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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

Lone Donbæk Jensen[1], Pia Ryom[2], Michael Victor Christensen[1], Johan Hviid Andersen[3]

1. Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Denmark.
2. Danish Ramazzini Centre, Department of Occupational Medicine, Aalborg University Hospital, Denmark.
3. Danish Ramazzini Centre, Department of Occupational Medicine, Herning University Hospital, Denmark

Correspondence to Lone Donbæk Jensen, Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Noerrebrogade 42, Building 2C, DK-8000 Aarhus C, Denmark;

lonjesen@rm.dk, phone: +45 78464290

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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 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.

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INTRODUCTION

10% of the European workforce is occupied in the health care sector[1]. 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 disorders[6]. Also risks of affective and stress related disorders[7-8] and hand eczema[9] 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 workers[12] or leaving nursing care[13]. 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 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 1993[3]. 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 1997. The follow up data included data from the DREAM register with weekly registration of public transfer payment at individual level in the follow up period.

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

Assessment of main outcome

The main outcome was permanent early retirement in the follow up period as disability pension or early voluntary retirement. 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, gender, education, vocational status of spouse, marital status and workers compensation case. Physical Work factors were assessed by questions of: Working hour's day, evening or night, working place hospital or eldercare, index describing heaviness of care where heavy care was defined by a combination of having more than 2/3 of the daily patients needing full care together with more than 10 handlings of persons per day. Rated Perceived Exertion (RPE) was assessed from a modified Borg scale range 0-14[15] anchored 1=very very light and 13=very very strenuous, values >=8 was defined as high RPE.

Psychosocial Work factors was assessed using a Danish version[16] of Karasek's Job Content Questionnaire (JCQ) which is shown to have acceptable internal consistency in the health care sector[17]. The 3 items in the demand score were time pressure, perceived strain and tiredness returning from work. The range in the demand index score was 5-15, low demand were defined by values lower or equal to 9. The 3 items in the decision latitude score were possibilities of decision of work pace, how the work was carried out and work disposition. The range in the decision latitude index score was 5-15. High decision latitude was defined by values lower or equal than 9. Violence at work assessed by 5 items: never, seldom, sometimes, often and very often. Upper and lower extremities symptoms was assessed using Nordic questionnaire[18], and serious upper extremity complaints was defined as sick leave > 30 days for at least one region within the last year, serious lower extremity complaints was defined as sick leave > 30 days for at least one region within the last year. LBP was assessed by pain drawing including level of radiating pain combined with 0-10 point Visual Analog Scale (VAS) describing level of usual pain, and duration of pain was assessed by a and a question asking : "For how long have you altogether had low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days, 31-90 days, more than 90 days" and a question asking "Have you ever had acute LBP in relation to person handling or other work tasks". Knowledge of health

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 figurers for Denmark as a whole at that time[19]. 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 Female	 1.7 98.3	 1.9 98.1	 1.5 98.5	 1.3 98.7
Education/grade % -7 -9 years primary school -10 years primary school or basic vocational course -Secondary school	 29.3 41.6 29.1	 22.9 41.3 35.8	 36.3 46.4 17.3	 39.4 35.0 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 - nursery home/homecare	30.5 69.5	29.8 70.2	32.2 67.8	30.0 70.0
Work hours % - mainly day work - mainly evening work - mainly night work - mixed	43.4 24.8 10.5 21.3	44.0 24.4 9.8 21.9	44.0 23.7 11.4 20.9	40.2 28.5 11.7 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 Seldom On and of Often Very often	42.8 23.8 27.6 4.3 1.6	38.8 25.3 29.9 4.4 1.7	45.2 24.0 25.3 4.4 1.1	44.8 21.3 27.2 4.4 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 1-7 days 8-30 days 31-90 days More than 90 days	32.9 25.4 20.3 7.8 13.6	31.8 27.8 22.3 9.0 9.1	39.9 23.0 17.5 5.5 14.0	24.4 21.9 18.0 7.4 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 limp disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limp 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

retirement, altogether 11,186 years amounting about 410 million Euro in direct costs from early retirement transfer payments.

Figure 2 shows an increasing number of participants who choose early voluntary retirement during the follow up period, whereas the number per year being granted disability pension is stable until 2002 with a rise the following years until 2007 where a decline is seen. At that time there is a corresponding rise in voluntary early retirement. This pattern could be explained by a change in the interpretation of the disability pension legislation. The mean age of those granted disability pension is stable between 50 and 55 years over the 15 year follow up period. The minimum age obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is explained by a temporary change in the legislation. Altogether 344 persons chose to postpone the early voluntary retirement after having got their early voluntary pension certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to the age of 66 year.

Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit and other nonpermanent transfer incomes every week the 2 years preceding the granting of disability pension respectively early voluntary retirement. The population is restricted to person changing to early retirement from 1999 as we only have data on sick leave from 1997 in the DREAM register.

Figure 3_a reveals that disability pension is preceded of a decline in work presence from about 60% two years prior to the week of disability pension to about 20%, 12 weeks before. During the 2 years preceding disability pension there is an increase other transfer incomes with a lower benefit properly because sick leave by Danish legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be sick listed as unemployed which can explain the decline in number receiving unemployment benefit. As see from figure 3_a and 3_b the pattern of vocational status the 2 years preceding the time of early retirement differs completely between disability pension and voluntary early

retirement. Contrasting the transfer income pattern seen the two years proceeding the time of disability pension there is no change in the part of the population working or receiving non permanent transfer income two years before starting early voluntary retirement. A bigger proportion compared to the part of the population granted disability pension is receiving unemployment benefit with an increasing number over the 2 years.

Risk factors for early retirement

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

Health related risk factors for disability pension was more than 90 days of LBP the last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk 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

	Voluntary early pension n= 904		Disability pension n=540	
Risk factors	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 limp 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 limp 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[20-22]. 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 with a (HR of 1.51(1.23-1.83)), 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 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 could not corroborate that physical or psychosocial workload found in other studies[12;21;25-27] played a major role as targets for primary prevention. Rated Perceived exertion at work, but not the heaviness of clients assessed from an index based on number of clients needing full care in combination with number of person handlings a day, was a risk factor (HR 1.23 (1.00 to 1.51)) The finding of an elevated risk (HR 1.34 (CI 1.02-1.75)) of evening work are in accordance with a Danish register study focusing on shift work in all sectors and disability[28] the only work related factor with an elevated risk of choosing early voluntary retirement was high demands at work. The interaction term job strain did not contribute to the models (results not shown). In a study from the

Finnish public service sector[21] it is argued that job strain are to be evaluated on job unit level, in this study we have information of 200 different work sites. But as the nursery homes, home care units or hospitals in the actual study are rather different in size we do not have the possibility to make valid work site aggregated measures of exposure.

Many studies report associations between sick leave and disability pension[29]. To our knowledge no other studies have investigated risk factors of early voluntary retirement. Early voluntary retirement at the age of 60 years was mainly associated with low educational level, and the protective effect of spouse being on income transfer and living alone is consistent with primarily economic imperatives for choosing early voluntary retirement. In this study we found no strong argument for health related factors as being important in the decision to retire voluntary, except for small effects from cardiovascular and gastrointestinal disease.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI, and this finding questions ongoing activity at the work site for making individual life style factors the main suspects for intervention in order to stay active in work for more years[30].

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

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

Different legislation obviously play a role but it is although surprising that health and work related factors seem to be without importance for people choosing voluntary early retirement in a profession which in many investigations are found to be physical and psychological demanding[2-5].

A major strength in the present study is the prospective design and number of

observations of both of the two outcomes of early retirement.

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

Exploring risk factors for disability pension in an uniform population have the advantages that the results are less dependent on residual confounding as underlying socio economical factors which are known to be strong predictors of disability[31]. The data on prognostic factors was self reported and assessed at one point only.

The information about the non musculoskeletal symptoms was limited to a question "Have our physician ever told you that you have one or more of the following diseases". The register gives no information of the diagnostic reasons/basis/foundation of the disability pension and 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. The working conditions as perceived exertion in care duties, part of very care needing clients use of helping equipment in the eldercare in 1993 are comparable with working conditions reported in 2003 and 2005[1;32]. 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 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.

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

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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Headings. Figure 1 to figure 3

Figure 1.

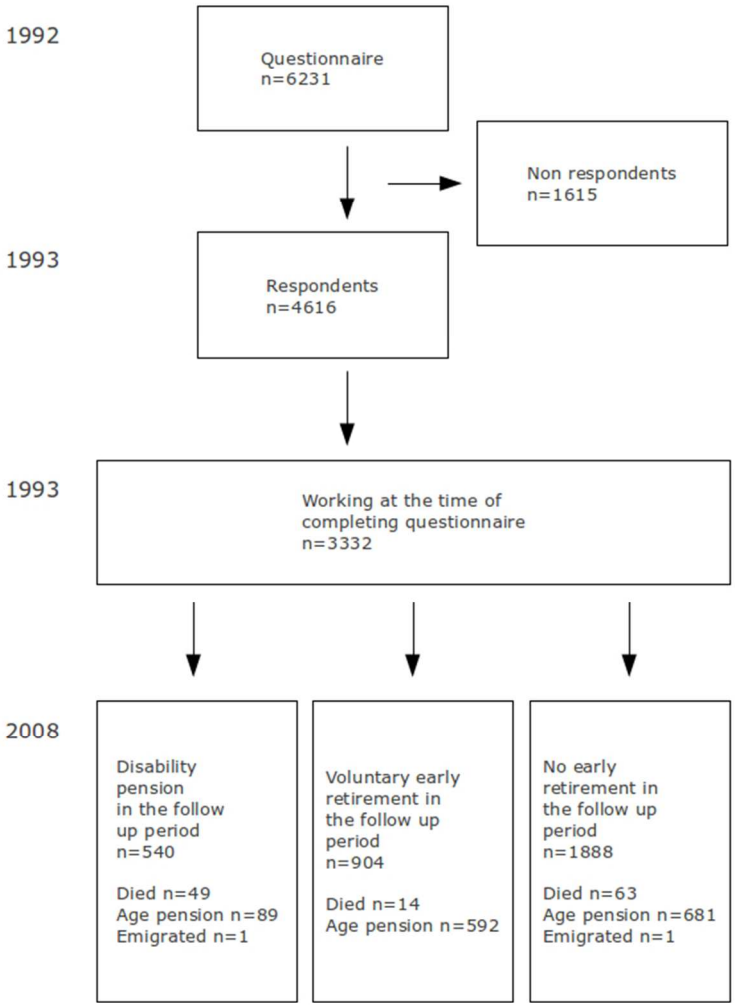
Flow chart, selection and course of study population

Figure 2.

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

Figure 3.

Vocational status, sick leave and other transfer incomes 104 weeks before start of disability pension or voluntary early retirement the period 1999-2008 .Zero on the x-axis indicates the week the person started getting disability pension or early voluntary retirement



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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Fig2.svg
Fig3.svg

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

Lone Donbæk Jensen[1], Pia Ryom[2], Michael Victor Christensen[1], Johan Hviid Andersen[3]

1. Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Denmark.
2. Danish Ramazzini Centre, Department of Occupational Medicine, Aalborg University Hospital, Denmark.
3. Danish Ramazzini Centre, Department of Occupational Medicine, Herning University Hospital, Denmark

Correspondence to Lone Donbæk Jensen, Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Noerrebrogade 42, Building 2C, DK-8000 Aarhus C, Denmark;

lonjesen@rm.dk, phone: +45 78464290

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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 sector[1]. 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 disorders[6]. Also risks of affective and stress related disorders[7-8] and hand eczema[9] 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 workers[12] or leaving nursing care[13]. Disability pension is shown to be associated with increased mortality[14] but also with better health[15] 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

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 1993[3]. 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)[18] 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 1997. The follow up data included data from the DREAM register with weekly registration of public transfer payment at individual level in the follow up period. We recoded the originally 104 different transfer payment codes from the DREAM register into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other non permanent transfer payment as vocational rehabilitation and social assistance, 5) disability pension and flex job a health dependent half time pension and 6) voluntary early retirement. The register is thought to be near to complete based on the economically incentive for the employer to report to public authorities. The cohort was followed in the DREAM register until 2008 providing a follow up time of 15 years.

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

or no. A positive answer includes both ongoing and confirmed cases. Physical Work factors were assessed by questions of: Working hour's day, evening or night, working place hospital or eldercare, index describing heaviness of care where heavy care was defined by a combination of having more than 2/3 of the daily patients needing full care together with more than 10 handlings of persons per day. Rated Perceived Exertion (RPE) was assessed from a modified Borg scale range 0-14[19] anchored 1=very very light and 13=very very strenuous, values >=8 was defined as high RPE. Psychosocial Work factors were assessed using a Danish version[20] of Karasek's Job Content Questionnaire (JCQ) which is shown to have acceptable internal consistency in the health care sector[21]. The 3 items in the demand score were time pressure, perceived strain and tiredness returning from work. The range in the demand index score was 5-15, low demand were defined by values lower or equal to 9. The 3 items in the decision latitude score were possibilities of decision of work pace, how the work was carried out and work disposition. The range in the decision latitude index score was 5-15. High decision latitude was defined by values lower or equal than 9. Violence at work assessed by 5 items: never, seldom, sometimes, often and very often. Upper and lower extremities symptoms was assessed using Nordic questionnaire[22], and serious upper extremity complaints was defined as sick leave > 30 days for at least one region within the last year, serious lower extremity complaints was defined as sick leave > 30 days for at least one region within the last year. LBP was assessed by pain drawing including level of radiating pain combined with 0-10 point Visual Analogue Scale (VAS) describing level of usual pain, and duration of pain was assessed by a and a question asking : "For how long have you altogether had low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days, 31-90 days, more than 90 days" and a question asking "Have you ever had acute LBP in relation to person handling or other work tasks". Knowledge of health parameters

as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro intestinal diseases and rheumatologic inflammatory diseases was obtained from a list of questions 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. Relevant covariates were tested for colinearity which was not found. 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, 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 time[23]. 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 Female	 1.7 98.3	 1.9 98.1	 1.5 98.5	 1.3 98.7
Education/grade % -7 -9 years primary school -10 years primary school or basic vocational course	 29.3 41.6	 22.9 41.3	 36.3 46.4	 39.4 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 31-90 days More than 90 days	20.3 7.8 13.6	22.3 9.0 9.1	17.5 5.5 14.0	18.0 7.4 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 limp disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limp 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[24]

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 retirement, altogether 11,186 years amounting about 410 million Euro in direct costs from early retirement transfer payments.

Figure 2 shows an increasing number of participants who choose early voluntary retirement during the follow up period, whereas the number per year being granted disability pension is stable until 2002 with a rise the following years until 2007 where a decline is seen. At that time there is a corresponding rise in voluntary early retirement. This pattern could be explained by a change in the interpretation of the disability pension legislation. The mean age of those granted disability pension is stable between 50 and 55 years over the 15 year follow up period. The minimum age obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is explained by a temporary change in the legislation. Altogether 344 persons chose to postpone the early voluntary retirement after having got their early voluntary pension certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to the age of 66 year.

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

Figure 3_a reveals that disability pension is preceded of a decline in work presence from about 60% two years prior to the week of disability pension to about 20% 12 weeks before. During the 2 years preceding disability pension there is an increase other transfer incomes with a lower benefit properly because sick leave by Danish

legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be sick listed as unemployed which can explain the decline in number receiving unemployment benefit.

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

Risk factors for early retirement

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

Health related risk factors for disability pension was more than 90 days of LBP the last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk 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

	Voluntary early pension n= 904		Disability pension n=540	
Risk factors	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 - mixed	1.16 0.90	0.92 to 1.46 0.74 to 1.11	1.18 0.97	0.87 to 1.61 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 1-7 days 8-30 days 31-90 days More than 90 days	 0.98 0.71 0.71 0.58 0.72	 0.77 to 1.24 0.56 to 0.89 0,55 to 0.91 0.40 to 0.82 0.54 to 0.97	 1.36 1.34 1.35 1.29 2.27	 0.93 to 1.26 0.94 to 1.92 0.92 to 1.97 0.81 to 2.05 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 limp 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 limp 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 Rheumatologic inflammatory diseases	1.21 1.76	1.00 to 1.47 1.25 to 2.48	1.39 2.42	1.10 to 1.76 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

could not corroborate that physical or psychosocial workload found in other studies[12;26;29-31] played a major role as targets for primary prevention. Rated Perceived exertion at work, but not the heaviness of clients assessed from an index based on number of clients needing full care in combination with number of person handlings a day, was a risk factor. The finding of an elevated risk of evening work are in accordance with a Danish register study focusing on shift work in all sectors and disability[32] the only work related factor with an elevated risk of choosing early voluntary retirement was high demands at work. The interaction term job strain did not contribute to the models (results not shown). In a study from the Finnish public service sector[26] it is argued that job strain are to be evaluated on job unit level, in this study we have information of 200 different work sites. But as the nursery homes, home care units or hospitals in the actual study are rather different in size we do not have the possibility to make valid work site aggregated measures of exposure.

Many studies report associations between sick leave and disability pension[33]. To our knowledge no other studies have investigated risk factors of early voluntary retirement. Early voluntary retirement at the age of 60 years was mainly associated with low educational level, and the protective effect of spouse being on income transfer and living alone is consistent with primarily economic imperatives for choosing early voluntary retirement. In this study we found no strong argument for health related factors as being important in the decision to retire voluntary, except for small effects from cardiovascular, rheumatologic inflammatory diseases and gastrointestinal disease.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI, and this finding questions ongoing activity at the work site for making individual life style factors the main suspects for intervention in order to stay active in work for more years[34].

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

The pattern of vocational status the 2 years preceding the time of early retirement differs completely between disability pension and voluntary early retirement. Different legislation obviously play a role but it is although surprising that health and work related factors seem to be without importance for people choosing voluntary early retirement in a profession which in many investigations are found to be physical and psychological demanding[2-5].

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

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

Exploring risk factors for disability pension in an uniform population have the advantages that the results are less dependent on residual confounding as underlying socio economical factors which are known to be strong predictors of disability[35]. The data on prognostic factors was self reported and assessed at one point only.

The information about the non musculoskeletal symptoms was limited to a question "Have our physician ever told you that you have one or more of the following diseases". The register gives no information of the diagnostic reasons/basis/foundation of the disability pension and 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 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.

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

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.

Headings. Figure 1 to figure 3

Figure 1.

Flow chart, selection and course of study population

Figure 2.

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

Figure 3.

Vocational status, sick leave and other transfer incomes 104 weeks before start of disability pension or voluntary early retirement the period 1999-2008 .Zero on the x-axis indicates the week the person started getting disability pension or early voluntary retirement

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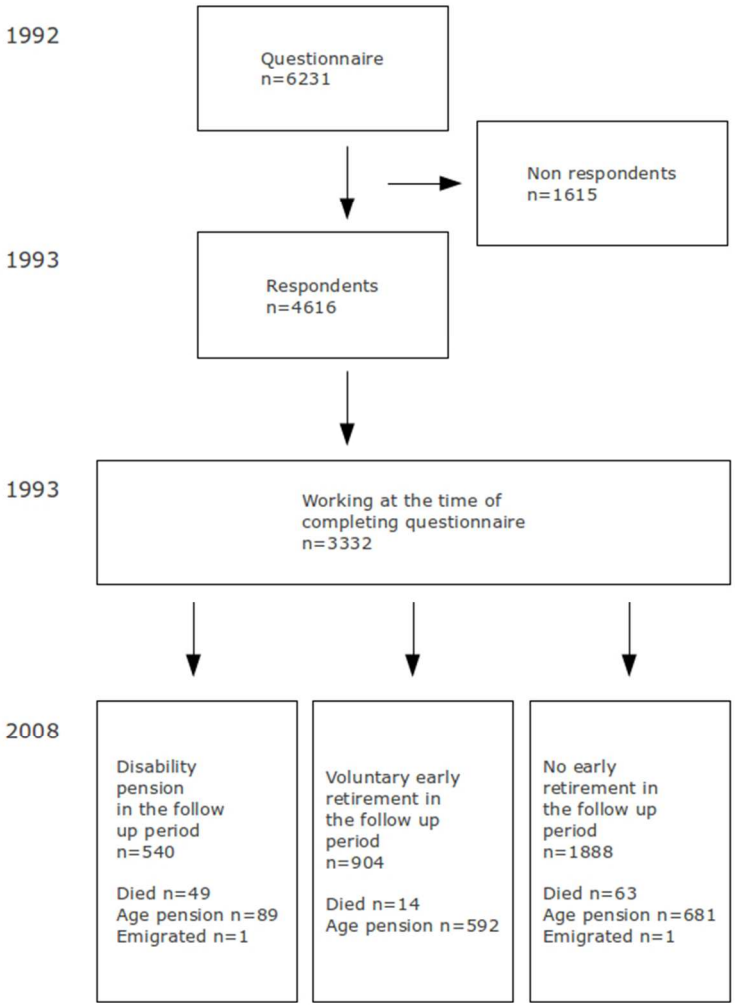

Point to point letter with our response to the issues raised by the referees

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.

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

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 was 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.

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

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 or no. A positive answer includes both ongoing and confirmed cases .**

As the term low education page 10 line l8 is imprecise it is changed to the following:

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 and ~~low educated~~.

3) The conclusion contains information that was not in the aims for the study.

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

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

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

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

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

Br J Ind Med. 1988 Jun;45(6):387-95.
Back pain, back abnormalities, and competing medical, psychological, and social factors as predictors of sick leave, early retirement, unemployment, labour turnover and mortality: a 22 year follow up of male employees in a Swedish pulp and paper company. Astrand NE, Isacsson SO.

Wallman T, Wedel H, Johansson S, Rosengren A, Eriksson H, Welin L, Svärdsudd K.

The prognosis for individuals on disability retirement. An 18-year mortality follow-up study of 6887 men and women sampled from the general population.

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

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

There are only few studies of predictors of early retirement among health care workers[12] or leaving nursing care[13]. **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)

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

We think the non response analyses is natural and relevant in the characterisation of the population and important in discussion of the bias and external validity of the study

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

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

The figures have 1 decimal which we find appropriate

We find that table 2 is important interpreting the final model in table 3

8) The discussion section contains many numbers that are presented earlier in the MS.

We have deleted the figures with the precise Hazard Ratios and confidence intervals

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

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

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

Reviewer 2: Jenny Hubertsson
Answers relating to 8 specific comments - Reviewer 2

1)Abstract:
The description of the design is very brief. There is no information on data sources or how and when baseline data was obtained.

We agree and have added the following

Abstract d**esign:**

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

2) I find the conclusion in the abstract somewhat misleading as it refers to those being granted disability pension and those choosing voluntary retirement as one group while in the conclusion of the article text the lack of shared risk factors for the two types of early retirement is pointed out. I think the conclusion of the article text is more accurate to the findings of the study.

We agree that the conclusion is unclear and do not fully cover the results of the study. The conclusion is changed to the following:

Conclusion: 43.3% of nurses aides gainfully employed in 1993 ~~was granted disability pension or chose early voluntary retirement in~~ **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.

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

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

..the vocational record in the 15 years follow up for each person was established. **Relevant covariates were tested for colinearity which was not found.** We used Cox proportional hazards models to examine the longitudinal association between the outcome measure

4)I would like to see a discussion around why BMI and physical activity are dichotomized and how this might affect the results for these variables. Could it have been done differently?

BMI was analysed as a continuous variable where we found a linear association, leading to the choice to dichotomise to limit the number of freedom degrees.

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

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

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

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

Concerning changing in exposure over time there is a tendency in Denmark towards heavier clients and lesser time per client. In 1993 hoist and other helping devices was introduced in many places, but the use of helping devices had grown during the follow up time.
A Study from Sweden ***(hornej 2004)*** *report slight higher RPE at work compared to our study but support that the working conditions reported in 1993 are still relevant and not due to major changes in the follow up period.*

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We have added the following in the discussion section(page 19 line: 50-56)

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;32+ (hornej 2004)].

6)According to for example the STROBE Statement the discussion should address limitations, taking into account eventual imprecision's of the study results. As reflected in my comments above I think a discussion around this is lacking.

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

We have after the revision addressed the following limitations:

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

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

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. Page19: line55-60

The register gives no information of the diagnostic reasons/basis/foundation of the disability pension and the lacking information of sick leave before 2007 rule out the inclusion of sick leave data in the prognostic model for both outcomes(page 19: line 33-37).

The data on prognostic factors was self reported and assessed at one point only. The information about the non musculoskeletal symptoms was limited to a question "Have our physician ever told you that you have one or more of the following diseases". The register gives no information of the diagnostic reasons/basis/foundation of the disability pension and the lacking information of sick…(page 19: line24-31)

Other minor comments:

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

You are right the rheumatologic diseased is included(page 18: line26)

In this study we found no strong argument for health related factors as being important in the decision to retire voluntary, except for ~~small~~ effects from cardiovascular, **rheumatologic inflammatory diseases** and gastrointestinal disease.

8)Figure 3_a and 3_b is a bit unclear. Should it say -104 weeks at both points?

You are right, the figure has been corrected

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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

Lone Donbæk Jensen[1], Pia Ryom[2], Michael Victor Christensen[1], Johan Hviid Andersen[3]

1. Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Denmark.
2. Danish Ramazzini Centre, Department of Occupational Medicine, Aalborg University Hospital, Denmark.
3. Danish Ramazzini Centre, Department of Occupational Medicine, Herning University Hospital, Denmark

Correspondence to Lone Donbæk Jensen, Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Noerrebrogade 42, Building 2C, DK-8000 Aarhus C, Denmark;

lonjesen@rm.dk, phone: +45 78464290

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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 with a follow up period of 15 years~~

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:

Conclusion: 43.3% of nurses aides gainfully employed in 1993 ~~was granted disability pension or chose early voluntary retirement in~~ **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.

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INTRODUCTION

10% of the European workforce is occupied in the health care sector[1]. 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 disorders[6]. Also risks of affective and stress related disorders[7-8] and hand eczema[9] 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 workers[12] or leaving nursing care[13] **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 1993[3]. 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

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

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 was 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 or no. A positive answer includes both ongoing and confirmed cases .** ~~Demographic and background variables included age, gender, education, vocational status of spouse, marital status and workers compensation case~~. Physical Work factors were assessed by questions of: Working hour's day, evening or night, working place hospital or eldercare, index describing heaviness of care where heavy care was defined by a combination of having more than 2/3 of the daily patients needing full care together with more than 10 handlings of persons per day. Rated Perceived Exertion (RPE) was assessed from a modified Borg scale range 0-14[15] anchored 1=very very light and 13=very very strenuous, values >=8 was defined as high RPE. Psychosocial Work factors was assessed using a Danish version[16] of Karasek's Job Content Questionnaire (JCQ) which is shown to have acceptable internal consistency in the health care sector[17]. The 3 items in the demand score were time pressure, perceived strain and tiredness returning from work. The range in the demand index

score was 5-15, low demand were defined by values lower or equal to 9. The 3 items in the decision latitude score were possibilities of decision of work pace, how the work was carried out and work disposition. The range in the decision latitude index score was 5-15. High decision latitude was defined by values lower or equal than 9. Violence at work assessed by 5 items: never, seldom, sometimes, often and very often. Upper and lower extremities symptoms was assessed using Nordic questionnaire[18], and serious upper extremity complaints was defined as sick leave > 30 days for at least one region within the last year, serious lower extremity complaints was defined as sick leave > 30 days for at least one region within the last year. LBP was assessed by pain drawing including level of radiating pain combined with 0-10 point Visual Analog Scale (VAS) describing level of usual pain, and duration of pain was assessed by a and a question asking : "For how long have you altogether had low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days, 31-90 days, more than 90 days" and a question asking "Have you ever had acute LBP in relation to person handling or other work tasks". Knowledge of health 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. **Relevant covariates were tested for colinearity which was not found.** 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.~~ 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 time[19]. 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 limp disorder %	4.2	1.9	4.5	11.7
More than 30 days of sick leave the last year because of lower limp 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 retirement, altogether 11,186 years amounting about 410 million Euro in direct costs from early retirement transfer payments.

Figure 2 shows an increasing number of participants who choose early voluntary retirement during the follow up period, whereas the number per year being granted disability pension is stable until 2002 with a rise the following years until 2007 where a decline is seen. At that time there is a corresponding rise in voluntary early retirement. This pattern could be explained by a change in the interpretation of the disability pension legislation. The mean age of those granted disability pension is stable between 50 and 55 years over the 15 year follow up period. The minimum age obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is explained by a temporary change in the legislation. Altogether 344 persons chose to postpone the early voluntary retirement after having got their early voluntary pension certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to the age of 66 year.

Figure 3_a and 3_b includes distribution of work, sick leave, unemployment benefit and other nonpermanent transfer incomes every week the 2 years preceding the granting of disability pension respectively early voluntary retirement. The population is restricted to person changing to early retirement from 1999 as we only have data on sick leave from 1997 in the DREAM register.

Figure 3_a reveals that disability pension is preceded of a decline in work presence from about 60% two years prior to the week of disability pension to about 20%, 12 weeks before. During the 2 years preceding disability pension there is an increase other transfer incomes with a lower benefit properly because sick leave by Danish legislation is restricted to 52 weeks. The Danish legislation offers the possibility to be

sick listed as unemployed which can explain the decline in number receiving unemployment benefit.

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

Risk factors for early retirement

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

Health related risk factors for disability pension was more than 90 days of LBP the last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk 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

	Voluntary early pension n= 904		Disability pension n=540	
Risk factors	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 limp 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 limp 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[20-22]. 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

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 could not corroborate that physical or psychosocial workload found in other studies[12;21;25-27] played a major role as targets for primary prevention. Rated Perceived exertion at work, but not the heaviness of clients assessed from an index based on number of clients needing full care in combination with number of person handlings a day, was a risk factor. The finding of an elevated risk of evening work are in accordance with a Danish register study focusing on shift work in all sectors and disability[28] the only work related factor with an elevated risk of choosing early voluntary retirement was high demands at work. The interaction term job strain did not contribute to the models (results not shown). In a study from the Finnish public service sector[21] it is argued that job strain are to be evaluated on job unit level, in this study we have information of 200 different work sites. But as the nursery homes, home care units or hospitals in the actual study are rather different in size we do not have the possibility to make valid work site aggregated measures of exposure. Many studies report associations between sick leave and disability pension[29]. To our knowledge no other studies have investigated risk factors of early voluntary retirement. Early voluntary retirement at the age of 60 years was mainly associated with low educational level, and the protective effect of spouse being on income transfer and living alone is consistent with primarily economic imperatives for choosing early voluntary retirement. In this study we found no strong argument for health related factors as being important in the decision to retire voluntary, except for small effects from cardiovascular, **rheumatologic inflammatory diseases** and gastrointestinal disease.

For both outcomes we found no associations with smoking, low physical leisure activity or BMI, and this finding questions ongoing activity at the work site for making individual life style factors the main suspects for intervention in order to stay active in work for more years[30].

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

The pattern of vocational status the 2 years preceding the time of early retirement differs completely between disability pension and voluntary early retirement. Different legislation obviously play a role but it is although surprising that health and work related factors seem to be without importance for people choosing voluntary early retirement in a profession which in many investigations are found to be physical and psychological demanding[2-5].

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

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

Exploring risk factors for disability pension in an uniform population have the advantages that the results are less dependent on residual confounding as underlying socio economical factors which are known to be strong predictors of disability[31]. The data on prognostic factors was self reported and assessed at one point only.

The information about the non musculoskeletal symptoms was limited to a question "Have our physician ever told you that you have one or more of the following diseases". The register gives no information of the diagnostic reasons/basis/foundation of the disability pension and 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;32+ (hornej 2004)] .

~~The working conditions as perceived exertion in care duties, part of very care needing clients use of helping equipment in the eldercare in 1993 are comparable with working conditions reported in 2003 and 2005~~[~~1;32~~]. 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 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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Licence statement

Competing interest declaration.

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

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.

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Headings. Figure 1 to figure 3

Figure 1.

Flow chart, selection and course of study population

Figure 2.

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

Figure 3.

Vocational status, sick leave and other transfer incomes 104 weeks before start of disability pension or voluntary early retirement the period 1999-2008 .Zero on the x-axis indicates the week the person started getting disability pension or early voluntary retirement

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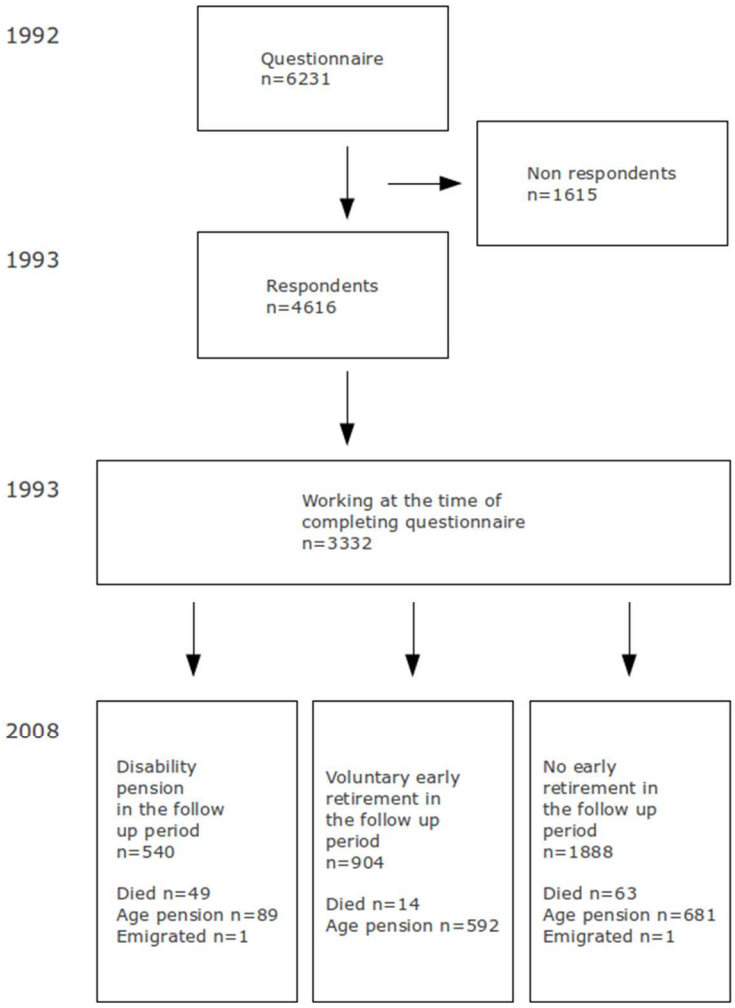
Note: The following files were submitted by the author for peer review, but cannot be converted to PDF. You must view these files (e.g. movies) online.

Fig2.svg
Fig3.svg



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Lone Donbæk Jensen[1], Pia Ryom[2], Michael Victor Christensen[1], Johan Hviid Andersen[3]

1. Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Denmark.
2. Danish Ramazzini Centre, Department of Occupational Medicine, Aalborg University Hospital, Denmark.
3. Danish Ramazzini Centre, Department of Occupational Medicine, Herning University Hospital, Denmark

Correspondence to Lone Donbæk Jensen, Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Noerrebrogade 42, Building 2C, DK-8000 Aarhus C, Denmark;

lonjesen@rm.dk, phone: +45 78464290

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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 sector[1]. 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 disorders[6]. Also risks of affective and stress related disorders[7-8] and hand eczema[9] 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 workers[12] or leaving nursing care[13]. Disability pension is shown to be associated with increased mortality[14] but also with better health[15] 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

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 1993[3]. 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)[18] 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 1997. The follow up data included data from the DREAM register with weekly registration of public transfer payment at individual level in the follow up period. We recoded the originally 104 different transfer payment codes from the DREAM register into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other non permanent transfer payment as vocational rehabilitation and social assistance, 5) disability pension and flex job a health dependent half time pension and 6) voluntary early retirement. The register is thought to be near to complete based on the economically incentive for the employer to report to public authorities. The cohort was followed in the DREAM register until 2008 providing a follow up time of 15

years.

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 or no. A positive answer includes both ongoing and confirmed cases. Physical Work factors were assessed by questions of: Working hour's day, evening or night, working place hospital or eldercare, index describing heaviness of care where heavy care was defined by a combination of having more than 2/3 of the daily patients needing full care together with more than 10 handlings of persons per day. Rated Perceived Exertion (RPE) was assessed from a modified Borg scale range 0-14[19] anchored 1=very very light and 13=very very strenuous, values >=8 was defined as high RPE. Psychosocial Work factors were assessed using a Danish version[20] of Karasek's Job Content Questionnaire (JCQ) which is shown to have acceptable internal consistency in the health care sector[21]. The 3 items in the demand score were time pressure, perceived strain and tiredness returning from work. The range in the demand index score was 5-15, low demand were defined by values lower or equal to 9. The 3 items in the decision latitude score were possibilities of decision of work pace, how the work was carried out and work disposition. The range in the decision latitude index score was 5-15. High decision latitude was defined by values lower or equal than 9. Violence at work assessed by 5 items: never, seldom, sometimes, often and very often. Upper and lower extremities symptoms was assessed using Nordic questionnaire[22], and serious upper extremity complaints was defined as sick leave > 30 days for at least one region within the last year, serious lower extremity complaints was defined as sick leave > 30 days for at least one region within the last year. LBP was assessed by pain drawing including level of radiating pain combined with 0-10 point Visual Analogue Scale (VAS) describing level of usual pain, and duration of pain was assessed by a and a question asking : "For how long have you altogether had low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days,

31-90 days, more than 90 days" and a question asking "Have you ever had acute LBP in relation to person handling or other work tasks". Knowledge of health parameters as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro intestinal diseases and rheumatologic inflammatory diseases was obtained from a list of questions 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. Relevant covariates were tested for colinearity which was not found. 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, 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 time[23]. 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 Female Education/grade %	 1.7 98.3	 1.9 98.1	 1.5 98.5	 1.3 98.7

-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[24]

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 retirement, altogether 11,186 years amounting about 410 million Euro in direct costs from early retirement transfer payments.

Figure 2 shows an increasing number of participants who choose early voluntary retirement during the follow up period, whereas the number per year being granted disability pension is stable until 2002 with a rise the following years until 2007 where a decline is seen. At that time there is a corresponding rise in voluntary early retirement. This pattern could be explained by a change in the interpretation of the disability pension legislation. The mean age of those granted disability pension is stable between 50 and 55 years over the 15 year follow up period. The minimum age obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is explained by a temporary change in the legislation. Altogether 344 persons chose to postpone the early voluntary retirement after having got their early voluntary pension certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to the age of 66 year.

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

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

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

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

Risk factors for early retirement

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

Health related risk factors for disability pension was more than 90 days of LBP the last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk

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

	Voluntary early pension n= 904		Disability pension n=540	
Risk factors	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 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 could not corroborate that physical or psychosocial workload found in other studies[12;26;29-31] played a major role as targets for primary prevention. Rated Perceived exertion at work, but not the heaviness of clients assessed from an index based on number of clients needing full care in combination with number of person handlings a day, was a risk factor. The finding of an elevated risk of evening work are in accordance with a Danish register study focusing on shift work in all sectors and disability[32] the only work related factor with an elevated risk of choosing early voluntary retirement was high demands at work. The interaction term job strain did not contribute to the models (results not shown). In a study from the Finnish public service sector[26] it is argued that job strain are to be evaluated on job unit level, in this study we have information of 200 different work sites. But as the nursery homes, home care units or hospitals in the actual study are rather different in size we do not have the possibility to make valid work site aggregated measures of exposure.

Many studies report associations between sick leave and disability pension[33]. To our knowledge no other studies have investigated risk factors of early voluntary retirement. Early voluntary retirement at the age of 60 years was mainly associated with low educational level, and the protective effect of spouse being on income transfer and living alone is consistent with primarily economic imperatives for choosing early voluntary retirement. In this study we found no strong argument for health related factors as being important in the decision to retire voluntary, except for small effects from cardiovascular, rheumatologic inflammatory diseases and gastrointestinal disease.

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

activity or BMI, and this finding questions ongoing activity at the work site for making individual life style factors the main suspects for intervention in order to stay active in work for more years[34].

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

The pattern of vocational status the 2 years preceding the time of early retirement differs completely between disability pension and voluntary early retirement. Different legislation obviously play a role but it is although surprising that health and work related factors seem to be without importance for people choosing voluntary early retirement in a profession which in many investigations are found to be physical and psychological demanding[2-5].

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

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

Exploring risk factors for disability pension in an uniform population have the advantages that the results are less dependent on residual confounding as underlying socio economical factors which are known to be strong predictors of disability[35]. The data on prognostic factors was self reported and assessed at one point only.

The information about the non musculoskeletal symptoms was limited to a question "Have our physician ever told you that you have one or more of the following

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

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.

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

interests that may be relevant to the submitted work to declare.

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.

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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

Lone Donbæk Jensen[1], *Pia Ryom*[2], *Michael Victor Christensen*[1], *Johan Hviid Andersen*[3]

1. Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Denmark.
2. Danish Ramazzini Centre, Department of Occupational Medicine, Aalborg University Hospital, Denmark.
3. Danish Ramazzini Centre, Department of Occupational Medicine, Herning University Hospital, Denmark

Correspondence to Lone Donbæk Jensen, Danish Ramazzini Centre, Department of Occupational Medicine, Aarhus University Hospital, Noerrebrogade 42, Building 2C, DK-8000 Aarhus C, Denmark;

lonjesen@rm.dk, phone: +45 78464290

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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 sector[1]. 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 disorders[6]. Also risks of affective and stress related disorders[7-8] and hand eczema[9] 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 workers[12] or leaving nursing care[13]. Disability pension is shown to be associated with increased mortality[14] but also with better health[15] 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

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 1993[3]. 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)[18] 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 1997. The follow up data included data from the DREAM register with weekly registration of public transfer payment at individual level in the follow up period. We recoded the originally 104 different transfer payment codes from the DREAM register into five variables: 1) employment, 2) sick leave, 3) unemployment benefit, 4) other non permanent transfer payment as vocational rehabilitation and social assistance, 5) disability pension and flex job a health dependent half time pension and 6) voluntary early retirement. The register is thought to be near to complete based on the economically incentive for the employer to report to public authorities. The cohort was followed in the DREAM register until 2008 providing a follow up time of 15

years.

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 or no. A positive answer includes both ongoing and confirmed cases. Physical Work factors were assessed by questions of: Working hour's day, evening or night, working place hospital or eldercare, index describing heaviness of care where heavy care was defined by a combination of having more than 2/3 of the daily patients needing full care together with more than 10 handlings of persons per day. Rated Perceived Exertion (RPE) was assessed from a modified Borg scale range 0-14[19] anchored 1=very very light and 13=very very strenuous, values >=8 was defined as high RPE. Psychosocial Work factors were assessed using a Danish version[20] of Karasek's Job Content Questionnaire (JCQ) which is shown to have acceptable internal consistency in the health care sector[21]. The 3 items in the demand score were time pressure, perceived strain and tiredness returning from work. The range in the demand index score was 5-15, low demand were defined by values lower or equal to 9. The 3 items in the decision latitude score were possibilities of decision of work pace, how the work was carried out and work disposition. The range in the decision latitude index score was 5-15. High decision latitude was defined by values lower or equal than 9. Violence at work assessed by 5 items: never, seldom, sometimes, often and very often. Upper and lower extremities symptoms was assessed using Nordic questionnaire[22], and serious upper extremity complaints was defined as sick leave > 30 days for at least one region within the last year, serious lower extremity complaints was defined as sick leave > 30 days for at least one region within the last year. LBP was assessed by pain drawing including level of radiating pain combined with 0-10 point Visual Analogue Scale (VAS) describing level of usual pain, and duration of pain was assessed by a and a question asking : "For how long have you altogether had low back pain the last year, with the response alternatives 0 days, 1-7 days, 8-30 days,

31-90 days, more than 90 days" and a question asking "Have you ever had acute LBP in relation to person handling or other work tasks". Knowledge of health parameters as lung diseases, nervous diseases, skin diseases, cardiovascular disease, gastro intestinal diseases and rheumatologic inflammatory diseases was obtained from a list of questions 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. Relevant covariates were tested for colinearity which was not found. 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, 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 time[23]. 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 Female Education/grade %	 1.7 98.3	 1.9 98.1	 1.5 98.5	 1.3 98.7

-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[24]

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 retirement, altogether 11,186 years amounting about 410 million Euro in direct costs from early retirement transfer payments.

Figure 2 shows an increasing number of participants who choose early voluntary retirement during the follow up period, whereas the number per year being granted disability pension is stable until 2002 with a rise the following years until 2007 where a decline is seen. At that time there is a corresponding rise in voluntary early retirement. This pattern could be explained by a change in the interpretation of the disability pension legislation. The mean age of those granted disability pension is stable between 50 and 55 years over the 15 year follow up period. The minimum age obtaining early voluntary pension is 60 years. The drop below 60 years in 1995 is explained by a temporary change in the legislation. Altogether 344 persons chose to postpone the early voluntary retirement after having got their early voluntary pension certificate: 55 to the age of 61 year, 166 to the age of 62, 12 to the age of 65 and 6 to the age of 66 year.

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

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

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

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

Risk factors for early retirement

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

Health related risk factors for disability pension was more than 90 days of LBP the last 12 years (HR 2.27(95 % CI 1.55 to 3.34)), more than 30 days of sick leave because of upper extremity disorders (HR 2.18 (95 % CI 1.08 to 2.11)), more than 30 days of sick leave because of lower extremity disorders (HR 1.51 (95%CI 1.08 to 2.11)), inflammatory rheumatic disease (HR 2.42 (95 % CI 1.67 to 3.52)) and gastro intestinal disorders (HR 1.39 (CI 1.10 to 1.76)). Of non health factors low education (HR 1.27 (95 % CI 1.02 to 1.57)), workers compensation case (HR 1.51 (95 % CI 1.23 to 1.87)), evening work (HR 1.29 (95 % CI 1.03 to 1.60)) and high rated perceived exertion at work (HR 1.23 (95% CI 1.00 1.51)) were independent risk

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

	Voluntary early pension n= 904		Disability pension n=540	
Risk factors	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 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 could not corroborate that physical or psychosocial workload found in other studies[12;26;29-31] played a major role as targets for primary prevention. Rated Perceived exertion at work, but not the heaviness of clients assessed from an index based on number of clients needing full care in combination with number of person handlings a day, was a risk factor. The finding of an elevated risk of evening work are in accordance with a Danish register study focusing on shift work in all sectors and disability[32] the only work related factor with an elevated risk of choosing early voluntary retirement was high demands at work. The interaction term job strain did not contribute to the models (results not shown). In a study from the Finnish public service sector[26] it is argued that job strain are to be evaluated on job unit level, in this study we have information of 200 different work sites. But as the nursery homes, home care units or hospitals in the actual study are rather different in size we do not have the possibility to make valid work site aggregated measures of exposure.

Many studies report associations between sick leave and disability pension[33]. To our knowledge no other studies have investigated risk factors of early voluntary retirement. Early voluntary retirement at the age of 60 years was mainly associated with low educational level, and the protective effect of spouse being on income transfer and living alone is consistent with primarily economic imperatives for choosing early voluntary retirement. In this study we found no strong argument for health related factors as being important in the decision to retire voluntary, except for small effects from cardiovascular, rheumatologic inflammatory diseases and gastrointestinal disease.

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

activity or BMI, and this finding questions ongoing activity at the work site for making individual life style factors the main suspects for intervention in order to stay active in work for more years[34].

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

The pattern of vocational status the 2 years preceding the time of early retirement differs completely between disability pension and voluntary early retirement. Different legislation obviously play a role but it is although surprising that health and work related factors seem to be without importance for people choosing voluntary early retirement in a profession which in many investigations are found to be physical and psychological demanding[2-5].

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

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

Exploring risk factors for disability pension in an uniform population have the advantages that the results are less dependent on residual confounding as underlying socio economical factors which are known to be strong predictors of disability[35]. The data on prognostic factors was self reported and assessed at one point only.

The information about the non musculoskeletal symptoms was limited to a question "Have our physician ever told you that you have one or more of the following

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

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.

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

interests that may be relevant to the submitted work to declare.

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.

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