5.0)
BMI severe overweight > 30	5.1	4.7	5.9	5.7
Physical activity# High %	15.3	17.5	11.7	12.8

* 60 years is the lower limit for voluntary early retirement

^ Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity high: at least one time a week strenuous physical activity

Early retirement and lost working years

As seen from the flow chart figure 1, 540 persons (16.2%) were granted disability pension and 904 persons (27.1 %) obtained voluntary early retirement, in the follow up period all together 43.3%.

The total number of lost working years in the population presuming that all persons who retired early had remained at work until the normal pension age is 7,472 years for the 540 persons granted disability pension and 3,714 years for the 904 persons

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6 obtaining early retirement, altogether 11,186 years amounting about 410 million Euro
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8 in direct costs from early retirement transfer payments.
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10 Figure 2 shows an increasing number of participants who choose early voluntary
11 retirement during the follow up period, whereas the number per year being granted
12 disability pension is stable until 2002 with a rise the following years until 2007 where
13 a decline is seen. At that time there is a corresponding rise in voluntary early
14 retirement. This pattern could be explained by a change in the interpretation of the
15 disability pension legislation. The mean age of those granted disability pension is
16 stable between 50 and 55 years over the 15 year follow up period. The minimum age
17 obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is
18 explained by a temporary change in the legislation. Altogether 344 persons chose to
19 postpone the early voluntary retirement after having got their early voluntary pension
20 certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to
21 the age of 66 year.
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33 Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit
34 and other nonpermanent transfer incomes every week the 2 years preceding the
35 granting of disability pension respectively early voluntary retirement. The population
36 is restricted to person changing to early retirement from 1999 as we only have data on
37 sick leave from 1997 in the DREAM register.
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43 Figure 3_a reveals that disability pension is preceded of a decline in work presence
44 from about 60% two years prior to the week of disability pension to about 20%, 12
45 weeks before. During the 2 years preceding disability pension there is an increase
46 other transfer incomes with a lower benefit properly because sick leave by Danish
47 legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be
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6 sick listed as unemployed which can explain the decline in number receiving
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8 unemployment benefit.

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10 As see from figure 3_a and 3_b the pattern of vocational status the 2 years preceding
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12 the time of early retirement differs completely between disability pension and
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14 voluntary early retirement. Contrasting the transfer income pattern seen the two years
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16 proceeding the time of disability pension there is no change in the part of the
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18 population working or receiving non permanent transfer income two years before
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20 starting early voluntary retirement. A bigger proportion compared to the part of the
21
22 population granted disability pension is receiving unemployment benefit with an
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24 increasing number over the 2 years.

25 26 27 28 **Risk factors for early retirement**

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30 Table 3 shows adjusted risk factors of being granted disability pension or choosing
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32 early voluntary retirement in the follow up period.

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34 Health related risk factors for disability pension was more than 90 days of LBP the
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36 last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave
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38 because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30
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40 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to
41
42 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro
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44 intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education
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46 (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI
47
48 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated
49
50 perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk
51
52 factors. Risk factors for early voluntary retirement were: low education (HR 3.19 (95
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54 % CI 2.65 to 3.85), high job demands (HR 1.28 (95 % CI 1.09 1.50)), inflammatory

rheumatic disease (HR 1.76 (95 % CI 1.25 to 2.48)), cardio vascular disease (HR 1.47 (95 % CI 1.27 to 1.69)) and gastro intestinal disorders (HR 1.39(95 % CI 1.10 to 1.76)).

Apart from low education, gastro intestinal disorders and inflammatory rheumatic diseases, the two types of early retirement do not share any prognostic factors for the two types of early retirement. Life style factors as BMI, smoking and physical activity did not show associations with either of the two outcomes. Living alone protected against voluntary retirement, but showed up as a risk factor for disability pension.

Table 3.
Hazard Ratio of obtaining voluntary early pension or disability pension in the study period according to baseline information's

Risk factors	Voluntary early pension n= 904		Disability pension n=540	
	HR	95% CI	HR	95% CI
Education grade				
-Secondary school	1		1	
-10 years primary school or basic vocational course	0.83	0.65 to 1.06	0.92	0.71 to 1.18
-7 -9 years primary school	3.19	2.65 to 3.85	1.27	1.02 to 1.57
Vocational status spouse				
-transfer income versus paid work	0.55	0.46 to 0.67	1.11	0.85 to 1.45
Marital status				
- Living alone versus live in partner	0.64	0.51 to 0.80	1.54	1.14 to 2.09
Workers compensation case	1.02	0.84 to 1.23	1.51	1.23 to 1.87
Workplace				
- nursery home/homecare versus Hospital	1.04	0.88 to 1.23	1.08	0.87 to 1.35
Work hours				
- mainly day work	1		1	

- mainly evening work	1.03	0.86 to 1.23	1.29	1.03 to 1.60
- mainly night work	1.16	0.92 to 1.46	1.18	0.87 to 1.61
- mixed	0.90	0.74 to 1.11	0.97	0.74 to 1.27
Heaviness of care duties				
Index " high	0.79	0.62 to 1.01	0.98	0.74 – 1.29
RPE* (range 0-14)				
high >=8	0.96	0.82 to 1.13	1.23	1.00 to 1.51
Decision latitude -low	1.09	0.92 to 1.28	0.90	0.72 to 1.12
Demand -high %	1.28	1.09 to 1.50	0.92	0.75 to 1.13
Number of days LBP the last 12 month altogether				
0 days	0.98	0.77 to 1.24	1.36	0.93 to 1.26
1-7 days	0.71	0.56 to 0.89	1.34	0.94 to 1.92
8-30 days	0.71	0.55 to 0.91	1.35	0.92 to 1.97
31-90 days	0.58	0.40 to 0.82	1.29	0.81 to 2.05
More than 90 days	0.72	0.54 to 0.97	2.27	1.55 to 3.34
Usual back pain :				
Radiation below knee level	0.90	0.73 to 1.10	1.18	0.05 to 1.48
Ever acute LBP in relation to patient handling or other work tasks				
	1.07	0.89 to 1.27	1.01	0.80 to 1.28
More than 30 days of sick leave the last year because of upper limb disorder				
	1.04	0.72 to 1.50	2.18	1.57 to 3.01
More than 30 days of sick leave the last year because of lower limb disorder				
	0.91	0.63 to 1.31	1.51	1.08 to 2.11
Cardiovascular disease	1.47	1.27 to 1.69	1.14	0.94 to 1.38
Lung diseases	0.88	0.75 to 1.05	1.14	0.93 to 1.39
Skin diseases	0.61	0.49 to 0.75	1.13	0.90 to 1.42
Gastro intestinal diseases	1.21	1.00 to 1.47	1.39	1.10 to 1.76
Rheumatologic inflammatory diseases	1.76	1.25 to 2.48	2.42	1.67 to 3.52

Nervous disorder	0.87	0.62 to 1.24	1.31	0.92 to 1.87
Current Smoking	0.80	0.69 to 0.93	1.20	0.98 to 1.45
BMI				
severe overweight > 30	0.87	0.64 to 1.17	0.85	0.57 to 1.26
Physical activity# low	0.87	0.74 to 1.02	0.94	0.77 to 1.15

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity low: less than "at least one time a week strenuous physical activity"

DISCUSSION

This study compared risk factors for two different types of early retirement and thereby contribute to the discussion of the disability process and how to prevent disability and social exclusion²⁰⁻²². The study document a high number of early retirement in a cohort with an earlier strong connection to the labour market with an enormous number of lost productive years and money in direct costs from disability pension, voluntary early retirement. Risk factors for disability pension were mainly health related factors in accordance with the fact that health related reduction of the working capacity is the most important criteria for granting disability pension. HR above 2 for disability pension were low back pain more than 90 days the last year, more than 30 of sick leave the last year and known rheumatologic inflammatory disease at baseline registration in 1993. A workers compensation case was an independent risk factor, which has been found in other studies^{23;24}. This finding could result from residual confounding as it is possible that the persons notified for a workers compensation case have more serious health problems than the persons not notified. In this study the introduction in the model of interaction variables between compensation status and pain variables decreased the HR, and is in favour of more serious health problems among compensation cases. Another explanation could stem

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6 from accelerating a disability process by the way the compensation system works and
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8 impacts on the worker, and we cannot exclude that this could play a role. This study
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10 could not corroborate that physical or psychosocial workload found in other
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12 studies^{12;21;25-27} played a major role as targets for primary prevention. Rated Perceived
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14 exertion at work, but not the heaviness of clients assessed from an index based on
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16 number of clients needing full care in combination with number of person handlings a
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18 day, was a risk factor. The finding of an elevated risk of evening work are in
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20 accordance with a Danish register study focusing on shift work in all sectors and
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22 disability²⁸ the only work related factor with an elevated risk of choosing early
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24 voluntary retirement was high demands at work. The interaction term job strain did
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26 not contribute to the models (results not shown). In a study from the Finnish public
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28 service sector²¹ it is argued that job strain are to be evaluated on job unit level, in this
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30 study we have information of 200 different work sites. But as the nursery homes,
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32 home care units or hospitals in the actual study are rather different in size we do not
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34 have the possibility to make valid work site aggregated measures of exposure.
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36 Many studies report associations between sick leave and disability pension²⁹. To our
37
38 knowledge no other studies have investigated risk factors of early voluntary
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40 retirement. Early voluntary retirement at the age of 60 years was mainly associated
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42 with low educational level, and the protective effect of spouse being on income
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44 transfer and living alone is consistent with primarily economic imperatives for
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46 choosing early voluntary retirement. In this study we found no strong argument for
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48 health related factors as being important in the decision to retire voluntary, except for
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50 small effects from cardiovascular, **rheumatologic inflammatory diseases** and
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52 gastrointestinal disease.

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6 For both outcomes we found no associations with smoking, low physical leisure
7 activity or BMI, and this finding questions ongoing activity at the work site for
8 making individual life style factors the main suspects for intervention in order to stay
9 active in work for more years³⁰.

14 The finding that voluntary early retirement and disability pension only has
15 few mutual prognostic factors, challenges common notions of a retirement process
16 driven by work related or health related factors.
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20 The pattern of vocational status the 2 years preceding the time of early retirement
21 differs completely between disability pension and voluntary early retirement.
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23 Different legislation obviously play a role but it is although surprising that health and
24 work related factors seem to be without importance for people choosing voluntary
25 early retirement in a profession which in many investigations are found to be physical
26 and psychological demanding²⁻⁵.

31 A major strength in the present study is the prospective design and number of
32 observations of both of the two outcomes of early retirement.
33

35 In this study early retirement - both disability pension and early voluntary retirement -
36 was assessed from a national register, including weekly registration of all types of
37 transfer income from the social system. The registers are time accurate and complete
38 concerning disability pension and early voluntary retirement because it is a part of the
39 payment system. Another strength of this study was the opportunity to look at a
40 population early retired without a legislative requirement of disability.
41

47 Exploring risk factors for disability pension in an uniform population have the
48 advantages that the results are less dependent on residual confounding as underlying
49 socio economical factors which are known to be strong predictors of disability³¹. The
50 data on prognostic factors was self reported and assessed at one point only.
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6 The information about the non musculoskeletal symptoms was limited to a question
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8 “Have our physician ever told you that you have one or more of the following
9
10 diseases”. The register gives no information of the diagnostic
11
12 reasons/basis/foundation of the disability pension and the lacking information of sick
13
14 leave before 2007 rule out the inclusion of sick leave data in the prognostic model for
15
16 both outcomes.

17
18 The study have a high external validity concerning the Danish health and eldercare as
19
20 the study population comprises a total population of nurses’ aides in a well defined
21
22 geographical area representative for the rest of Denmark including a loss to follow up
23
24 analyses which support the representativeness of the study population. As
25
26 membership of a pension fund and trade union is mandatory the original register of
27
28 nurses’ aides are thought to be near to complete. **We assume that** the working
29
30 conditions as perceived exertion in care duties, part of very care needing client’s use
31
32 of helping equipment in the eldercare in 1993 are comparable with working
33
34 conditions **during the follow up period. There had been a tendency towards**
35
36 **heavier clients and lesser time per client but on the other hand a growing use of**
37
38 **helping devices. Our assumption is supported by description of working**
39
40 **conditions in studies from 2003, 2004 and 2005^{1,32+ (hornej 2004)}.**

41
42 The working conditions as perceived exertion in care duties, part of very care
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44 needing clients use of helping equipment in the eldercare in 1993 are comparable with
45
46 working conditions reported in 2003 and 2005^{1,32}. As to generalisability to other
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48 countries both differences in legislation across countries and differences in standard
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50 of equipment and working procedures are to be taken in account.

51 **Conclusion**

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6 In conclusion we find an alarming high proportion of early retirement from an area of
7 growing importance for society in the years to come. The lack of shared risk factors
8 for the two types of early retirement was unexpected in a population sharing social
9 and working characteristics, but also points to the importance of being aware of
10 underlying legislation when translating data partly driven on legislation. Work related
11 factors at baseline in 1993 only seemed to play a minor prognostic role for early
12 retirement of both kinds, and individual factors as smoking, BMI and physical activity
13 at baseline were not associated with early retirement at all. Risk factors for disability
14 pension were mainly health related factors while economical factors as income of
15 spouse and unemployment seemed to influence the decision to choose early voluntary
16 retirement.
17

18 Our results point at secondary prevention managing especially musculoskeletal claims
19 at an early state in preventing disability pension with the aim to stay occupied despite
20 musculoskeletal symptoms.
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27 **Policy implications**

28 The huge numbers of lost working years in a population with an initially strong
29 connection to the labour market call for action, where the finding that musculoskeletal
30 symptoms up to 15 years before disability pension are prognostic factors points at a
31 more active counselling and help to restore connection to the labour market among
32 those with musculoskeletal problems
33
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36 **Funding**

37 The Danish insurance fund PENSAM .
38
39

40 **Licence statement**

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15 **Competing interest declaration.**

16 All authors have completed the Unified Competing interest form at
17 www.icmje.org/coi_disclosure and declare that none of the authors have financial
18 interests that may be relevant to the submitted work to declare.
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23 **Ethics approval**

24 The study has been notified to and authorized by the Danish Data Protection Agency
25 J.nr. 2007-41-0667. and notified to the local ethic and scientific committee J.nr. 1992-
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10 **Headings. Figure 1 to figure 3**

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15 Flow chart, selection and course of study population

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20 Time trends in number and mean age of persons obtaining early retirement from
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22 1993-2008

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25 Figure 3.

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27 Vocational status, sick leave and other transfer incomes 104 weeks before start of
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29 disability pension or voluntary early retirement the period 1999-2008 .Zero on the x-
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31 axis indicates the week the person started getting disability pension or early voluntary
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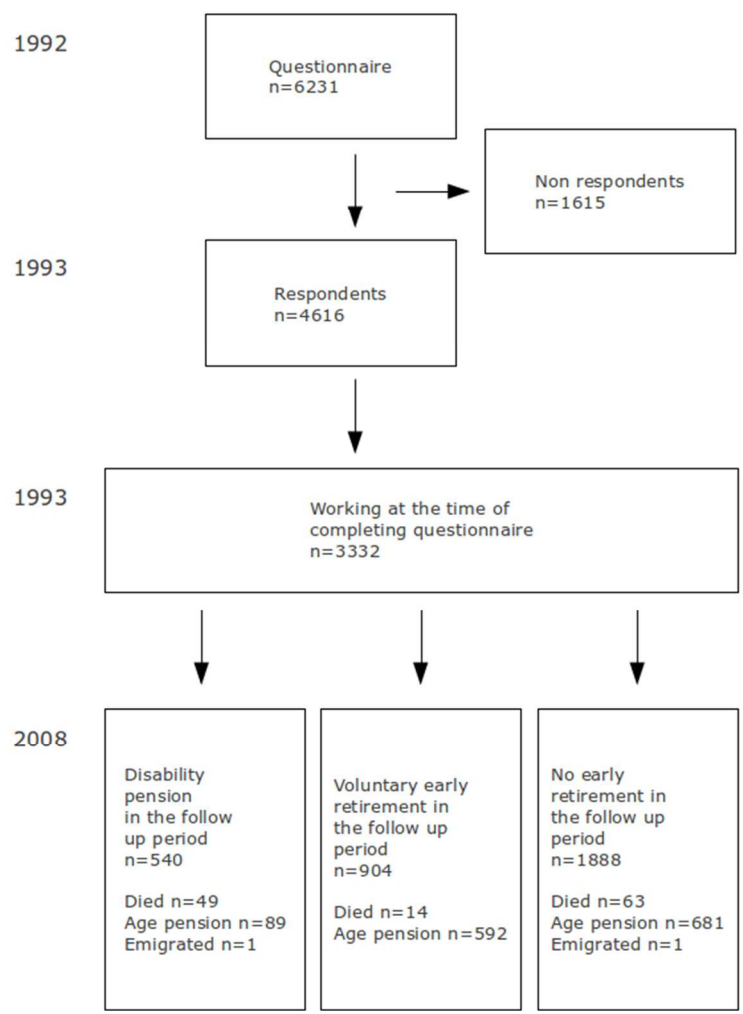
Differences in risk factors for voluntary early retirement and disability pension -a 15 year follow-up in a cohort of nurses' aides

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<p>Note: The following files were submitted by the author for peer review, but cannot be converted to PDF. You must view these files (e.g. movies) online.</p> <p>Fig2.svg Fig3.svg</p>	

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Differences in risk factors for voluntary early retirement and disability pension - a 15 year follow-up in a cohort of nurses' aides

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Keywords

Auxiliary nurses, labour market, cohort study, early retirement

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ABSTRACT

Objective: To estimate the extent of early retirement and examine risk factors for voluntary early retirement and disability pension in a cohort of nurses' aides

Design: Register study including baseline questionnaire and register data covering all transfer incomes from 1991 to 2008 in a cohort of nurses aides established in 1993 with a follow up period of 15 years

Setting: Nurses' aides working in nursery homes, homecare or hospitals.

Participants: 3332 gainfully employed nurses' aides at the time of inclusion in the study.

Outcome: Disability pension or early voluntary retirement

Results: 16.2% of the population was granted disability pension and 27.1% entered early voluntary retirement in the follow up period representing 11,186 lost working years with a direct cost in transfer payment amounting about 410 million Euro.

Health related risk factors for disability pension was long lasting Low Back Pain (Hazard ratio (HR) 2.27(95 % CI 1.55 to 3.34), sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11), and inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)). Of non health-related factors, low education, workers compensation case, evening work and high rated perceived exertion at work all were minor risk factors for disability pension. The primary risk factor for early voluntary retirement was low education (HR 3.19 (95 % CI 2.65 to 3.85)).

Conclusion: 43.3% of nurses aides gainfully employed in 1993 retired before due time during the follow up period. Work related factors at baseline only seemed to play a minor prognostic role. Risk factors for disability pension were mainly health related factors while economical factors seemed to influence the decision to choose early voluntary retirement. The number of persons and the amount of lost working years

underscores the need of a more active counselling towards maintaining employment especially among those with persistent musculoskeletal disorders.

ARTICLE SUMMERY

Article focus

High prevalence's of low back pain and sick leave are found among healthcare workers in many countries

Predictors of negative vocational prognosis for healthcare workers are unknown.

Key messages

Musculoskeletal complaints at baseline predicted disability pension but not voluntary early retirement. Work related factors played a minor role as risk factors for both disability pension and voluntary early retirement.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI

Our results point at secondary prevention managing especially musculoskeletal claims at an early state in preventing disability pension.

Strength and limitations

Study strengths are a follow up time of 15 years in a national register with a high accuracy and completeness and the possibility to compare risk factors for two different types of early retirement. Study limitations are that data on prognostic factors were self reported and assessed at one point only.

INTRODUCTION

10% of the European workforce is occupied in the health care sector¹. Several, mainly cross sectional studies have reported adverse health effects among health care workers especially nurses' aides and home care workers. Most of the studies comprise low back pain (LBP)²⁻⁵ and other musculoskeletal disorders⁶. Also risks of affective and stress related disorders⁷⁻⁸ and hand eczema⁹ has been discussed.

High prevalence's of sick leave are found among nurses, nurses aides and homecare workers in many countries^{10;11}. There are only few studies of predictors of early retirement among health care workers¹² or leaving nursing care¹³. Disability pension is shown to be associated with increased mortality¹⁴ but also with better health¹⁵ dependent of socioeconomically class^{16;17}.

Lack of nursing personnel are thought to be a serious problem in many countries in the future due aging of the actual workforce and population, a rapid job turnover and problems with recruitment^{1;13}. To face these problems there is a need of studies of predictors of early retirement in the profession to be able to strengthen the prevention of negative vocational outcomes being of benefit for both the nursing personnel and the society.

Objectives

To estimate the extent of early retirement and examine and compare predictors established at baseline from self reported questionnaire including data of demographic, health and work conditions and socioeconomically history from register data of two different types of early retirement: voluntary early retirement and disability pension in a cohort of occupational employed nurse's aides in a follow up period of 15 years.

METHODS

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3 A prospective register study of predictors of early retirement in a fixed cohort
4 including all nurses' aides registered in 1992 in the county of Aarhus with 15 years of
5 follow up.
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10 11 12 **Study population and data sources**

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14 The cohort was identified by data from an insurance fund (Danish acronym
15 PENSAM) including all former and current persons registered as nurses' aides for
16 minimum one year in 1992 in the county of Aarhus. 74% of the cohort (n= 4,616)
17 completed a questionnaire including demographic, lifestyle, physical and
18 psychological workload and disease related factors in 1993³. The part of this
19 population gainfully employed as a nurse's aides n=3,332 in 1993 comprised the
20 study cohort for the present study. The Danish civil personal registration number
21 (CPR) was used to link questionnaire data with person specific data from the Danish
22 National Register on Public Transfer Payments (Danish acronym DREAM)¹⁸ from
23 1991-2008 (both years inclusive). Information of permanent transfer income were
24 available from the start of the register in 1991 while information's of non-permanent
25 transfer payments as sick leave and unemployment benefit first were available from
26 1997. The follow up data included data from the DREAM register with weekly
27 registration of public transfer payment at individual level in the follow up period. We
28 recoded the originally 104 different transfer payment codes from the DREAM register
29 into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other
30 non permanent transfer payment as vocational rehabilitation and social assistance, 5)
31 disability pension and flex job a health dependent half time pension and 6) voluntary
32 early retirement. The register is thought to be near to complete based on the
33 economically incentive for the employer to report to public authorities. The cohort
34 was followed in the DREAM register until 2008 providing a follow up time of 15
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8 **Assessment of main outcome**

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10 The main outcome was permanent early retirement in the follow up period as
11 disability pension or early voluntary retirement. Lost working years were calculated
12 by extracting the person age at the year of early retirement from 65 which is the year
13 of old age pension in Denmark. Obtaining disability pension require an evaluation of
14 work ability which is to be reduced to a minimum while early voluntary retirement
15 are independent of health status. Voluntary early retirement is available from the age
16 of 60 years if the persons have achieved 25 years of membership of an unemployment
17 benefit fund for a period of 30 years. For each patient, disability pension and
18 voluntary early retirement was estimated, including time and the person's age at the
19 time of achievement of early retirement. Disability pension includes flex job, which
20 was introduced in the year 2000 as a health dependent half time pension achieved in
21 the same legislation context as disability pension, based on a permanent health
22 dependent condition. According to the rules of achievement of early voluntary
23 retirement it is not possible to change from disability pension to early voluntary
24 retirement. If a person have changed from early voluntary retirement to disability
25 pension she is classified with the outcome disability pension (n= 8). The register gives
26 no information of reason for achieving early retirement.
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49 **Sample characteristics**

50 Baseline data was obtained from a self administered questionnaire completed in 1993.
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52 Demographic and background variables included age register based age at January
53 1993, gender, education divided in education up to 9 years primary school, 10 years
54 primary school or basic vocational course or secondary school , vocational status of
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3 spouse dichotomised in paid work or transfer income, marital status,
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5 Live in with partner (yes or no) and workers compensation case dichotomized into yes
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7 or no. A positive answer includes both ongoing and confirmed cases. Physical Work
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9 factors were assessed by questions of: Working hour's day, evening or night, working
10
11 place hospital or eldercare, index describing heaviness of care where heavy care was
12
13 defined by a combination of having more than 2/3 of the daily patients needing full
14
15 care together with more than 10 handlings of persons per day. Rated Perceived
16
17 Exertion (RPE) was assessed from a modified Borg scale range 0-14¹⁹ anchored
18
19 1=very very light and 13=very very strenuous, values ≥ 8 was defined as high RPE.
20
21 Psychosocial Work factors were assessed using a Danish version²⁰ of Karasek's Job
22
23 Content Questionnaire (JCQ) which is shown to have acceptable internal consistency
24
25 in the health care sector²¹. The 3 items in the demand score were time pressure,
26
27 perceived strain and tiredness returning from work. The range in the demand index
28
29 score was 5-15, low demand were defined by values lower or equal to 9. The 3 items
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31 in the decision latitude score were possibilities of decision of work pace, how the
32
33 work was carried out and work disposition. The range in the decision latitude index
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35 score was 5-15. High decision latitude was defined by values lower or equal than 9.
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37 Violence at work assessed by 5 items: never, seldom, sometimes, often and very
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39 often. Upper and lower extremities symptoms was assessed using Nordic
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41 questionnaire²², and serious upper extremity complaints was defined as sick leave >
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43 30 days for at least one region within the last year, serious lower extremity complaints
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45 was defined as sick leave > 30 days for at least one region within the last year. LBP
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47 was assessed by pain drawing including level of radiating pain combined with 0-10
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49 point Visual Analogue Scale (VAS) describing level of usual pain, and duration of
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51 pain was assessed by a and a question asking : "For how long have you altogether had
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53 low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days,
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3 31-90 days, more than 90 days” and a question asking “Have you ever had acute LBP
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5 in relation to person handling or other work tasks”. Knowledge of health parameters
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7 as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro
8
9 intestinal diseases and rheumatologic inflammatory diseases was obtained from a list
10
11 of questions in the questionnaire “Have our physician ever told you that you have one
12
13 or more of the following diseases”. Lung disease included asthma, chronic bronchitis
14
15 and pneumonia, nervous diseases included nervous disease, skin disease included
16
17 eczema and cardiovascular disease included elevated blood pressure, angina pectoris,
18
19 unsteady hearth, coronary infarction and arteriosclerosis. Gastro intestinal diseases
20
21 included colon irritable and duodenal ulcers and rheumatologic inflammatory
22
23 included rheumatoid arthritis and inflammatory connective tissue disease. Lifestyle
24
25 variables comprised body mass index (BMI) dichotomized ≥ 30 =high versus BMI
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27 < 30 , actual smoking yes/no, physical activity 8 items dichotomized: moderate
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29 physical activity more than 3 times a week or more versus less or no activity. For the
30
31 part of the population achieving early retirement after 1998 pattern and cumulated
32
33 sick leave the two year before early retirement were estimated from register data.
34
35
36
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39

40 **Statistical analysis**

41
42 After linking data from the PENSAM register including all nurses’ aides in the
43
44 geographical area of interest and the DREAM register by CPR numbers, the
45
46 vocational record in the 15 years follow up for each person was established. Relevant
47
48 covariates were tested for colinearity which was not found. We used Cox proportional
49
50 hazards models to examine the longitudinal association between the outcome measure
51
52 and the full set of predictor variables. The hazard ratio of achieving disability pension
53
54 or early voluntary pension was estimated with 95% confidence intervals (95 % CI).
55
56
57
58 The analyses were made separately for disability pension and voluntary early
59
60

retirement where the reference group for both groups was the part of the population receiving neither disability pension nor voluntary early retirement. SAS version 9.1.3 (SAS Institute Cary, NC, USA) and STATA 11.0 were used to perform data management and statistical analyses.

RESULTS

Study population

The invited population in 1993 comprised all nurses aides (N= 6,231) in the county of Aarhus with at least one years seniority as nurse's aides work in the preceding 5 year representing about 200 different working sites. The response rate in 1993 was 74%.

Table 1 shows a register based non response analysis.

Table 1.
Non response analyses, including all nurses aides in the county of Aarhus 1993 with more than 1 years of nursing aides work the last five years n=6231

Register data DREAM	Questionnaire respondents 1993 n=4616	Questionnaire non-respondents 1993 n=1615
Age 1.7.1993 mean (SD)	42.7 (9.4)	44.3 (11.0)
Years working as nurses aides 1.7.1993 mean (SD)	10.9 (7.1)	11.2 (7.4)
Gender woman %	98.1	97.1
Ethnicity other than Danish %	2.3	3.4
Dead in the follow up period %	2.5	3.0
Granted disability pension in the follow up period %	16.2	14.8
Voluntary early retirement in the follow up period %	18.2	19.3

There were only minor differences between the responders and the non responders concerning the two outcome measures and population characteristics.

The response rate among people with foreign ethnicity was lower than the non foreign

group, probably because of language problems. In the questionnaire response 3,332 participants stated that they were working as nurse's aides at the time they completed the questionnaire. Those 3332 comprised the study population in the present paper. The baseline characteristics of the 3,332 respondents are shown in table 2. The population is mainly female with a mean age of 41.9 years, 70% with education below secondary school and experienced in nursing care with a mean of 13.0 years seniority. 69.5 % was working in homecare or at nursery homes and 30.5% in hospitals in accordance with figures for Denmark as a whole at that time²³. The prevalence of having more than 90 days of back pain was 13.6%, 44.4% scored their rated perceived exertion more than or equal to 8 (strenuous), 48.7% experienced high job demands and 24.1 % low decision latitude according to the Karasek model. A minor part, 5.9 % reported violence at work often or very often and 15.9% was physical active with at least one time a week with strenuous physical activity.

Table 2.
Baseline characteristics among the study population of nurse's aides working in hospital or nursery home/homecare at the time of baseline registration

Baseline characteristics	Study population	No early retirement in the follow up period	Voluntary early pension in the follow up period	Disability pension in the follow up period
	n= 3332	n=1888	n=904	n=540
Age, mean(SD)	41.9(8.2)	37.3(5.4)	51.3(5.1)	42.4(6.8)
Age obtaining early retirement mean (SD)			60.7 (1.9)*	50.7(6.0)
Years occupied in health care work, mean(SD)	13.0(6.5)	11.8(5.9)	15.6(7.0)	13.1(6.5)
Gender %				
Male	1.7	1.9	1.5	1.3
Female	98.3	98.1	98.5	98.7
Education/grade %				

-7 -9 years primary school	29.3	22.9	36.3	39.4
-10 years primary school or basic vocational course	41.6	41.3	46.4	35.0
-Secondary school	29.1	35.8	17.3	25.6
Vocational status spouse %				
-paid work	73.2	79.2	63.6	67.8
-transfer income	26.8	20.8	36.4	32.8
Marital status %				
Married/live in partner	82.6	84.5	81.6	76.7
Workers compensation case %	19.1	15.2	19.5	31.7
Workplace %				
- hospital	30.5	29.8	32.2	30.0
- nursery home/homecare	69.5	70.2	67.8	70.0
Work hours %				
- mainly day work	43.4	44.0	44.0	40.2
- mainly evening work	24.8	24.4	23.7	28.5
- mainly night work	10.5	9.8	11.4	11.7
- mixed	21.3	21.9	20.9	19.6
Heaviness of care duties index %				
high	11.0	11.4	9.3	12.6
RPE \times (range 0-14)%				
high ≥ 8	44.4	43.5	41.6	53.3
Violence at work %				
Never	42.8	38.8	45.2	44.8
Seldom	23.8	25.3	24.0	21.3
On and of	27.6	29.9	25.3	27.2
Often	4.3	4.4	4.4	4.4
Very often	1.6	1.7	1.1	2.2
Decision latitude -low %	24.1	23.4	25.3	24.6
Demand -high %	48.7	47.5	49.5	51.3
Number of days LBP the last 12 month				

altogether %				
0 days	32.9	31.8	39.9	24.4
1-7 days	25.4	27.8	23.0	21.9
8-30 days	20.3	22.3	17.5	18.0
31-90 days	7.8	9.0	5.5	7.4
More than 90 days	13.6	9.1	14.0	28.3
Usual back pain %				
Radiation below knee level	15.9	13.6	15.1	25.4
Ever acute LBP in relation to patient handling or other work tasks %	58.8	57.2	56.1	69.3
More than 30 days of sick leave the last year because of upper limb disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limb disorder %	4.7	2.5	5.2	11.9
Cardiovascular disease %	14.5	10.9	20.5	17.2
Lung diseases %	23.2	22.8	21.1	28.2
Skin diseases%	16.7	18.2	11.7	19.4
Gastro intestinal diseases %	12.6	10.0	14.9	18.2
Rheumatologic inflammatory diseases %	2.8	1.3	4.0	6.1
Nervous disorder %	4.1	3.1	4.4	7.6
Current Smoking, %	47.0	47.4	41.9	54.4
BMI, mean(SD)	23.4(3.8)	23.0(3.5)	24.0(3.5)	23.9(5.0)
BMI				
severe overweight > 30	5.1	4.7	5.9	5.7
Physical activity# High %	15.3	17.5	11.7	12.8

* 60 years is the lower limit for voluntary early retirement

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity high: at least one time a week strenuous physical activity²⁴

Early retirement and lost working years

As seen from the flow chart figure 1, 540 persons (16.2%) were granted disability

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3 pension and 904 persons (27.1 %) obtained voluntary early retirement, in the follow
4
5 up period all together 43.3%.
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7
8 The total number of lost working years in the population presuming that all persons
9
10 who retired early had remained at work until the normal pension age is 7,472 years
11
12 for the 540 persons granted disability pension and 3,714 years for the 904 persons
13
14 obtaining early retirement, altogether 11,186 years amounting about 410 million Euro
15
16 in direct costs from early retirement transfer payments.
17

18
19 Figure 2 shows an increasing number of participants who choose early voluntary
20
21 retirement during the follow up period, whereas the number per year being granted
22
23 disability pension is stable until 2002 with a rise the following years until 2007 where
24
25 a decline is seen. At that time there is a corresponding rise in voluntary early
26
27 retirement. This pattern could be explained by a change in the interpretation of the
28
29 disability pension legislation. The mean age of those granted disability pension is
30
31 stable between 50 and 55 years over the 15 year follow up period. The minimum age
32
33 obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is
34
35 explained by a temporary change in the legislation. Altogether 344 persons chose to
36
37 postpone the early voluntary retirement after having got their early voluntary pension
38
39 certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to
40
41 the age of 66 year.
42
43

44
45 Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit
46
47 and other non permanent transfer incomes every week the 2 years preceding the
48
49 granting of disability pension respectively early voluntary retirement. The population
50
51 is restricted to persons changing to early retirement from 1999 as we only have data
52
53 on sick leave from 1997 in the DREAM register.
54

55
56 Figure 3_a reveals that disability pension is preceded of a decline in work presence
57
58 from about 60% two years prior to the week of disability pension to about 20% 12
59
60

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3 weeks before. During the 2 years preceding disability pension there is an increase
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5 other transfer incomes with a lower benefit properly because sick leave by Danish
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7 legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be
8
9 sick listed as unemployed which can explain the decline in number receiving
10
11 unemployment benefit.
12

13
14 As see from figure 3_a and 3_b the pattern of vocational status the 2 years preceding
15
16 the time of early retirement differs completely between disability pension and
17
18 voluntary early retirement. Contrasting the transfer income pattern seen the two years
19
20 proceeding the time of disability pension there is no change in the part of the
21
22 population working or receiving non permanent transfer income two years before
23
24 starting early voluntary retirement. A bigger proportion compared to the part of the
25
26 population granted disability pension is receiving unemployment benefit with an
27
28 increasing number over the 2 years.
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34 **Risk factors for early retirement**

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36 Table 3 shows adjusted risk factors of being granted disability pension or choosing
37
38 early voluntary retirement in the follow up period.
39

40
41 Health related risk factors for disability pension was more than 90 days of LBP the
42
43 last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave
44
45 because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30
46
47 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to
48
49 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro
50
51 intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education
52
53 (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI
54
55 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated
56
57 perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk
58
59
60

factors. Risk factors for early voluntary retirement were: low education (HR 3.19 (95 % CI 2.65 to 3.85), high job demands (HR 1.28 (95 % CI 1.09 1.50)), inflammatory rheumatic disease (HR 1.76 (95 % CI 1.25 to 2.48)), cardio vascular disease (HR 1.47 (95 % CI 1.27 to 1.69)) and gastro intestinal disorders (HR 1.39(95 % CI 1.10 to 1.76)).

Apart from low education, gastro intestinal disorders and inflammatory rheumatic diseases, the two types of early retirement do not share any prognostic factors for the two types of early retirement. Life style factors as BMI, smoking and physical activity did not show associations with either of the two outcomes. Living alone protected against voluntary retirement, but showed up as a risk factor for disability pension.

Table 3.
Hazard Ratio of obtaining voluntary early pension or disability pension in the study period according to baseline information's

Risk factors	Voluntary early pension n= 904		Disability pension n=540	
	HR	95% CI	HR	95% CI
Education grade				
-Secondary school	1		1	
-10 years primary school or basic vocational course	0.83	0.65 to 1.06	0.92	0.71 to 1.18
-7 -9 years primary school	3.19	2.65 to 3.85	1.27	1.02 to 1.57
Vocational status spouse				
-transfer income versus paid work	0.55	0.46 to 0.67	1.11	0.85 to 1.45
Marital status				
- Living alone versus live in partner	0.64	0.51 to 0.80	1.54	1.14 to 2.09
Workers compensation				
case	1.02	0.84 to 1.23	1.51	1.23 to 1.87
Workplace				
- nursery home/homecare versus Hospital	1.04	0.88 to 1.23	1.08	0.87 to 1.35

Work hours				
- mainly day work	1		1	
- mainly evening work	1.03	0.86 to 1.23	1.29	1.03 to 1.60
- mainly night work	1.16	0.92 to 1.46	1.18	0.87 to 1.61
- mixed	0.90	0.74 to 1.11	0.97	0.74 to 1.27
Heaviness of care duties				
Index " high	0.79	0.62 to 1.01	0.98	0.74 – 1.29
RPE _x (range 0-14)				
high >=8	0.96	0.82 to 1.13	1.23	1.00 to 1.51
Decision latitude -low	1.09	0.92 to 1.28	0.90	0.72 to 1.12
Demand -high %	1.28	1.09 to 1.50	0.92	0.75 to 1.13
Number of days LBP the last 12 month altogether				
0 days	0.98	0.77 to 1.24	1.36	0.93 to 1.26
1-7 days	0.71	0.56 to 0.89	1.34	0.94 to 1.92
8-30 days	0.71	0,55 to 0.91	1.35	0.92 to 1.97
31-90 days	0.58	0.40 to 0.82	1.29	0.81 to 2.05
More than 90 days	0.72	0.54 to 0.97	2.27	1.55 to 3.34
Usual back pain :				
Radiation below knee level	0.90	0.73 to 1.10	1.18	0.05 to 1.48
Ever acute LBP in relation to patient handling or other work tasks	1.07	0.89 to 1.27	1.01	0.80 to 1.28
More than 30 days of sick leave the last year because of upper limb disorder	1.04	0.72 to 1.50	2.18	1.57 to 3.01
More than 30 days of sick leave the last year because of lower limb disorder	0.91	0.63 to 1.31	1.51	1.08 to 2.11
Cardiovascular disease	1.47	1.27 to 1.69	1.14	0.94 to 1.38
Lung diseases	0.88	0.75 to 1.05	1.14	0.93 to 1.39
Skin diseases	0.61	0.49 to 0.75	1.13	0.90 to 1.42
Gastro intestinal diseases	1.21	1.00 to 1.47	1.39	1.10 to 1.76

Rheumatologic inflammatory diseases	1.76	1.25 to 2.48	2.42	1.67 to 3.52
Nervous disorder	0.87	0.62 to 1.24	1.31	0.92 to 1.87
Current Smoking	0.80	0.69 to 0.93	1.20	0.98 to 1.45
BMI				
severe overweight > 30	0.87	0.64 to 1.17	0.85	0.57 to 1.26
Physical activity# low	0.87	0.74 to 1.02	0.94	0.77 to 1.15

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity low: less than "at least one time a week strenuous physical activity"

DISCUSSION

This study compared risk factors for two different types of early retirement and thereby contribute to the discussion of the disability process and how to prevent disability and social exclusion^{15;25;26}. The study document a high number of early retirement in a cohort with an earlier strong connection to the labour market with an enormous number of lost productive years and money in direct costs from disability pension, voluntary early retirement. Risk factors for disability pension were mainly health related factors in accordance with the fact that health related reduction of the working capacity is the most important criteria for granting disability pension. HR above 2 for disability pension were low back pain more than 90 days the last year, more than 30 of sick leave the last year and known rheumatologic inflammatory disease at baseline registration in 1993. A workers compensation case was an independent risk factor, which has been found in other studies^{27;28}. This finding could result from residual confounding as it is possible that the persons notified for a workers compensation case have more serious health problems than the persons not notified. In this study the introduction in the model of interaction variables between compensation status and pain variables decreased the HR, and is in favour of more

1
2
3 serious health problems among compensation cases. Another explanation could stem
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5 from accelerating a disability process by the way the compensation system works and
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7 impacts on the worker, and we cannot exclude that this could play a role. This study
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9 could not corroborate that physical or psychosocial workload found in other
10
11 studies^{12;26;29-31} played a major role as targets for primary prevention. Rated Perceived
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13 exertion at work, but not the heaviness of clients assessed from an index based on
14
15 number of clients needing full care in combination with number of person handlings a
16
17 day, was a risk factor. The finding of an elevated risk of evening work are in
18
19 accordance with a Danish register study focusing on shift work in all sectors and
20
21 disability³² the only work related factor with an elevated risk of choosing early
22
23 voluntary retirement was high demands at work. The interaction term job strain did
24
25 not contribute to the models (results not shown). In a study from the Finnish public
26
27 service sector²⁶ it is argued that job strain are to be evaluated on job unit level, in this
28
29 study we have information of 200 different work sites. But as the nursery homes,
30
31 home care units or hospitals in the actual study are rather different in size we do not
32
33 have the possibility to make valid work site aggregated measures of exposure.
34
35 Many studies report associations between sick leave and disability pension³³. To our
36
37 knowledge no other studies have investigated risk factors of early voluntary
38
39 retirement. Early voluntary retirement at the age of 60 years was mainly associated
40
41 with low educational level, and the protective effect of spouse being on income
42
43 transfer and living alone is consistent with primarily economic imperatives for
44
45 choosing early voluntary retirement. In this study we found no strong argument for
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47 health related factors as being important in the decision to retire voluntary, except for
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49 small effects from cardiovascular, rheumatologic inflammatory diseases and
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51 gastrointestinal disease.
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58 For both outcomes we found no associations with smoking, low physical leisure
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3 activity or BMI, and this finding questions ongoing activity at the work site for
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5 making individual life style factors the main suspects for intervention in order to stay
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7 active in work for more years³⁴.
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10 The finding that voluntary early retirement and disability pension only has
11
12 few mutual prognostic factors, challenges common notions of a retirement process
13
14 driven by work related or health related factors.

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16 The pattern of vocational status the 2 years preceding the time of early retirement
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18 differs completely between disability pension and voluntary early retirement.
19

20
21 Different legislation obviously play a role but it is although surprising that health and
22
23 work related factors seem to be without importance for people choosing voluntary
24
25 early retirement in a profession which in many investigations are found to be physical
26
27 and psychological demanding²⁻⁵.
28

29
30 A major strength in the present study is the prospective design and number of
31
32 observations of both of the two outcomes of early retirement.

33
34 In this study early retirement - both disability pension and early voluntary retirement -
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36 was assessed from a national register, including weekly registration of all types of
37
38 transfer income from the social system. The registers are time accurate and complete
39
40 concerning disability pension and early voluntary retirement because it is a part of the
41
42 payment system. Another strength of this study was the opportunity to look at a
43
44 population early retired without a legislative requirement of disability.
45
46

47
48 Exploring risk factors for disability pension in an uniform population have the
49
50 advantages that the results are less dependent on residual confounding as underlying
51
52 socio economical factors which are known to be strong predictors of disability³⁵. The
53
54 data on prognostic factors was self reported and assessed at one point only.

55
56 The information about the non musculoskeletal symptoms was limited to a question
57
58 "Have our physician ever told you that you have one or more of the following
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diseases". The register gives no information of the diagnose behind the disability pension A knowledge of the specific health related reasons for the disability pension could have given the opportunity to estimate predictors for different reasons for obtaining disability pension.

The lacking information of sick leave before 2007 rule out the inclusion of sick leave data in the prognostic model for both outcomes. The study have a high external validity concerning the Danish health and eldercare as the study population comprises a total population of nurses' aides in a well defined geographical area representative for the rest of Denmark including a loss to follow up analyses which support the representativeness of the study population. As membership of a pension fund and trade union is mandatory the original register of nurses' aides are thought to be near to complete. We assume that the working conditions as perceived exertion in care duties, part of very care needing client's use of helping equipment in the eldercare in 1993 are comparable with working conditions during the follow up period. There had been a tendency towards heavier clients and lesser time per client but on the other hand a growing use of helping devices. Our assumption is supported by description of working conditions in studies from 2003, 2004 and 2005^{1;11;36}. As to generalisability to other countries both differences in legislation across countries and differences in standard of equipment and working procedures are to be taken in account.

Conclusion

In conclusion we find an alarming high proportion of early retirement from an area of growing importance for society in the years to come. The lack of shared risk factors for the two types of early retirement was unexpected in a population sharing social and working characteristics, but also points to the importance of being aware of underlying legislation when translating data partly driven on legislation. Work related factors at baseline in 1993 only seemed to play a minor prognostic role for early

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3 retirement of both kinds, and individual factors as smoking, BMI and physical activity
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5 at baseline were not associated with early retirement at all. Risk factors for disability
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7 pension were mainly health related factors while economical factors as income of
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9 spouse and unemployment seemed to influence the decision to choose early voluntary
10
11 retirement.
12

13
14 Our results point at secondary prevention managing especially musculoskeletal claims
15
16 at an early state in preventing disability pension with the aim to stay occupied despite
17
18 musculoskeletal symptoms.
19

20 21 22 23 **Policy implications**

24
25 The huge numbers of lost working years in a population with an initially strong
26
27 connection to the labour market call for action, where the finding that musculoskeletal
28
29 symptoms up to 15 years before disability pension are prognostic factors points at a
30
31 more active counselling and help to restore connection to the labour market among
32
33 those with musculoskeletal problems
34
35

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38
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40

41 42 **Licence statement**

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54 55 **Competing interest declaration.**

56
57 All authors have completed the Unified Competing interest form at
58
59 www.icmje.org/coi_disclosure and declare that none of the authors have financial
60

1
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3 interests that may be relevant to the submitted work to declare.
4

5 **Ethics approval**
6

7 The study has been notified to and authorized by the Danish Data Protection Agency
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Differences in risk factors for voluntary early retirement and disability pension - a 15 year follow-up in a cohort of nurses' aides

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ABSTRACT

Objective: To estimate the extent of early retirement and examine risk factors for voluntary early retirement and disability pension in a cohort of nurses' aides

Design: Register study including baseline questionnaire and register data covering all transfer incomes from 1991 to 2008 in a cohort of nurses aides established in 1993 with a follow up period of 15 years

Setting: Nurses' aides working in nursery homes, homecare or hospitals.

Participants: 3332 gainfully employed nurses' aides at the time of inclusion in the study.

Outcome: Disability pension or early voluntary retirement

Results: 16.2% of the population was granted disability pension and 27.1% entered early voluntary retirement in the follow up period representing 11,186 lost working years with a direct cost in transfer payment amounting about 410 million Euro.

Health related risk factors for disability pension was long lasting Low Back Pain (Hazard ratio (HR) 2.27(95 % CI 1.55 to 3.34), sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11), and inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)). Of non health-related factors, low education, workers compensation case, evening work and high rated perceived exertion at work all were minor risk factors for disability pension. The primary risk factor for early voluntary retirement was low education (HR 3.19 (95 % CI 2.65 to 3.85)).

Conclusion: 43.3% of nurses aides gainfully employed in 1993 retired before due time during the follow up period. Work related factors at baseline only seemed to play a minor prognostic role. Risk factors for disability pension were mainly health related factors while economical factors seemed to influence the decision to choose early voluntary retirement. The number of persons and the amount of lost working years

underscores the need of a more active counselling towards maintaining employment especially among those with persistent musculoskeletal disorders.

ARTICLE SUMMERY

Article focus

High prevalence's of low back pain and sick leave are found among healthcare workers in many countries

Predictors of negative vocational prognosis for healthcare workers are unknown.

Key messages

Musculoskeletal complaints at baseline predicted disability pension but not voluntary early retirement. Work related factors played a minor role as risk factors for both disability pension and voluntary early retirement.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI

Our results point at secondary prevention managing especially musculoskeletal claims at an early state in preventing disability pension.

Strength and limitations

Study strengths are a follow up time of 15 years in a national register with a high accuracy and completeness and the possibility to compare risk factors for two different types of early retirement. Study limitations are that data on prognostic factors were self reported and assessed at one point only.

INTRODUCTION

10% of the European workforce is occupied in the health care sector¹. Several, mainly cross sectional studies have reported adverse health effects among health care workers especially nurses' aides and home care workers. Most of the studies comprise low back pain (LBP)²⁻⁵ and other musculoskeletal disorders⁶. Also risks of affective and stress related disorders⁷⁻⁸ and hand eczema⁹ has been discussed.

High prevalence's of sick leave are found among nurses, nurses aides and homecare workers in many countries^{10;11}. There are only few studies of predictors of early retirement among health care workers¹² or leaving nursing care¹³. Disability pension is shown to be associated with increased mortality¹⁴ but also with better health¹⁵ dependent of socioeconomically class^{16;17}.

Lack of nursing personnel are thought to be a serious problem in many countries in the future due aging of the actual workforce and population, a rapid job turnover and problems with recruitment^{1;13}. To face these problems there is a need of studies of predictors of early retirement in the profession to be able to strengthen the prevention of negative vocational outcomes being of benefit for both the nursing personnel and the society.

Objectives

To estimate the extent of early retirement and examine and compare predictors established at baseline from self reported questionnaire including data of demographic, health and work conditions and socioeconomically history from register data of two different types of early retirement: voluntary early retirement and disability pension in a cohort of occupational employed nurse's aides in a follow up period of 15 years.

METHODS

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3 A prospective register study of predictors of early retirement in a fixed cohort
4 including all nurses' aides registered in 1992 in the county of Aarhus with 15 years of
5 follow up.
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10 11 **Study population and data sources**

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14 The cohort was identified by data from an insurance fund (Danish acronym
15 PENSAM) including all former and current persons registered as nurses' aides for
16 minimum one year in 1992 in the county of Aarhus. 74% of the cohort (n= 4,616)
17 completed a questionnaire including demographic, lifestyle, physical and
18 psychological workload and disease related factors in 1993³. The part of this
19 population gainfully employed as a nurse's aides n=3,332 in 1993 comprised the
20 study cohort for the present study. The Danish civil personal registration number
21 (CPR) was used to link questionnaire data with person specific data from the Danish
22 National Register on Public Transfer Payments (Danish acronym DREAM)¹⁸ from
23 1991-2008 (both years inclusive). Information of permanent transfer income were
24 available from the start of the register in 1991 while information's of non-permanent
25 transfer payments as sick leave and unemployment benefit first were available from
26 1997. The follow up data included data from the DREAM register with weekly
27 registration of public transfer payment at individual level in the follow up period. We
28 recoded the originally 104 different transfer payment codes from the DREAM register
29 into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other
30 non permanent transfer payment as vocational rehabilitation and social assistance, 5)
31 disability pension and flex job a health dependent half time pension and 6) voluntary
32 early retirement. The register is thought to be near to complete based on the
33 economically incentive for the employer to report to public authorities. The cohort
34 was followed in the DREAM register until 2008 providing a follow up time of 15
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8 **Assessment of main outcome**

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10 The main outcome was permanent early retirement in the follow up period as
11 disability pension or early voluntary retirement. Lost working years were calculated
12 by extracting the person age at the year of early retirement from 65 which is the year
13 of old age pension in Denmark. Obtaining disability pension require an evaluation of
14 work ability which is to be reduced to a minimum while early voluntary retirement
15 are independent of health status. Voluntary early retirement is available from the age
16 of 60 years if the persons have achieved 25 years of membership of an unemployment
17 benefit fund for a period of 30 years. For each patient, disability pension and
18 voluntary early retirement was estimated, including time and the person's age at the
19 time of achievement of early retirement. Disability pension includes flex job, which
20 was introduced in the year 2000 as a health dependent half time pension achieved in
21 the same legislation context as disability pension, based on a permanent health
22 dependent condition. According to the rules of achievement of early voluntary
23 retirement it is not possible to change from disability pension to early voluntary
24 retirement. If a person have changed from early voluntary retirement to disability
25 pension she is classified with the outcome disability pension (n= 8). The register gives
26 no information of reason for achieving early retirement.
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49 **Sample characteristics**

50 Baseline data was obtained from a self administered questionnaire completed in 1993.
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52 Demographic and background variables included age register based age at January
53 1993, gender, education divided in education up to 9 years primary school, 10 years
54 primary school or basic vocational course or secondary school , vocational status of
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1 spouse dichotomised in paid work or transfer income, marital status,
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3 Live in with partner (yes or no) and workers compensation case dichotomized into yes
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5 or no. A positive answer includes both ongoing and confirmed cases. Physical Work
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7 factors were assessed by questions of: Working hour's day, evening or night, working
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9 place hospital or eldercare, index describing heaviness of care where heavy care was
10
11 defined by a combination of having more than 2/3 of the daily patients needing full
12
13 care together with more than 10 handlings of persons per day. Rated Perceived
14
15 Exertion (RPE) was assessed from a modified Borg scale range 0-14¹⁹ anchored
16
17 1=very very light and 13=very very strenuous, values ≥ 8 was defined as high RPE.
18
19 Psychosocial Work factors were assessed using a Danish version²⁰ of Karasek's Job
20
21 Content Questionnaire (JCQ) which is shown to have acceptable internal consistency
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23 in the health care sector²¹. The 3 items in the demand score were time pressure,
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25 perceived strain and tiredness returning from work. The range in the demand index
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27 score was 5-15, low demand were defined by values lower or equal to 9. The 3 items
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29 in the decision latitude score were possibilities of decision of work pace, how the
30
31 work was carried out and work disposition. The range in the decision latitude index
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33 score was 5-15. High decision latitude was defined by values lower or equal than 9.
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35 Violence at work assessed by 5 items: never, seldom, sometimes, often and very
36
37 often. Upper and lower extremities symptoms was assessed using Nordic
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39 questionnaire²², and serious upper extremity complaints was defined as sick leave >
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41 30 days for at least one region within the last year, serious lower extremity complaints
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43 was defined as sick leave > 30 days for at least one region within the last year. LBP
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45 was assessed by pain drawing including level of radiating pain combined with 0-10
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47 point Visual Analogue Scale (VAS) describing level of usual pain, and duration of
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49 pain was assessed by a and a question asking : "For how long have you altogether had
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51 low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days,
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3 31-90 days, more than 90 days” and a question asking “Have you ever had acute LBP
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5 in relation to person handling or other work tasks”. Knowledge of health parameters
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7 as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro
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9 intestinal diseases and rheumatologic inflammatory diseases was obtained from a list
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11 of questions in the questionnaire “Have our physician ever told you that you have one
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13 or more of the following diseases”. Lung disease included asthma, chronic bronchitis
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15 and pneumonia, nervous diseases included nervous disease, skin disease included
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17 eczema and cardiovascular disease included elevated blood pressure, angina pectoris,
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19 unsteady hearth, coronary infarction and arteriosclerosis. Gastro intestinal diseases
20
21 included colon irritable and duodenal ulcers and rheumatologic inflammatory
22
23 included rheumatoid arthritis and inflammatory connective tissue disease. Lifestyle
24
25 variables comprised body mass index (BMI) dichotomized ≥ 30 =high versus BMI
26
27 < 30 , actual smoking yes/no, physical activity 8 items dichotomized: moderate
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29 physical activity more than 3 times a week or more versus less or no activity. For the
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31 part of the population achieving early retirement after 1998 pattern and cumulated
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33 sick leave the two year before early retirement were estimated from register data.
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40 **Statistical analysis**

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42 After linking data from the PENSAM register including all nurses’ aides in the
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44 geographical area of interest and the DREAM register by CPR numbers, the
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46 vocational record in the 15 years follow up for each person was established. Relevant
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48 covariates were tested for colinearity which was not found. We used Cox proportional
49
50 hazards models to examine the longitudinal association between the outcome measure
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52 and the full set of predictor variables. The hazard ratio of achieving disability pension
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54 or early voluntary pension was estimated with 95% confidence intervals (95 % CI).
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58 The analyses were made separately for disability pension and voluntary early
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retirement where the reference group for both groups was the part of the population receiving neither disability pension nor voluntary early retirement. SAS version 9.1.3 (SAS Institute Cary, NC, USA) and STATA 11.0 were used to perform data management and statistical analyses.

RESULTS

Study population

The invited population in 1993 comprised all nurses aides (N= 6,231) in the county of Aarhus with at least one years seniority as nurse's aides work in the preceding 5 year representing about 200 different working sites. The response rate in 1993 was 74%.

Table 1 shows a register based non response analysis.

Table 1.
Non response analyses, including all nurses aides in the county of Aarhus 1993 with more than 1 years of nursing aides work the last five years n=6231

Register data DREAM	Questionnaire respondents 1993 n=4616	Questionnaire non-respondents 1993 n=1615
Age 1.7.1993 mean (SD)	42.7 (9.4)	44.3 (11.0)
Years working as nurses aides 1.7.1993 mean (SD)	10.9 (7.1)	11.2 (7.4)
Gender woman %	98.1	97.1
Ethnicity other than Danish %	2.3	3.4
Dead in the follow up period %	2.5	3.0
Granted disability pension in the follow up period %	16.2	14.8
Voluntary early retirement in the follow up period %	18.2	19.3

There were only minor differences between the responders and the non responders concerning the two outcome measures and population characteristics.

The response rate among people with foreign ethnicity was lower than the non foreign

group, probably because of language problems. In the questionnaire response 3,332 participants stated that they were working as nurse's aides at the time they completed the questionnaire. Those 3332 comprised the study population in the present paper. The baseline characteristics of the 3,332 respondents are shown in table 2. The population is mainly female with a mean age of 41.9 years, 70% with education below secondary school and experienced in nursing care with a mean of 13.0 years seniority. 69.5 % was working in homecare or at nursery homes and 30.5% in hospitals in accordance with figurers for Denmark as a whole at that time²³. The prevalence of having more than 90 days of back pain was 13.6%, 44.4% scored their rated perceived exertion more than or equal to 8 (strenuous), 48.7% experienced high job demands and 24.1 % low decision latitude according to the Karasek model. A minor part, 5.9 % reported violence at work often or very often and 15.9% was physical active with at least one time a week with strenuous physical activity.

Table 2.
Baseline characteristics among the study population of nurse's aides working in hospital or nursery home/homecare at the time of baseline registration

Baseline characteristics	Study population	No early retirement in the follow up period	Voluntary early pension in the follow up period	Disability pension in the follow up period
	n= 3332	n=1888	n=904	n=540
Age, mean(SD)	41.9(8.2)	37.3(5.4)	51.3(5.1)	42.4(6.8)
Age obtaining early retirement mean (SD)			60.7 (1.9)*	50.7(6.0)
Years occupied in health care work, mean(SD)	13.0(6.5)	11.8(5.9)	15.6(7.0)	13.1(6.5)
Gender %				
Male	1.7	1.9	1.5	1.3
Female	98.3	98.1	98.5	98.7
Education/grade %				

-7 -9 years primary school	29.3	22.9	36.3	39.4
-10 years primary school or basic vocational course	41.6	41.3	46.4	35.0
-Secondary school	29.1	35.8	17.3	25.6
Vocational status spouse %				
-paid work	73.2	79.2	63.6	67.8
-transfer income	26.8	20.8	36.4	32.8
Marital status %				
Married/live in partner	82.6	84.5	81.6	76.7
Workers compensation case %	19.1	15.2	19.5	31.7
Workplace %				
- hospital	30.5	29.8	32.2	30.0
- nursery home/homecare	69.5	70.2	67.8	70.0
Work hours %				
- mainly day work	43.4	44.0	44.0	40.2
- mainly evening work	24.8	24.4	23.7	28.5
- mainly night work	10.5	9.8	11.4	11.7
- mixed	21.3	21.9	20.9	19.6
Heaviness of care duties index %				
high	11.0	11.4	9.3	12.6
RPE \times (range 0-14)%				
high ≥ 8	44.4	43.5	41.6	53.3
Violence at work %				
Never	42.8	38.8	45.2	44.8
Seldom	23.8	25.3	24.0	21.3
On and of	27.6	29.9	25.3	27.2
Often	4.3	4.4	4.4	4.4
Very often	1.6	1.7	1.1	2.2
Decision latitude -low %	24.1	23.4	25.3	24.6
Demand -high %	48.7	47.5	49.5	51.3
Number of days LBP the last 12 month				

altogether %				
0 days	32.9	31.8	39.9	24.4
1-7 days	25.4	27.8	23.0	21.9
8-30 days	20.3	22.3	17.5	18.0
31-90 days	7.8	9.0	5.5	7.4
More than 90 days	13.6	9.1	14.0	28.3
Usual back pain %				
Radiation below knee level	15.9	13.6	15.1	25.4
Ever acute LBP in relation to patient handling or other work tasks %	58.8	57.2	56.1	69.3
More than 30 days of sick leave the last year because of upper limb disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limb disorder %	4.7	2.5	5.2	11.9
Cardiovascular disease %	14.5	10.9	20.5	17.2
Lung diseases %	23.2	22.8	21.1	28.2
Skin diseases%	16.7	18.2	11.7	19.4
Gastro intestinal diseases %	12.6	10.0	14.9	18.2
Rheumatologic inflammatory diseases %	2.8	1.3	4.0	6.1
Nervous disorder %	4.1	3.1	4.4	7.6
Current Smoking, %	47.0	47.4	41.9	54.4
BMI, mean(SD)	23.4(3.8)	23.0(3.5)	24.0(3.5)	23.9(5.0)
BMI severe overweight > 30	5.1	4.7	5.9	5.7
Physical activity# High %	15.3	17.5	11.7	12.8

* 60 years is the lower limit for voluntary early retirement

" Index based on part of clients needing full care in combination with number of person handlings a day

× Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity high: at least one time a week strenuous physical activity²⁴

Early retirement and lost working years

As seen from the flow chart figure 1, 540 persons (16.2%) were granted disability

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3 pension and 904 persons (27.1 %) obtained voluntary early retirement, in the follow
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5 up period all together 43.3%.
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8 The total number of lost working years in the population presuming that all persons
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10 who retired early had remained at work until the normal pension age is 7,472 years
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12 for the 540 persons granted disability pension and 3,714 years for the 904 persons
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14 obtaining early retirement, altogether 11,186 years amounting about 410 million Euro
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16 in direct costs from early retirement transfer payments.
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19 Figure 2 shows an increasing number of participants who choose early voluntary
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21 retirement during the follow up period, whereas the number per year being granted
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23 disability pension is stable until 2002 with a rise the following years until 2007 where
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25 a decline is seen. At that time there is a corresponding rise in voluntary early
26
27 retirement. This pattern could be explained by a change in the interpretation of the
28
29 disability pension legislation. The mean age of those granted disability pension is
30
31 stable between 50 and 55 years over the 15 year follow up period. The minimum age
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33 obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is
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35 explained by a temporary change in the legislation. Altogether 344 persons chose to
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37 postpone the early voluntary retirement after having got their early voluntary pension
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39 certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to
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41 the age of 66 year.
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45 Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit
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47 and other non permanent transfer incomes every week the 2 years preceding the
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49 granting of disability pension respectively early voluntary retirement. The population
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51 is restricted to persons changing to early retirement from 1999 as we only have data
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53 on sick leave from 1997 in the DREAM register.
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55
56 Figure 3_a reveals that disability pension is preceded of a decline in work presence
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58 from about 60% two years prior to the week of disability pension to about 20% 12
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3 weeks before. During the 2 years preceding disability pension there is an increase
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5 other transfer incomes with a lower benefit properly because sick leave by Danish
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7 legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be
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9 sick listed as unemployed which can explain the decline in number receiving
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11 unemployment benefit.
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14 As see from figure 3_a and 3_b the pattern of vocational status the 2 years preceding
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16 the time of early retirement differs completely between disability pension and
17
18 voluntary early retirement. Contrasting the transfer income pattern seen the two years
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20 proceeding the time of disability pension there is no change in the part of the
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22 population working or receiving non permanent transfer income two years before
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24 starting early voluntary retirement. A bigger proportion compared to the part of the
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26 population granted disability pension is receiving unemployment benefit with an
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28 increasing number over the 2 years.
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34 **Risk factors for early retirement**

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36 Table 3 shows adjusted risk factors of being granted disability pension or choosing
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38 early voluntary retirement in the follow up period.
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41 Health related risk factors for disability pension was more than 90 days of LBP the
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43 last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave
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45 because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30
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47 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to
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49 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro
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51 intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education
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53 (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI
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55 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated
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57 perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk
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factors. Risk factors for early voluntary retirement were: low education (HR 3.19 (95 % CI 2.65 to 3.85), high job demands (HR 1.28 (95 % CI 1.09 1.50)), inflammatory rheumatic disease (HR 1.76 (95 % CI 1.25 to 2.48)), cardio vascular disease (HR 1.47 (95 % CI 1.27 to 1.69)) and gastro intestinal disorders (HR 1.39(95 % CI 1.10 to 1.76)).

Apart from low education, gastro intestinal disorders and inflammatory rheumatic diseases, the two types of early retirement do not share any prognostic factors for the two types of early retirement. Life style factors as BMI, smoking and physical activity did not show associations with either of the two outcomes. Living alone protected against voluntary retirement, but showed up as a risk factor for disability pension.

Table 3.
Hazard Ratio of obtaining voluntary early pension or disability pension in the study period according to baseline information's

Risk factors	Voluntary early pension n= 904		Disability pension n=540	
	HR	95% CI	HR	95% CI
Education grade				
-Secondary school	1		1	
-10 years primary school or basic vocational course	0.83	0.65 to 1.06	0.92	0.71 to 1.18
-7 -9 years primary school	3.19	2.65 to 3.85	1.27	1.02 to 1.57
Vocational status spouse				
-transfer income versus paid work	0.55	0.46 to 0.67	1.11	0.85 to 1.45
Marital status				
- Living alone versus live in partner	0.64	0.51 to 0.80	1.54	1.14 to 2.09
Workers compensation				
case	1.02	0.84 to 1.23	1.51	1.23 to 1.87
Workplace				
- nursery home/homecare versus Hospital	1.04	0.88 to 1.23	1.08	0.87 to 1.35

Work hours				
- mainly day work	1		1	
- mainly evening work	1.03	0.86 to 1.23	1.29	1.03 to 1.60
- mainly night work	1.16	0.92 to 1.46	1.18	0.87 to 1.61
- mixed	0.90	0.74 to 1.11	0.97	0.74 to 1.27
Heaviness of care duties				
Index " high	0.79	0.62 to 1.01	0.98	0.74 – 1.29
RPE _x (range 0-14)				
high >=8	0.96	0.82 to 1.13	1.23	1.00 to 1.51
Decision latitude -low	1.09	0.92 to 1.28	0.90	0.72 to 1.12
Demand -high %	1.28	1.09 to 1.50	0.92	0.75 to 1.13
Number of days LBP the last 12 month altogether				
0 days	0.98	0.77 to 1.24	1.36	0.93 to 1.26
1-7 days	0.71	0.56 to 0.89	1.34	0.94 to 1.92
8-30 days	0.71	0,55 to 0.91	1.35	0.92 to 1.97
31-90 days	0.58	0.40 to 0.82	1.29	0.81 to 2.05
More than 90 days	0.72	0.54 to 0.97	2.27	1.55 to 3.34
Usual back pain :				
Radiation below knee level	0.90	0.73 to 1.10	1.18	0.05 to 1.48
Ever acute LBP in relation to patient handling or other work tasks	1.07	0.89 to 1.27	1.01	0.80 to 1.28
More than 30 days of sick leave the last year because of upper limb disorder	1.04	0.72 to 1.50	2.18	1.57 to 3.01
More than 30 days of sick leave the last year because of lower limb disorder	0.91	0.63 to 1.31	1.51	1.08 to 2.11
Cardiovascular disease	1.47	1.27 to 1.69	1.14	0.94 to 1.38
Lung diseases	0.88	0.75 to 1.05	1.14	0.93 to 1.39
Skin diseases	0.61	0.49 to 0.75	1.13	0.90 to 1.42
Gastro intestinal diseases	1.21	1.00 to 1.47	1.39	1.10 to 1.76

Rheumatologic inflammatory diseases	1.76	1.25 to 2.48	2.42	1.67 to 3.52
Nervous disorder	0.87	0.62 to 1.24	1.31	0.92 to 1.87
Current Smoking	0.80	0.69 to 0.93	1.20	0.98 to 1.45
BMI				
severe overweight > 30	0.87	0.64 to 1.17	0.85	0.57 to 1.26
Physical activity# low	0.87	0.74 to 1.02	0.94	0.77 to 1.15

" Index based on part of clients needing full care in combination with number of person handlings a day

* Rated Perceived Exertion 0-14 scale, anchored 1= very very light and 13=very very strenuous

Physical activity low: less than "at least one time a week strenuous physical activity"

DISCUSSION

This study compared risk factors for two different types of early retirement and thereby contribute to the discussion of the disability process and how to prevent disability and social exclusion^{15;25;26}. The study document a high number of early retirement in a cohort with an earlier strong connection to the labour market with an enormous number of lost productive years and money in direct costs from disability pension, voluntary early retirement. Risk factors for disability pension were mainly health related factors in accordance with the fact that health related reduction of the working capacity is the most important criteria for granting disability pension. HR above 2 for disability pension were low back pain more than 90 days the last year, more than 30 of sick leave the last year and known rheumatologic inflammatory disease at baseline registration in 1993. A workers compensation case was an independent risk factor, which has been found in other studies^{27;28}. This finding could result from residual confounding as it is possible that the persons notified for a workers compensation case have more serious health problems than the persons not notified. In this study the introduction in the model of interaction variables between compensation status and pain variables decreased the HR, and is in favour of more

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3 serious health problems among compensation cases. Another explanation could stem
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5 from accelerating a disability process by the way the compensation system works and
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7 impacts on the worker, and we cannot exclude that this could play a role. This study
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9 could not corroborate that physical or psychosocial workload found in other
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11 studies^{12;26;29-31} played a major role as targets for primary prevention. Rated Perceived
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13 exertion at work, but not the heaviness of clients assessed from an index based on
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15 number of clients needing full care in combination with number of person handlings a
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17 day, was a risk factor. The finding of an elevated risk of evening work are in
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19 accordance with a Danish register study focusing on shift work in all sectors and
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21 disability³² the only work related factor with an elevated risk of choosing early
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23 voluntary retirement was high demands at work. The interaction term job strain did
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25 not contribute to the models (results not shown). In a study from the Finnish public
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27 service sector²⁶ it is argued that job strain are to be evaluated on job unit level, in this
28
29 study we have information of 200 different work sites. But as the nursery homes,
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31 home care units or hospitals in the actual study are rather different in size we do not
32
33 have the possibility to make valid work site aggregated measures of exposure.
34
35 Many studies report associations between sick leave and disability pension³³. To our
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37 knowledge no other studies have investigated risk factors of early voluntary
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39 retirement. Early voluntary retirement at the age of 60 years was mainly associated
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41 with low educational level, and the protective effect of spouse being on income
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43 transfer and living alone is consistent with primarily economic imperatives for
44
45 choosing early voluntary retirement. In this study we found no strong argument for
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47 health related factors as being important in the decision to retire voluntary, except for
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49 small effects from cardiovascular, rheumatologic inflammatory diseases and
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51 gastrointestinal disease.
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58 For both outcomes we found no associations with smoking, low physical leisure
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3 activity or BMI, and this finding questions ongoing activity at the work site for
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5 making individual life style factors the main suspects for intervention in order to stay
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7 active in work for more years³⁴.
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10 The finding that voluntary early retirement and disability pension only has
11
12 few mutual prognostic factors, challenges common notions of a retirement process
13
14 driven by work related or health related factors.

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16 The pattern of vocational status the 2 years preceding the time of early retirement
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18 differs completely between disability pension and voluntary early retirement.
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21 Different legislation obviously play a role but it is although surprising that health and
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23 work related factors seem to be without importance for people choosing voluntary
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25 early retirement in a profession which in many investigations are found to be physical
26
27 and psychological demanding²⁻⁵.
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30 A major strength in the present study is the prospective design and number of
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32 observations of both of the two outcomes of early retirement.
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34
35 In this study early retirement - both disability pension and early voluntary retirement -
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37 was assessed from a national register, including weekly registration of all types of
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39 transfer income from the social system. The registers are time accurate and complete
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41 concerning disability pension and early voluntary retirement because it is a part of the
42
43 payment system. Another strength of this study was the opportunity to look at a
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45 population early retired without a legislative requirement of disability.
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48 Exploring risk factors for disability pension in an uniform population have the
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50 advantages that the results are less dependent on residual confounding as underlying
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52 socio economical factors which are known to be strong predictors of disability³⁵. The
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54 data on prognostic factors was self reported and assessed at one point only.
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57 The information about the non musculoskeletal symptoms was limited to a question
58
59 “Have our physician ever told you that you have one or more of the following
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diseases". The register gives no information of the diagnose behind the disability pension A knowledge of the specific health related reasons for the disability pension could have given the opportunity to estimate predictors for different reasons for obtaining disability pension.

The lacking information of sick leave before 2007 rule out the inclusion of sick leave data in the prognostic model for both outcomes. The study have a high external validity concerning the Danish health and eldercare as the study population comprises a total population of nurses' aides in a well defined geographical area representative for the rest of Denmark including a loss to follow up analyses which support the representativeness of the study population. As membership of a pension fund and trade union is mandatory the original register of nurses' aides are thought to be near to complete. We assume that the working conditions as perceived exertion in care duties, part of very care needing client's use of helping equipment in the eldercare in 1993 are comparable with working conditions during the follow up period. There had been a tendency towards heavier clients and lesser time per client but on the other hand a growing use of helping devices. Our assumption is supported by description of working conditions in studies from 2003, 2004 and 2005^{1;11;36}. As to generalisability to other countries both differences in legislation across countries and differences in standard of equipment and working procedures are to be taken in account.

Conclusion

In conclusion we find an alarming high proportion of early retirement from an area of growing importance for society in the years to come. The lack of shared risk factors for the two types of early retirement was unexpected in a population sharing social and working characteristics, but also points to the importance of being aware of underlying legislation when translating data partly driven on legislation. Work related factors at baseline in 1993 only seemed to play a minor prognostic role for early

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3 retirement of both kinds, and individual factors as smoking, BMI and physical activity
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5 at baseline were not associated with early retirement at all. Risk factors for disability
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7 pension were mainly health related factors while economical factors as income of
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9 spouse and unemployment seemed to influence the decision to choose early voluntary
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11 retirement.
12

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14 Our results point at secondary prevention managing especially musculoskeletal claims
15
16 at an early state in preventing disability pension with the aim to stay occupied despite
17
18 musculoskeletal symptoms.
19

20 21 22 23 **Policy implications**

24
25 The huge numbers of lost working years in a population with an initially strong
26
27 connection to the labour market call for action, where the finding that musculoskeletal
28
29 symptoms up to 15 years before disability pension are prognostic factors points at a
30
31 more active counselling and help to restore connection to the labour market among
32
33 those with musculoskeletal problems
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54 55 **Competing interest declaration.**

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57 All authors have completed the Unified Competing interest form at
58
59 www.icmje.org/coi_disclosure and declare that none of the authors have financial
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3 interests that may be relevant to the submitted work to declare.
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5 **Ethics approval**
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7 The study has been notified to and authorized by the Danish Data Protection Agency
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