

## EXTENDED REPORT

## Socioeconomic status, occupation, and risk of hospitalisation due to coxarthrosis in Denmark 1981–99

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**Objectives:** To predict the relative risk and time trend in hospitalisation due to coxarthrosis (CA) among groups of different socioeconomic status and occupations in order to test existing aetiological hypotheses.

**Methods:** Four consecutive cohorts of all gainfully employed Danish men were followed up for CA. Standardised hospitalisation ratios (SHR) and time trends were calculated.

**Results:** Self employed men had an SHR due to CA of 140 (95% confidence interval (CI) 130 to 151) in 1994–99. It changed  $-1.2\%$  (95% CI  $-2$  to  $-0.4$ ) annually from 1981 to 1999. Self employed farmers had an SHR of 286 (95% CI 262 to 313) during 1994–99, increasing  $0.14\%$  a year (95% CI  $-0.9$  to  $1.1$ ) from 1981 to 1999. Unskilled men had an SHR of 121 (95% CI 113 to 130) in 1994–99. The SHR increased  $1.6\%$  annually (95% CI  $0.7$  to  $2.4$ ) from 1981 to 1999. Employed agricultural workers had an SHR of 189 (95% CI 158 to 227) from 1994 to 1999. The SHR increased  $3.7\%$  annually (95% CI  $1.2$  to  $6.2$ ) from 1981 to 1999.

**Conclusions:** The relative risk of hospitalisation due to CA was consistently high among farmers in four successive analyses spanning an 18 year period. The relative risks remained stable over time despite the fact that the number of farmers decreased. The risk increased among employed workers in agriculture and horticulture over that period, and an increased risk was also found among tractor drivers and a few other occupations.

According to a Danish–Swedish study 40% of ideopathic cases of coxarthrosis (CA) can be attributed to physical workload, 55% to sports, and 15% to being overweight.<sup>1</sup> Altogether the three factors account for 80% of CA. The calculations are based on a case-control study of 239 male recipients of a hip prosthesis and 302 men randomly selected from the general population. March and Bachmeier estimated the costs connected with musculoskeletal disorders,<sup>2</sup> of which CA is the most common, to be 1–2.5% of the gross national product in Western industrialised countries. Clearly, identification of risk factors, monitoring of high risk groups, and prevention are very important public health issues.<sup>3</sup>

Two reviews from 1997 conclude that there is an association between farming and CA.<sup>3,4</sup> Lievense *et al* systematically reviewed two retrospective cohort and 14 case-control studies published between 1993 and April 2000 relating CA to the workload.<sup>5</sup> Cases of CA were defined as patients with radiological and/or clinical CA, or a (total) hip replacement, or who were on the waiting list for one. The authors evaluated a possible publication bias by means of a funnel diagram of the odds ratios (OR) by sample size but found none. The studies included found ORs between 1.1 and 13.8. The OR varied between 2 and 14 in those studies in which the physical workload was farming. The six studies on heavy lifting reported ORs between 1.5 and 3.5 compared with no or low exposure to lifting heavy weights. The authors found moderate evidence for a threefold risk of heavy workload in patients with CA. They also found moderate evidence for a positive relationship between a history of farming and the occurrence of CA. Further evidence to support the part that jobs and occupational physical activities play in the occurrence of CA was recently reported by Schouten *et al*.<sup>6</sup> Lau *et al* found increasing OR with body height, and a high OR in men with a history of joint injury (OR = 25; 95% confidence interval (CI) 3.5 to 181), and occupational exposure to walking, kneeling, climbing stairs

frequently (OR = 12.5; 95% CI 1.5 to 104), and lifting  $\geq 10$  kg more than 10 times a week (OR = 5.3; 95% CI 1.8 to 15.8).<sup>7</sup>

A relatively old case-control study published in Swedish and not included in the reviews should be mentioned.<sup>8</sup> Cases were 98 people with total hip replacement due to (CA). Ninety eight hospital controls with inguinal hernia and 202 population controls were included. Compared with the hospital controls the risk ratio in farmers was found to be 4.9 (95% CI 3.0 to 8.1). The author suggested that CA in farmers may be due to tractor driving in a twisted position. We will look at self employed in tractor pools to test that hypothesis. Also cow milking was associated with an increased risk (risk ratio = 1.8; 95% CI 1.1 to 3.4).

Interesting new hypotheses about specific work tasks of farmers are tested in a case-control study by Thelin *et al*, based on a cohort of farmers affiliated with the Swedish Farmers' Safety and Preventive Health Association.<sup>9</sup> Despite a limited exposure contrast because all the controls were farmers too, they found strong and significant evidence for an association between CA and several occupational burdens. Farmers with larger dairy and swine confinement operations had an increased risk of acquiring OA of the hip. In a multivariate logistic regression model those who milked more than 40 cows daily had an increased risk (OR = 4.5; 95% CI 1.9 to 11.0) compared with those who did not work in dairy production. Those who had worked more than five hours daily in animal barns over a long period of time also had an increased risk (OR = 13.3; 95% CI 1.2 to 145.0) compared with those who did not work with animals. In another model those who had large farm areas ( $>100$  ha) had a significantly decreased risk (OR = 0.14; 95% CI 0.05 to 0.43) compared with those who had smaller farm areas.

**Abbreviations:** CA, coxarthrosis; CI, confidence interval; OA, osteoarthritis; OR, odds ratio; SHR, standardised hospitalisation ratio

Further evidence for the role of CA was found in a recent study of hip pain.<sup>10</sup> Hip pain is both an antecedent and a symptom of CA, and the study showed that hip pain was predicted by obesity, physically demanding work, and self reported whole body vibrations five years earlier.

Although farming had already been reported to be associated with CA in 1966,<sup>11</sup> we found no studies of time trends for different socioeconomic groups or specific occupational groups such as farmers. A Swedish study suggests that the prevalence of CA as seen on radiographs in subjects who have had a normal radiographic examination of the colon may be increasing.<sup>12</sup> Because the division of farm labour has changed and employees are more exposed to whole body vibrations, twisted positions, and heavy physical labour for longer hours we suggest that more admissions to hospital due to CA will occur among employees in farming. If tractor driving is a risk factor, as has been suggested, we should find an increased risk among those working in tractor pools.

This study aimed at estimating the time trend in hospitalisation due to CA among different socioeconomic groups and groups with specific occupations by comparison of four successive cohorts. Another aim was to estimate the standardised hospitalisation ratio (SHR) for occupational groups in order to identify possible new occupational risk factors.

## MATERIAL AND METHODS

All gainfully employed Danish men, aged 20–59 years in January 1981, 1986, 1991, and 1994, were classified according to their most important occupation in 1980, 1985, 1990, and 1993, respectively. These cohorts were followed up for first hospital admission with CA from 1981 to 1985, 1986 to 1990, 1991 to 1993, and 1994 to 1999, respectively.

This study uses first admissions in the follow up periods with the discharge diagnosis of International Classification of Diseases codes (ICD-8 = 713.00 or ICD-10 = M16). People with hip pain are usually only admitted to hospital if they seek and accept hip replacement surgery. According to population based surveys, only 15% of those with severe arthritis do so.<sup>13</sup>

All admissions to hospital and all deaths during the five, five, three, and six years of follow up, respectively, were recorded by linkage of the population census of Denmark to the national patient register and the death register. Coding of occupations was done by an employment classification module. The linked information is stored in the occupational hospitalisation register.

### The national patient register and the death register

The national patient register contains data on all admissions to public and private Danish hospitals (more than 99% of all admissions); it is updated every year. The personal identification number (PIN) from the national patient register was used in the crosslinking procedure.

### The central population register

From the central population register information on sex, date, and year of birth was extracted. The central population register was used to identify all gainfully employed men who lived in Denmark on 1 January 1981, 1986, 1991, or 1994.

### The employment classification module

The employment classification module contains information about economic activity, employment status, socioeconomic status, occupation, and industry. Employment status is a national code. The occupational code is an extended classification of the International Standard Classification of Occupations (ISCO) 1968 version, which also includes self employed men or from 1993 DISCO-88 (used in table 3). The

industrial code is a national extension of the International Standard Classification of all Economic Activity (ISIC) 1968 version.

Everybody in Denmark older than 16 years of age is classified annually according to occupation in the employment classification module. From 1975 the employment classification module replaced the traditional survey based censuses. The data sources are several administrative registers. In Denmark the reportable financial transactions, including capital gains, salary, and wages, enable taxation authorities to preprint a tax declaration for each employee that is usually correct. A register for self employed people kept by the customs and taxation authorities holds additional information from independent enterprises. The Danish version of the 1988 ISCO classification (DISCO) of employees is also reportable for the employer. Registers of payments to the supplementary labour market pension fund, employment files for public employees, registers of graduation from various educational establishments, including education in the labour market, are all used in the classification of each person. Fixed criteria are used to handle inconsistencies between various sources of information.

### Validity of the basic information

Year of birth and sex are parts of the PIN and are consequently recorded practically without errors. The completeness and accuracy of these data are shown by the fact that the matching of different registers by the PIN was 100% complete. The primary data producers do not routinely check data on occupation, but information from various sources is compared and pooled together in the employment classification module. A recent thesis showed that 66.4% of the bus drivers occupied in Greater Copenhagen for more than six months in 1980, according to company personnel files, were also classified as employed by a bus company and as a bus driver in the classification of occupations. An additional 30% had either the occupation or the industry code correct. It was shown that these misclassifications bias the risk estimate slightly towards unity.<sup>14</sup> Farmers have an additional classification as an independent firm so the classification of occupation may be almost without errors.

The validity of the register based CA diagnosis was evaluated by one of the authors (MVJ) based on medical file abstraction of a complete sample of 110 hospitalisations occurring between 1987 and 1988 in a university hospital in Copenhagen.<sup>15 16</sup> A diagnosis was considered confirmed if it was based both on symptoms and on *x* ray diagnosis according to the classification of diseases. A diagnosis was considered tentative if the basis was only a clinical examination without *x* ray or surgery. Because a review of the symptoms and disease were present in the text it was not possible to blind the evaluator, who reassessed the diagnosis on basis of the entire medical file. The criteria were conservative because they are used to decide whether patients need surgery or not and whether surgery was recommended. Tentative diagnoses are not included in the occupational hospitalisation register.

### Analysis

We calculated SHRs by dividing the observed number by the expected number of admissions to hospital in each cohort in a given occupation and multiplying it by 100. The expected number was based on age-specific incidence rates for all gainfully employed men in Denmark. The counting of person-years at risk was censored at the date of first admission to hospital due to CA, emigration, or death, whichever came first.

Because the socioeconomic groups and the employment groups are large and the number of admissions due to CA is

**Table 1** Average annual change rate 1981–99 with 95% confidence interval (CI) in predicted age standardised hospitalisation ratio (SHR), and SHR 1994–99 for coxarthrosis (ICD-8=713.00, ICD-10=M16) by socioeconomic status among Danish men

Socioeconomic status	People	Annual change rate (%)		Predicted SHR	
		1981–99	95% CI	1994–99	95% CI
Self employed men	159591	–1.2	–2 to –0.4	140	130 to 151
Managers*	5100	1.6	–3.9 to 7.0	83	55 to 126
Senior salaried staff	162868	0.0	–1.5 to 1.6	56	50 to 63
Leading salaried staff	170402	1.7	0.4 to 3.0	87	80 to 95
Other salaried staff	198460	0.9	–0.4 to 2.3	96	87 to 106
Skilled workers	267169	1.2	0.1 to 2.4	95	88 to 104
Unskilled workers	332686	1.6	0.7 to 2.4	121	113 to 130
Not economically active	192088	0.1	–1.0 to 1.1	156	145 to 169

\*With more than 20 employees.

low per person-year at risk, log-linear Poisson regression is an appropriate way to model the SHR, with interaction between employment group and time, and with the expected number of discharges as an offset. As time we used the distance in years between the midpoints of the follow up periods in each of the four cohorts. The model was applied to groups of different socioeconomic status and occupations. The parameters were estimated using SAS (SAS Institute Inc) Proc Genmod. The large-sample 95% CIs were calculated using the estimated standard errors. Pearson's goodness of fit test<sup>17</sup> was used to evaluate the appropriateness of the model assumptions. The model passed the test ( $p = 0.72$  for the analysis of occupations,  $p = 0.79$  for the analysis of socioeconomic groups).

## RESULTS

The diagnosis validation study showed that 98% of cases were correctly classified as 713.00, coxarthrosis (ICD-8 code). One case (1%) was misclassified, as it should have been 713.01 arthrosis of the knee. One case (1%) with the modification "obs. Pro." (under observation for) had minimal  $\chi$  ray findings in disagreement with the symptoms.

Table 1 shows the association between socioeconomic status and admissions due to CA in 1994–99. Self employed men, unskilled workers, and people not economically active have a high risk of admission while senior salaried staff and leading staff have a low risk. We found a statistically significant decrease in SHR among self employed from 164 (95% CI 152 to 177) in 1981–85 to 140 (95% CI 129 to 151) in the most recent period. Among skilled workers we saw an SHR increasing to 95 (95% CI 88 to 104) in the most recent

period. Among unskilled manual workers we saw an SHR increasing to 121 (95% CI 113–130) in the most recent period. These figures need to be interpreted with caution because the measures are relative. Therefore changes in one group automatically imply changes in the others. In the earliest period 1981–85 the self employed farmers accounted for 32% of the self employed men and as many as 70% of the cases in that group. In the most recent period self employed farmers accounted only for 21% of the self employed men and 53% of the cases in that group. The dramatic fall in the numbers of farmers may even explain some of the change in SHR among the unskilled workers and the other socioeconomic groups.

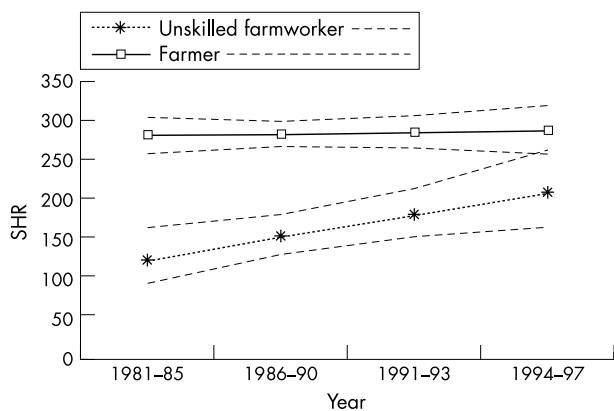
Table 2 shows SHR in agricultural occupations. We found a high relative risk of CA among self employed farmers who had a predicted SHR of 281 in the first follow up period, and 286 during 1994 to 1999. Among employed agricultural workers the predicted SHR increased from 114 in the first follow up period to 189 (95% CI 158 to 227) in the most recent period. Among self employed in tractor pools we found an SHR of 210 in the first period. From 1994 to 1999 it was 183.

Figure 1 shows a stable triple risk of CA among self employed farmers (0.14% average annual increase in the predicted SHR (95% CI –0.9 to 1.1)). Among employees (skilled and unskilled farm workers combined) we found an average risk at the start of the period but a high risk in the most recent periods. The increase in predicted SHRs was strong and statistically significant (3.7% per year; 95% CI 1.2 to 6.2).

Table 3 shows SHR for other occupations with statistically significant relative risks. Occupations with low risk can be

**Table 2** Predicted age standardised hospitalisation ratio (SHR) for coxarthrosis among men in selected occupations by follow up period and 95% confidence intervals (CI)

Occupational category	Time period	People at risk	Observed number	SHR	95% CI
Self employed farmers	1981–85	63990	458	281	259 to 304
	1986–90	52907	433	283	269 to 298
	1991–93	42825	213	285	268 to 302
	1994–99	34068	355	286	262 to 313
Self employed people in agricultural tractor pools	1981–85	1414	4	210	97 to 455
	1986–90	1365	6	200	122 to 327
	1991–93	1287	3	192	116 to 315
	1994–99	1157	5	183	86 to 387
Employees in agriculture and horticulture	1981–85	21811	37	114	89 to 147
	1986–90	21507	60	138	118 to 161
	1991–93	20351	33	160	140 to 183
	1994–99	20734	97	189	158 to 227



**Figure 1** Time trends in predicted standardised hospitalisation ratios and 95% confidence intervals due to coxarthrosis among male self employed farmers and male employees in farming and horticulture.

characterised as white collar jobs performed mostly while sitting. High risk occupations can be described as blue collar jobs with exposure to vibrations, heavy lifting, walking, and standing work.

## DISCUSSION

We found that the relative risk of admission to hospital due to CA was consistently high among farmers in four successive analyses spanning 19 years. These increased risks remained stable over time despite the fact that the number of farmers decreased significantly. The risk increased among employed workers in agriculture and horticulture over the same period. The results agree with reports of high risks found among farmers in the UK,<sup>18, 19</sup> and in Sweden.<sup>1, 20-24</sup> We also found an increased risk in tractor drivers and a few other occupations. The relative high risk among self employed men in agricultural tractor pools is interesting because of the exposure to vibrations and work in a twisted posture. High risks found among other professional drivers also support the hypothesis that driving and whole body vibration contribute to the development of CA.

Our results are based on admissions to hospital due to CA in four consecutive cohorts of all gainfully employed men in Denmark. Referral bias is often a major problem in hospital

based studies. It is, however, a methodological strength that all first hospital admissions due to CA in Denmark are included and that geographical distances are small even for farmers. It is also an advantage that admissions are free of charge. It was shown for ischaemic heart disease that only lower grade hospital staff had referral bias resulting in an excess SHR.<sup>25</sup> If there were any effect of the referral system it should show up as a reduced risk in farmers because of the geographical distances and not as an excess risk. Population based studies show that only a small fraction of those with hip pain seek and accept hip replacement surgery.<sup>13</sup> We cannot exclude the possibility that farmers and other groups who are very dependent on their mobility are more likely to accept hip replacement surgery, but Thelin suggest that the opposite may also happen: "The entrepreneurship and the family-farming situation very often force the farmer to delay a planned surgery."<sup>26</sup> Neither can we exclude the possibility that an increasing load of heavy work among farm employees might motivate a higher proportion to accept hip replacement. On the other hand, many other groups have the same dependence on their mobility without having an increased relative risk of admission to hospital due to CA.

It is often difficult to choose a comparable reference group. We chose the entire gainfully employed male population as our standard in order to mitigate the healthy worker effect. We did not standardise for social class because CA seems to have more specific causes and because such standardisation tends to underestimate the true effects.

Vingård, *et al* argued that CA may remove people from their occupation a long time before they have a hospital diagnosis, and that a better point at which to measure occupation is 10 years before the start of follow up.<sup>23</sup> To test this we selected men who had the same occupation in 1985 as they had in 1980 and followed them up for CA in the following five years. For all three occupational groups the corresponding SHR values were only one point higher or lower than for the entire cohort. Therefore we did not implement that restriction in the entire study because it would have prevented full use of the four consecutive cohorts.

A possible explanation for the high risk among agricultural occupations might be that more than 50% of all part time disability pensions are given to farmers, which implies that they continue to work despite some disability. In a study of 1283 male farmers and 334 male farm workers, Thelin *et al* found a lower risk of retiring due to health problems among

**Table 3** Estimated age standardised hospitalisation ratio (SHR) for coxarthrosis among Danish men in occupations with significantly low or high SHR\* 1994-99 and 95% confidence intervals (CI)

	People	Cases	Exp.	SHR	95% CI
Electronics mechanics and servicers	5920	1	8.1	12	0.3 to 68.7
Business professionals†	7442	6	21.2	28	10.4 to 61.7
Buyers	2963	3	9.2	33	6.7 to 95.1
Teaching professionals†	5658	4	10.7	37	10.2 to 95.4
Medical doctors	8959	11	24.1	46	22.8 to 81.6
College, university, and higher education teaching professionals	4502	8	16.6	48	20.8 to 94.9
Agricultural or industrial machinery mechanics and fitters	8716	9	18.1	50	22.7 to 94.3
Architects, engineers, and related professionals†	35751	47	87.2	54	39.6 to 71.7
Armed forces	27739	14	24.6	57	31.1 to 95.3
Technical and commercial sales representatives	21014	36	50.4	71	50.0 to 98.9
Heavy truck and lorry drivers	25879	82	60.3	136	108.1 to 168.8
Motor vehicle drivers†	9062	43	29.1	148	106.9 to 199.0
Meat and fish processing machine operators	13001	30	16.4	183	123.7 to 261.6
Bakers, pastry cooks, and confectionery makers	4487	20	9.8	204	124.5 to 314.7
Waiters and bartenders	3496	11	5.4	204	102.0 to 365.6
Wood product machine operators	6940	17	8.3	205	119.3 to 327.9
Machine operators and assemblers†	3367	16	7.7	207	118.3 to 336.2

\*Except those already shown in table 2; †not elsewhere classified.



farmers but a higher relative risk among farm employees than in other occupationally active men in the same rural community.<sup>27</sup> Therefore, removal from the workforce due to health may be less prevalent among farmers than in other occupations. Because our study did not include people aged over 60 at baseline, and because we have at least three years of follow up time, independent of current occupational status, we do not believe that health based early retirement in other occupational groups can explain our findings. The group of pensioners retiring at an early age had a risk nearly as high as that of the farmers: in the period 1994–99, 434 cases of “early age” pensioners had an SHR of 174 (95% CI 158 to 191).

One might speculate that farmers are more active in sports. Thelin *et al* suggested this might be a confounding factor.<sup>9</sup> They had no data about sports activities, however. We have recently collected data for the Danish Work Environment Cohort (a national representative survey carried out every five years) and found that only one third of self employed farmers in the year 2000 were physically active in leisure time for more than four hours a week compared with 42% of all occupationally active men. In conclusion, we find it unlikely that any selection bias or confounding could explain the consistent pattern of a stable high relative risk among farmers and the increasing relative risk among skilled and unskilled agricultural workers.

The increasing risk among farm employees may be partially explained by the concentration in farming. The number of farms (and self employed farmers) has dropped dramatically from 64 000 in 1980 to 34 000 in 1995. The number of farm workers is almost the same (17 500) but the average number on each farm has increased accordingly. Because there are fewer farmers and they function more as managing directors, the farm workers have taken over the ploughing, which may be the worst hip loading work, and other heavy physical work as well. The standing work in connection with milking is now often four hours compared with only one hour some years ago when a typical farm had only 40–50 cows. In addition, many other functions have become specialised, meaning that a worker is doing the same task for longer periods and is therefore relatively more exposed to repetitive strains (Hjort C, personal communication).

The pathogenesis of osteoarthritis (OA) is not entirely known, although many different workloads have been suggested in the aetiology of CA. Thelin suggested that driving a tractor in a twisted posture may contribute to the disease and loads from heavy lifting and walking on rough ground.<sup>8 22 28</sup> Jacobsson *et al* reported an increased incidence of heavy labour, farming, heavy lifting, and tractor driving among patients with CA (defined as being on the waiting list for total hip replacement or having a joint space <3 mm).<sup>24</sup> Our results for people employed in tractor pools give some support to the hypothesis that tractor driving is a high risk factor of CA. The risk we found among farmers was, however, higher than among tractor pool owners. This might imply that tractor driving is not the only or the main cause of CA among farmers. These results do not give any indication of whether a high risk of CA is due to driving in a twisted position or due to vibrations, heavy lifting, or two or more of these causes.

Sisto *et al* were surprised to find an association between OA and varicose veins.<sup>29</sup> We suggest that prolonged standing may be the common causal factor.<sup>30</sup> We find support for this hypothesis in the high risk of CA we found among meat and fish processing operators, bakers, pastry cooks and confectionery makers, waiter and bartenders, wood product machine operators and machine operators and assemblers. Such an explanation is also in accordance with findings by

Cvijetic *et al*, who found a strong association between radiological signs of hip arthritis and standing at work for men.<sup>31</sup> In this Croatian–British study, 292 women and 298 men who did not have rheumatoid arthritis or gout were asked detailed questions on their occupational history, including load on the hip (hours spent sitting, standing, walking, and lifting heavy objects). The authors conclude that prolonged standing may influence the development of CA. They suggest that prevention of prolonged standing may reduce the incidence of CA.

A recent Japanese case-control study found a significant OR of 3.6 of CA among people regularly lifting  $\geq 25$  kg or more during their first employment and an OR of 4.0 among workers lifting  $\geq 50$  kg in their main job.<sup>32</sup> Lau *et al* found that Chinese men who lifted  $\geq 10$  kg, more than 10 times a week had fivefold risk of CA and the risk was 10-fold if they lifted  $\geq 50$  kg.<sup>7</sup> Two other studies found a strong association between lifting and CA,<sup>33 34</sup> and a clear chronological order between exposure and effect support a causal interpretation of this finding.

Hip pain is both an antecedent and a symptom of CA, and a recent study showed that hip pain can be predicted by obesity, physically demanding work, and whole body vibrations five years earlier.<sup>10</sup> The idea that vibrations may have a role in the causation of OA is not new, but documentation is sparse. According to a review by Felson, OA of the elbow, shoulder, and wrist joints was, however, already associated with vibrations from Jackhammer vibrations before the second world war.<sup>35</sup>

Our finding of a stable high relative risk of CA among the self employed and a rapidly increasing risk among farm employees clearly indicates the need for a focused intervention strategy. Such a strategy may include identification and reduction of the suspected exposures: heavy lifting, prolonged standing, whole body vibrations, heavy physical work, tractor driving in a twisted posture, and much walking, especially on rough ground.

Our data support the hypothesis that professional driving may play a part in the aetiology of CA because we found a high risk of the disease among the self employed in tractor pools and among heavy lorry and truck drivers. We also found an increased risk among employees whose jobs required much walking and standing, such as waiters and machine operators.

In conclusion, we have found, firstly, that the relative risk of admission to hospital due to CA was consistently high among farmers in four successive analyses spanning a 19 year period; secondly, that these increased risks have remained stable over time despite the fact that the number of farmers has decreased; thirdly, the risk increased among employed workers in agriculture and horticulture over that time period; and fourthly, we also found an increased risk in tractor drivers and a few other occupations.

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