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Baseline incidence of ill health in agriculture in Great Britain

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This report reviews existing information on baseline levels of ill health in agriculture. Information on ill health in the industry was identified using a wide ranging search strategy, including searches of online bibliographical databases, web search engines and reports from expert committees and researchers in the area of agriculture and health. Papers identified were then subject to critical review.

Overall, the review showed that there is very little current information available on the prevalence or incidence of occupational ill health in the agriculture industry. Incidence data are available only for zoonoses and skin disease, with some prevalence data available primarily for musculo-skeletal and respiratory conditions. Mortality data and cancer data are invariably reported as proportional increases rather than as death or incidence rates, because of a lack of baseline population data.

Information gaps could be filled by expansion of existing recording schemes in agricultural areas, by further analysis of existing mortality data or by new studies of specific high risk groups (for example, forestry workers), with a view to assessing the baseline frequency, and measuring the success of interventions over a period.

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EXECUTIVE SUMMARY

Agriculture has one of the worst fatal accident records of any industry, while such issues as the physical nature of the work, exposure to weather, noise and vibration, contact with animals and exposure to hazardous chemicals pose threats to the health of the workers in the industry. In order to (i) assist in meeting the Public Service Agreement target of reducing the incidence of new cases of ill health and (ii) to help to evaluate and support the Workplace Health Direct initiative, the Health and Safety Executive need to establish baselines for the annual incidence of work-related ill health in the industry. The current study was therefore commissioned to carry out a review of existing information on baseline levels of ill health in agriculture.

The objectives of the study were (i) to identify and analyse existing information and evidence of defined ill health outcomes in agriculture in Great Britain, (ii) to evaluate the quality, reliability and relevance of existing information/data, (iii) to identify information/data gaps and (iv) to make recommendations as to how those gaps might be filled. For the purposes of the study, 'agriculture' was defined by reference to section A of the UK Standard Industrial Classification of Economic Activities, which includes agriculture, horticulture, forestry and related activities. Potential diseases were identified from medical knowledge, and from assessment of potential exposures in the agricultural industry and their associated medical conditions. Diseases were summarised in four mutually exclusive groups:

- Infectious diseases
- Musculo-skeletal diseases
- Diseases from physical agents (noise, vibration etc)
- Other diseases (including respiratory disease, dermatitis, mortality)

Information on ill health in the industry was identified using a wide ranging search strategy, including searches of online bibliographical databases, web search engines and reports from expert committees and researchers in the area of agriculture and health.

Many hundreds of papers and reports were identified during the information search. The abstracts of these papers were examined and used to identify those sources most relevant to the aims of the current study. This review process included the exclusion of papers which were more than 20 years old (unless these were the only source of information on a specific disease), and of papers referring to other countries where significant climate or process differences between there and the UK meant that the data were not helpful to the study. The remaining papers were then critically reviewed using a standard review form which included information on the diseases and occupations included, study design and reliability of findings.

Overall, the review showed that there is very little current information available on the prevalence or incidence of occupational ill health in the agriculture industry. Relatively few of the papers and reports identified contained UK data, many were case studies or were focused on agriculture in other European or North American countries. In some cases, the published information available was more than 20 years old. Nevertheless, some relevant data have been found and extracted.

Incidence data are available only for zoonoses and skin disease, with some prevalence data available primarily for musculo-skeletal and respiratory conditions. Mortality data and cancer data are invariably reported as proportional increases rather than as death or incidence rates, because of a lack of baseline population data. Of the zoonoses reported, Lyme disease and Q Fever are the most frequent, with incidence rates of 100 and 185 cases per year respectively. Musculo-skeletal conditions are also relatively prevalent, particularly low back pain (41%). Using current information on the number of agricultural workers in the UK we can estimate that this is equivalent to almost 200,000 cases of low back pain.

Chain saw users are at high risk of upper limb complaints, including shoulder, elbow and hand/wrist complaints with prevalence of over one third. This group of workers has also prevalence of 44% for HAVS/VWF, suggesting around 2000 to 2500 cases across the country. Respiratory disease generally, and particularly upper respiratory tract infections symptoms are reported by just under 40% of farm workers exposed to organic dusts.

It is clear that agricultural workers suffer a large number of occupational conditions, with high frequencies in some occupations. In most cases the information on frequency of these diseases is weak, and is unsatisfactory as a baseline for measuring the effect of interventions. Good information on frequency can best be obtained by specially designed studies. It would be convenient, if it were possible, to link to ongoing studies, such as the HSE series of self-reported work-related illness (SRWRI), or the THOR series of physician reporting schemes. Expansion of these schemes in agricultural areas might be possible.

Frequencies of pneumonia and other non-zoonotic infections in agricultural occupations in the UK are unknown, but the mortality data indicates that they are increased, and agricultural workers are heavily exposed to pathogenic bacteria. Some more detailed analysis of the mortality data would clarify the need for a special study of the frequency of infections in agricultural workers.

These apart, specific studies would be necessary, and we suggest that these could be focussed on specific high risk groups, with a view to assessing the baseline frequency, and measuring the success of interventions over a period. Forestry workers and tomato growers are obvious possibilities, and the relatively small number of employers would make studies easier to conduct than studies of multiple small farms.

1 INTRODUCTION

Agriculture has one of the worst fatal accident records of any industry while such issues as the physical nature of the work, exposure to weather, noise and vibration, contact with animals and exposure to hazardous chemicals pose threats to the health of workers in the industry. Some of HSC/E's priority topics are believed to be important contributors to the overall levels of occupational injury and ill health in the industry. In 1999, the HSC reported that 80% of agricultural workers had some form of musculoskeletal injury (aches, sprains or strains), twice the national average of people were affected by asthma, more than 20,000 people were affected by zoonoses and 25% of the workforce suffered some hearing loss from their work (Health and Safety Commission, 1999). Higher than average levels of anxiety and depression have been found among farmers in the UK (Malmberg *et al.*, 1997) and the suicide rate among farmers is among the highest for male occupational groups.

HSE needs to establish baselines for the annual incidence of work-related ill health in agriculture in Great Britain in order to (i) assist in measuring progress towards meeting the Public Service Agreement (PSA) target of reducing the incidence of new cases of ill health and (ii) help to evaluate and support the Workplace Health Direct initiative.

2 AIMS AND SCOPE OF THE STUDY

2.1 STUDY OBJECTIVES

The objectives of the study, based on the Invitation to Tender and subsequent discussions with the HSE project officer, were:

i. To identify and analyse existing information and evidence of defined ill health outcomes in agriculture in Great Britain
ii. To evaluate the quality, reliability and relevance of existing information/data
iii. To identify the information/data gaps
iv. To make recommendations as to how those gaps might be filled, with a view to establishing the incidence of ill health in the industry as a baseline against which progress towards the RHS/SH2 targets can be measured
v. To produce a written report

Specifically, the study aimed to estimate the incidence (or, where incidence data were not available, prevalence) of conditions for which there was some plausible cause attributable to occupation in the agricultural industry. These conditions could be specific to agriculture, for example dipper's flu, or more general conditions such as back pain which have many potential causes, of which working in agriculture is one.

For these more general causes we have included, where reported, information on data from outwith the agricultural industry, to help to assess what proportion of cases may be attributable to agricultural work.

2.2 OCCUPATIONS AND DISEASES TO BE STUDIED

The HSE stated that 'agriculture' was to be defined by reference to Section A of the UK Standard Industrial Classification of Economic Activities 1992, (Central Statistical Office, 1992) which includes agriculture, horticulture, forestry and related activities.

The review included all work-related ill health in agriculture with the exception of work-related stress which was the subject of a separately commissioned project. Potential diseases were identified from medical knowledge, and from assessment of potential exposures in the agriculture industry and any associated medical conditions. Table 1, taken from the study proposal, shows the types of exposures which may be experienced in the industry, and potential health effects.

Using expert judgement, this table was further refined, by associating exposures with specific occupations within the agriculture industry. This allowed the allocation of groups of diseases to specific occupations, e.g. occupational brucellosis would only affect individuals who work with cattle or cattle products. (For further details see section 2.3).

Table 1 Potential exposures and health effects in the agriculture industry sector

Exposures	***Health Effects***
Asthmagens (e.g. grain dust, feedstuffs, hay, straw)	Occupational asthma, respiratory disease, eye irritation, allergic reactions, bronchitis, farmer's lung, grain fever, bird breeder's lung
Biological agents	Zoonoses: brucellosis, orf, cow pox (mainly from cats), ringworm, cryptosporidium, ticks (Lyme disease), hydatids, leptospirosis (Weil's disease), tuberculosis, Q fever, tetanus, E coli, Salmonella, Streptococcus suis, ovine chlamydiosis, psittacosis
Chemical exposure, including pesticides and biocides	Dermatitis, systemic poisoning, neurological disease
Noise	Noise-induced hearing loss
Vibration	Vibration white finger, hand-arm vibration syndrome, back pain
Manual Handling	Arthritis, musculo-skeletal disorders, work-related upper limb disorders
Sunlight	Skin cancer
Burning moorland vegetation	Heat stress

All of the forgoing information was drawn together in a matrix of disease by occupation. This listed all occupations in Section A of the SIC (1992) and cross-tabulated these by exposure/disease groups. The matrix is reproduced in Appendix 2. The matrix was defined using an iterative process whereby additional information gained during the information searches was added as appropriate. The rows of the matrix list the occupation groups of interest as defined using the SIC codes for agriculture, augmented by job names from the Standard Occupational Classification (Office of Population censuses and Surveys, 1990) and more generic occupation terms. The occupations have been broadly grouped into categories such as horticulture, arable farming, forestry etc. The columns of the matrix are disease categories classified by exposure (where relevant), broad disease category and specific disease type.

2.3 IDENTIFICATION OF RELEVANT OCCUPATION/DISEASE COMBINATIONS

Greyed out cells in the occupation/disease matrix represent occupation/disease combinations which were not thought plausible. Cells were categorised in this way using the following process.

Firstly, the matrix of disease by occupation was drawn up as described above, with the diseases subdivided by causative agent (infection, chemical agent, noise etc). These diseases were reviewed and sources of disease identified (e.g. grain, animals, cattle, machinery etc). The sources of disease were used to identify those occupations which were potentially exposed to that source. Combinations of other occupations with these diseases were then designated as 'not relevant'.

'Relevant' occupations were those where exposure to the source of disease was as a direct result of the occupation. For example, cowman would be a relevant occupation for a disease carried by cattle, and although a poultry farmer may be indirectly exposed by working on a farm that also had cattle this occupation was not designated as relevant. Some specific rules used were:

- General terms for farmers, e.g. farm workers, farmers, farmer's wives were assumed to be potentially exposed to any of the sources of disease with the exception of bee stings
- Horticultural occupations (gardeners, glasshouse workers), forestry workers and mushroom, vegetable and herb growers were assumed not to be exposed to occupational disease from animals.
- Horticultural occupations (gardeners, glasshouse workers) were assumed not to be exposed to disease from grains.
- Diseases from specific animals were assumed to be relevant only to occupations concerned directly with those animals.
- Only beekeepers were designated as a relevant occupation for allergic reactions to bee stings.

Table 2 lists the identified sources of the diseases in the matrix.

Table 2 Diseases and sources identified

Disease	***Source or agent***
Alveolitis, farmer's lung, bird breeder's lung	Mouldy grain/hay, compost, birds
Asthma	Various, possible in any occupation
Brucellosis, undulant fever	Animals
Chronic obstructive pulmonary disease	Dust, outdoor working
Cow pox	Cattle, cats
Cryptosporidium	Animals
Dermatitis, eczema	Chemicals, animals, minor trauma
Dipper's flu	Sheep
Endotoxin fever	Stock, grain
Enteritis, colitis, diarrhoea, E coli, salmonella, typhoid	Animals, including game
Eye irritation, conjunctivitis, blepharitis	All occupations
General allergic reactions, anaphylactic shock	Bees
General poisoning, chronic and acute	Pesticides, fertilisers
Grain fever	Grain
Hand-Arm Vibration Syndrome	Vibrating tools
Heat exhaustion, dehydration, hypothermia	Working outside
Hydatid	Dogs (sheep)
Leptospirosis (rodent and non-rodent),	Rats (sewers, rivers), cattle
Lung cancer, mesothelioma	Asbestos (in buildings)
Meningitis, Streptococcus suis	Pig farming
Musculo-skeletal problems (including hip arthritis)	Various, possible in any occupation
Noise induced hearing loss, industrial deafness	Machinery, chainsaws
Ornithosis	Bird breeding, poultry workers
Ovine chlamydiosis	Sheep
Peripheral neuropathy	Sheep, pesticides
Pneumonia	Outdoor work
Rhinitis, hay fever	Pollen, possible in any occupation
Ringworm	Animals
Silo-fillers disease (allergic)	Grain
Staphylococcus, impetigo, boils	Animals
Sunburn, skin cancer, melanoma	Radiation, working outdoors
Tetanus	Cows, badgers, horses
Tick-borne disease (Q fever, lyme disease, Ricketsia burnetti)	Straw
Tuberculosis	Cows, deer
Warts	Slaughterhouse workers, butchers

2.4 POPULATION AT RISK

The principal focus of the study was on occupational ill health in the agriculture industry. The population at risk therefore comprised owners, managers and workers in the agriculture and forestry industry sectors. It was agreed with HSE that other individuals potentially exposed on farms, for example farmers' children, were not included in the review, whether or not their exposure might be considered occupational.

Information was extracted from the June Agricultural Census in 2003, published by DEFRA, on the estimated size of the labour force in agriculture in England, with comparable information for Wales for 2003 provided by the National Assembly for Wales. Labour force information for Scotland in 2003 was extracted from the Economic Report on Scottish Agriculture: 2004 edition published by the Scottish Executive. These data are summarised in Table 3.

Table 3 Size of the labour force in the agriculture sector in 2003

Employment group	*England*	*Scotland*	*Wales*	*Total*
Owners/Directors & Spouses	219123	42509	43800	305432
Managers[1]	11562	-	400	11962
Full-time Employees	52636	14510	3400	70546
Part-time Employees	26163	7039	3000	36202
Casual Labour	44933	4223	5000	54156
Total	354417	68281	55600	478298

[1] *Not identified separately in Scotland*

Limited information was available from England and Scotland on the breakdown of the labour force by gender, with no information available from Wales. In England, 85% of full-time employees were men while just over half (51%) of part-time employees were women. In Scotland, there was a similar pattern with most full-time workers being male (91%) and a lower proportion of men among part-time workers (66%). In Scotland, it was reported that 75% of casual labour were men.

It was noted that in Scotland, just over a third (34%) of owners/directors/spouses were spouses, compared to 24% in Wales (in 1993, the latest year for which this information was available).

Data for employment in the forestry sector are available from the Forestry Employment Survey 1998/99 published in 2001. These are summarised in Table 4.

Table 4 Size of the labour force in the forestry sector

Employment group	*England*	*Scotland*	*Wales*	*Total*
Forest nurseries	421	201	2	624
Establishment	1088	1189	252	2529
Maintenance	1680	1304	380	3364
Harvesting	2330	1947	493	4770
Road construction	181	179	47	407
Other Forest	466	372	144	982
Total Forest	6166	5192	1318	12676
Haulage	326	593	142	1061
Processing	5952	3083	2192	11227
Other non-forest	2295	1826	447	4568
Total non-Forest	8573	5502	2781	16856
Overall Total	14739	10694	4099	29532

Overall, there were just over half a million workers in the agricultural and forestry industries. Of these, only 6% worked in occupations in forestry. Almost three-quarters of those in the agricultural and forestry industries worked in England, 16% in Scotland and 12% in Wales.

3 METHODS

3.1 LITERATURE SEARCHES

The literature searches involved a wide sweep of the literature on diseases of people working in agriculture and related areas. The diseases identified in the disease by occupation matrix were used as search terms. To simplify the search process and the collation of large numbers of identified references, the diseases and agents were subdivided into three mutually exclusive groups, and searches carried out separately for each group. The groups were:

- Zoonoses, chemical agents, allergens and organic materials
- Other infections and physical agents
- Musculo-skeletal disease

Online medical dictionaries were consulted to check synonyms and the names of related diseases to be used in the searches. A list of the terms and synonyms is provided in Appendix 3. These terms were then combined using Boolean operators (AND/OR/NOT) with the terms 'horticulture', 'agriculture', 'farming' and 'forestry'. To reduce the number of 'false drops' (i.e. where a matching result is found to be not relevant to the search) and focus in on where the statistical basis of the research was indicated, the searches were then further refined with the search terms 'workers' and 'data'.

The databases used were the online CCOHS bibliographical databases: HSELINE, NIOSHTIC, OSHLINE, CISILO and CANADIANA, Toxline, Medline/PubMed, and Barbour Health and Safety Professional (see Appendix 3 for details). In addition, web search engines were used. References retrieved were on articles and reports, and included material published not just on UK studies, but on agriculture in the US, Europe, Australia and Japan. The purpose of this was to highlight and focus on any gaps in the UK research.

These searches resulted in the identification of hundreds of papers for each disease group. A first filtering process was then carried out, based on the abstracts, in which the papers were divided into:

- Papers which were clearly not relevant
- Non-UK papers which were unlikely to be relevant to UK processes (references to the agriculture in countries (such as South America and Africa) where the significant climate or process differences between there and the UK meant that the data were not helpful to this study)
- Non-UK papers which were possibly relevant to UK processes (mainly European and North American)
- UK papers which were possibly relevant to the study (but may be too old, or not contain useful information)
- UK papers which were definitely relevant to the study

All of the papers with the exception of the first group then went through a second stage review process where the abstracts were examined in detail to determine whether a copy of the paper should be obtained, based on the information provided in the abstract.

3.2 SEARCHES OF OTHER SOURCES

In addition to the literature searches, information was sought from websites, reports of expert committees and researchers in the area of agriculture and health. Websites were identified which listed potential sources of information outside of the published papers, including www.agrifor.ac.uk which provides a list of agricultural research centres (many of these are concerned with research into agricultural practices but a few address human health issues) and www.agsites.net which provides a comprehensive listing of agriculture websites worldwide. Information from the Advisory Committee on Pesticides and the Veterinary Products Committee was also obtained. Occupational reporting schemes were also consulted. The principal reporting scheme is THOR (The Health and Occupation Reporting) network which encompasses seven separate reporting schemes:

- SWORD: Surveillance of work related and occupational respiratory disease (Respiratory physicians)
- EPIDERM: (Dermatologists)
- MOSS: Musculoskeletal occupational surveillance scheme (Rheumatologists)
- OPRA: Occupational physicians reporting activity (Occupational physicians)
- SIDAW: Surveillance of infectious disease at work (Consultants in communicable disease control)
- OSSA: Occupational surveillance for audiological physicians (Audiological physicians)
- SOSMI: Surveillance of occupational stress and mental illness (Psychiatrists).

3.3 CRITICAL REVIEW OF PAPERS

A standard form was developed for the review of papers (Appendix 4). The form included the following information:

1. What diseases are described?
2. Are the diseases described occupational, or potentially (or partly) so?
3. Are formal frequencies given; incidence, prevalence; denominators
4. Does the information comprise case reports; how many, over what period, what geographical area
5. What agricultural sector and jobs
6. Caveats – e.g. study design issues, availability of exposure data
7. Other information
8. Other papers that should be read

Each UK paper was read, reviewed and given an overall classification as a key paper, a possibly relevant paper or a paper that was not relevant. Non-UK papers were judged according to how similar the processes were to what happens in the UK and were used mainly to identify potential gaps in the UK literature.

We have summarised the information from the papers differently according to the amount of data available, which varied by disease. Briefly, there were two main processes. For some diseases (for example, eye irritation), all of the relevant papers which were identified provided information which was not available in other publications and so were included in the detailed results reported in Chapter 4. For other diseases (e.g. infections), there was information from papers which, while not key to the findings of the study, provided some useful additional information on the diseases of interest. In these cases, the additional papers are not summarised in the main body of the report but are described briefly in Appendix 5.

3.4 MEASURES OF ILL HEALTH

The HSE is particularly interested in the annual incidence of occupational ill health in the agriculture industry. The annual incidence of a disease is the rate at which new cases occur in a defined population in a one year time period, for example an incidence of 10 per 100,000 people per year. However, many studies and reports present the prevalence of ill health rather than the incidence. The prevalence of a disease is the proportion of a defined population who have the disease at a specific point in time, for example when a survey is carried out. The two measures can be very different for any specific disease. A chronic incurable disease may have low incidence but high prevalence, whereas a short-duration curable condition may have a high incidence but low prevalence. In general terms, the prevalence rate is approximately equal to the incidence rate multiplied by the average duration of the disease. In this report, we have shown incidence rates where available, and prevalence rates where no incidence rates could be found.

Results of mortality studies would ideally be reported as cause specific death rates - the number of deaths from a specific cause divided by the population at risk - thus providing a measure of the number of deaths from that cause observed or expected in a population. However, many of the papers reviewed as part of the current study reported one of the following measures:

- Proportional Mortality Ratio (PMR): the proportion of the total number of deaths in the study group that were from a certain cause, expressed as a ratio of the proportion of all deaths in the general population that are from that cause.
- Proportional Cancer Mortality Ratio (PCMR): the proportion of the total number of cancer deaths in the study group that were from a certain cancer, expressed as a ratio of the proportion of all cancer deaths in the general population that are from that cancer cause.

Both of these measures are used when the size of the population from which the deaths occurred is unknown. They provide a comparative measure of mortality, compared to the reference population but cannot be used to determine a death rate in the population of interest. An analogous measure, the Proportional Registration Ratio (PRR) is used for cancer registration data rather than cancer mortality data. In the present study, no information on cause specific death rates was available due to the difficulties in enumerating the population at risk, and mortality findings have been reported as PMR, PCMR and PRR as appropriate.

4 RESULTS

4.1 STRUCTURE OF THIS CHAPTER

This chapter contains the detailed results of the information review, followed by a summary overview section. The detailed results are subdivided into four principal groups of diseases:

i. Infectious diseases (Section 4.2)
ii. Musculo-skeletal diseases (Section 4.3)
iii. Diseases from physical agents (Section 4.4)
iv. Other diseases – including respiratory disease, dermatitis and mortality (Section 4.5)

The summary overview is presented in section 4.6

4.2 INFECTIOUS DISEASES

Many individual papers were consulted in the course of the review of infectious diseases. These are listed in the reference section, and brief notes on the papers and reports that were consulted are included in Appendix 5. The key sources of information for the UK were found to be two overview reports. These are detailed below.

4.2.1 Zoonoses

The main sources of information on frequency of occupational infectious diseases are the Zoonoses Reports provided by the Department for Environment, Food and Rural Affairs and others. (Department for Environment, Food and Rural Affairs *et al.,* 2004) Overall frequency in the UK irrespective of occupation is reported, but some guide to the occupations implicated is given in the text of the reports. Additionally the 1993 HSE Report "The Occupational Zoonoses" (Health and Safety Executive, 1993) naturally refers only to zoonoses that were principally occupational. Table 5 lists the zoonoses reported by each of these sources. Cross-referencing between them enables judgements on which of the recent general frequencies of zoonoses described in the Zoonoses Reports are likely to be related to agricultural occupations. They have been grouped in the table according to whether they are (i) predominantly related to agricultural occupations, (ii) widespread but with reason for expecting farmers to be highly exposed (source in agriculture), or (iii) not strongly occupational or agriculturally related.

Inspection of the list of agricultural occupationally related infections reveals that most are relatively infrequent. The most frequent is Q Fever, though figures for 2002 were inflated by a single outbreak. Usually the incidence is about 50 per annum. Other infections are relatively uncommon. In the past Bovine Tuberculosis and Brucellosis have been major problems, but have responded to intensive control programmes focussing on animal health.

Inspection of the list of zoonoses that are widespread but have sources in farming reveals a massive endemic of Salmonella infections in the general population (actually half the number reported in the mid 1990s) (Department for Environment, Food and Rural Affairs *et al.,* 2004). No information is provided on the frequency in agricultural occupations. The sources are meats and farm animals, so it is probable that people in farming occupations are highly exposed to the infections. One 1988 report from Canada (West *et al.,* 1988) showed an association between carriage of Salmonella by dairy farm workers and the presence of the same organism in the bulk milk tank. The workers drank raw milk. Evidence was presented that the milk infected the workers rather than the other way round.

Infections with Vero cytotoxin-producing E. coli are becoming increasingly frequent in the general population, the source of outbreaks is usually infected meat. Contact with animals and their environment is important in the causation of sporadic cases (Department for Environment, Food and Rural Affairs *et al.*, 2004). The main reservoirs are cattle, sheep and goats. It is probable that farming occupations are highly exposed, but there is no information on the frequency of infections in these workers. Cryptosporidiosis is also widespread, and now mostly related to contamination of water supplies. Sources of sporadic cases are young calves or lambs. The frequency in agricultural occupations is unknown. The list of zoonoses not related particularly to agricultural occupations is included for completeness, but these diseases are not considered further.

Table 5 Reports on frequency of zoonoses

Disease	***Occupations and frequency stated by HSE 1993, unless otherwise noted***	***2002 Zoonoses Report***	***Source***
HSE lists as related to occupation		**Frequency in general population**	
Anthrax	1 in 10 years. Agricultural, abattoir workers, bone/bone meal processing, vets, knackermen, construction, stock farming/breeding, butchery, wool industry, hair and bristle processing, tannery workers	None in 2002	Imported hides
Bovine TB	40 in 1998 (MAFF 1998). Stockmen, dairy and deer farmers, vets, abattoir workers, laboratory workers	20 in 2002	Milk from infected cows
Brucellosis	7/annum in 1984 Farm workers, dairy workers, vets, laboratory workers. Lower risks in slaughterhouse, knackermen, butchers	36 in 2002 mostly in N Ireland, and in farmers	
Hantavirus	Farmworkers, water sports, sewage workers, nature conservancy	None in 2002	From rodents, water borne
Hydatid	20/annum Shepherds, vets, kennel staff, hunt pack workers	10 in 2002	From dogs: sheep an intermediate host
Leptospirosis (Weil's disease and cattle form)	Weil's disease; farmers, farmworkers, fish farmers, construction workers, water industry, leisure industry, sewer workers, laboratory workers Cattle form; cattle handlers, laboratory workers, vets and knackermen; about 50/year 1983-88	47 in 2002 13 were farmers or livestock workers	

Disease	*Occupations and frequency stated by HSE 1993, unless otherwise noted*	*2002 Zoonoses Report*	*Source*
Lyme disease	About 100/annum Tick bites; agriculture, forestry or leisure land management; esp. woodland and grassland	339 in 2002 14 in farm and forestry workers	
Newcastle disease	Rare. Lab. workers, lab. Animal attendants, vets, poultry breeders, preparers and packers, pet store workers, zoological and bird park keepers	Not stated	From birds
Orf	50/annum in farmers, shepherds, shearers, stock, cow, slaughterhouse workers, butchers, meat porters, vets	4 in 2002	Contact with sheep, rats[1] under-reported
Chlamydiosis 1. Ovine; (enzootic abortion)	Pregnant agricultural workers and vets; rare	None reported in recent years	From products of gestation; sheep, possibly goats and cattle.
Chlamydiosis 2. Psittacosis	Pet shop, garden centre workers, taxidermists, roof demolition and repair, farmers, poultry process workers, vets, meat inspectors, feather processors	145 in 2002	From birds
Q Fever	Can be sporadic non-agricultural, some associated with exposure to cattle; total185 in 1998	163 in 2002 (95 in a single outbreak)	Reservoirs in sheep and cattle, also goats, small mammals and ticks
Ringworm	Farmers, farmworkers, livestock handlers, vets, grooms, slaughterhouse workers, knackermen. Frequency not known	Common but unreported	From farm animals and pets
Streptococcus suis	1-2/annum, in pig farmers, abattoir workers, knackermen, butchers, domestic handling of pork	1 in 2002	Contact with pigs and pork
General in population, but source in agriculture			
Salmonella		16319 in 2002 (under-reported)	Meats, farm animals
Vero cytotoxin-producing E. coli		852 in 2002	Ruminants, meat products
Cryptosporidiosis		3663 in 2002	Water borne, contact with farm animals less commonly now .

Disease	*Occupations and frequency stated by HSE 1993, unless otherwise noted*	*2002 Zoonoses Report*	*Source*
Not related to agricultural occupations			
Campylobacter		52519 in 2002	Food: not occupational
Listeria		150 in 2002	Not occupational
Tapeworm		72 in 2002	Not occupational
Toxocariasis		3 in 2002	From dogs and cats
Toxoplasmosis		92 in 2002	From cat faeces
Trichinellosis		None in 2002	Infected pork
Yersiniosis		44 in 2002	Infected food or water
variant Creutzfeldt-Jacob disease		17 deaths in 2002	Not occupational
Rabies		None	
Cowpox		Rare, 11 between 1987-90	From cats, small rodents; in vets, lab., zoo workers

[1](Thomas *et al.*, 1999)

4.2.2 Non-zoonotic infections

Some reports from France and Canada (Gallagher *et al.*, 1984, Neukirch *et al.*, 1983) indicate increased rates of respiratory infections in farming occupations, possibly the result of exposure to inclement weather. Agricultural workers are exposed to heavy airborne loads of pathogenic and other bacteria (Staphylococci and Streptococci) (Dutkeiwicz, 1978).

In male farmers in England and Wales between 1979-80 and 1982-90, the mortality from infections of skin, joints and bone was increased; an SMR of 181 (Office of Population Censuses and Surveys *et al.*, 1995). It would be helpful to analyse this grouping in more detail.

4.2.3 Recommendations

Since many zoonoses are infrequent, and are strongly related to farming, the information provided by the Communicable Disease Surveillance Centres (CDSCs) (Department for Environment, Food and Rural Affairs *et al.*, 2004) is adequate for monitoring frequencies in agricultural occupations (more information on occupation would nevertheless be helpful, if it can be provided). Information is less satisfactory for zoonoses that are frequent and widespread in the general population, but are sourced originally from farm animals. Information is needed on the frequencies in agricultural workers. The CDSCs could be approached with a view to obtaining occupational information.

Frequencies of pneumonia and other non-zoonotic infections in agricultural occupations in the UK are unknown, but the mortality data indicates that they are increased, and agricultural workers are heavily exposed to pathogenic bacteria. Some more detailed analysis of the mortality data would clarify the need for a special study of the frequency of infections in agricultural workers.

4.3 MUSCULO-SKELETAL

4.3.1 Introduction

Material on musculoskeletal disorders (MSDs) can be clustered into two broad categories. Firstly there are those, primarily osteoarthritis (but also rheumatoid arthritis), for which objective diagnostic criteria are generally applied. The second broad category relates to symptom-based disorders of which the most commonly documented is low back pain (LBP). However, this distinction is not always clearly defined. For example, some upper limb disorders (ULDs) have clinically defined diagnostic signs (such as the crepitus associated with tenosynovitis) which can be used to provide a more objective diagnosis although even clinical examination can provide conflicting outcomes (Walker-Bone *et al.,* 2002). For epidemiology purposes, most studies rely on self-reported symptoms such as 'elbow pain' or 'shoulder pain'. In order to provide as broad a picture as possible of MSDs amongst those working in agriculture this review will reflect this common practice, presenting symptom-based 'diagnoses' as well as information on clinically defined and objectively diagnosed disorders.

From approximately 180 abstracts/titles (some were duplicates) approximately 52 were selected for closer examination. Of these, some 30 were reviewed in more detail.

4.3.2 The Evidence

General Musculo-Skeletal Disorders

A key text to provide a starting point for this review is the review article on MSDs in farmers and farm-workers prepared by Walker-Bone and Palmer (2002). Although published in 2002, few of the articles cited, other than others prepared by the same team, date from 2000 onwards. Therefore, papers published from 2000 are included in the present review. In addition, a few other papers published prior to this date are referred to, where they were not cited by Walker-Bone and Palmer.

Information at a general level is available from the series of surveys of self-reported work-related illness published by the HSE carried out as part of the Labour Force Survey. Walker-Bone and Palmer cite the 1995 survey, published in 1998. However, the most recent survey, relating to 2001/2002 (Jones *et al.,* 2003) provides more up to date information.

Jones et al estimate that some 12,000 workers in 'skilled agricultural trades' ascribe MSDs to their current job, representing a prevalence of 3.4 per 100 employed (although this estimate is based upon relatively few responses to the survey). This latter estimate can be compared to the prevalence for 'all occupations' of 2 per 100 employed. Analysing the data by industry sector rather than occupation, gives a slightly different prevalence for 'agriculture, hunting and forestry' of 3.8 per 100 (17,000 workers), again compared to a benchmark of 2 per 100 for all industries. Sample sizes were too small to allow estimates to be prepared by subdividing MSDs by locus of injury (backs, upper limbs, etc). Superficially, this appears to imply a considerable reduction in prevalence since the 1995 survey results cited by Walker-Bone and Palmer. These authors quote an estimate of 43,000 agricultural workers affected (no rate is given). However, the earlier survey presented all cases whilst the more recent data relate solely to those where the MSD is considered (by the respondent) to have been caused or made worse by their current job.

Data on self-reported sickness were also published in 2001 (Jones *et al.,* 2001) based upon a survey in 1998/99. However, responses from those working in the agricultural sector were

too few for any statistics to be computed. This is reflected in the most recent report (Jones *et al.,* 2003) where data from this sector are described as insufficient either to compare with the GB average or with the rate previously reported.

Osteoarthritis

The clearest evidence for an increased risk of MSD amongst those working in the agricultural sector appears to relate to osteoarthritis (OA), particularly OA of the hip. Walker-Bone and Palmer cite a number of studies from the UK and elsewhere which they describe as providing 'compelling evidence that farmers have an increased risk of hip OA'. Two papers are cited from the UK, by Croft et al (1992a, 1992b). In the first, a case-control study of subjects with hip OA compared to controls who no hip problems, the authors report an odds ratio of 2.0 for 10 or more years of employment in agriculture for cases with severe osteoarthritis compared to controls (1.6 for all agricultural workers and farmers irrespective of duration). However, no prevalence or incidence data are provided. In the second paper, a case control study of farmers compared to office workers, type of farming was also analysed. This analysis showed farmers employed in the growing of 'root vegetables' to have the highest odds ratio (2.5) compared to farmers in other types of farms, with dairy farmers second (1.9), although neither odds ratio was significantly different from 1.0. The prevalence of hip osteoarthritis amongst those who had farmed for at least one year was 13% (60-70 years of age) increasing to 23.6% for those above 70 years. In comparison prevalence amongst office worker controls was 1.6% (60-70) rising to 5% for those over 70 years. No data on younger workers were presented.

Walker-Bone and Palmer next reviewed the published evidence relating to OA of the knee. This yielded fewer studies, none of which was based upon UK populations. Based on consistent findings from three studies, the authors concluded that farming presented an increased risk of knee OA. However, since this article was published, contrary evidence in the form of a further paper by Holmberg et al (2004) has been published. This concludes that two relevant occupations in Sweden (farming and forestry) were not related to knee OA, at least amongst men. Curiously, women who had worked in agriculture for 11-30 years showed an increased risk (OR 2.1). Whilst this perhaps weakens the findings of Walker-Bone and Palmer, on balance the evidence would appear to support an increased risk of knee OA amongst farmers, although no incidence or prevalence data are available for UK farmers or farm workers or others within the agricultural sector.

One of the papers cited by Walker-Bone and Palmer (Vingard *et al.,* 1991) refers to 116 cases of knee osteoarthritis amongst 35,981 male farmers in Sweden (at least 10 years in the occupation) (0.3%), and 5 female cases amongst 1,739 (0.3%). Inclusion was on the basis of in-patient hospital care suggesting that this is likely to underestimate the occurrence of lower levels of osteoarthritis. It was also limited to those aged between 35-75 years at the time of selection.

Low Back Pain

Walker-Bone and Palmer next address the issue of low back pain (LBP). The authors differentiate between studies of LBP in general and specific studies of LBP and tractor driving. The authors list eight papers, none of which is based upon a British agricultural population. A further complication lies in the specific case definition adopted in each paper. This varied from the simple designation 'low back pain' to herniated lumbar discs. In addition to these studies from the research literature the authors also present original data from a postal survey conducted in the UK which gained responses from 122 farm workers (including mangers and owners), 2424 blue-collar workers and 2228 white-collar workers. 'Troublesome Back Pain' (defined as LBP which made it difficult or impossible to put on hosiery) was reported by 41.3% of farm workers; 37.5% of blue collar workers; and 26.7% of

white collar workers. Although no statistical comparisons are presented, simple calculations on the reported data show that the difference between farm and blue collar workers is not statistically significant although both these groups differ significantly from the prevalence amongst white collar workers.

This percentage prevalence of low back pain in the last year is slightly lower than that reported for Swedish farmers by Holmberg et al (2002) who documented that 47.2% of farmers indicated pain in the last year. Details of the specific question asked are not presented and it could be that the qualifier included by Walker-Bone and Palmer was more stringent. However, this seems unlikely given that, in the Swedish study, 45.2% reported that their pain had been sufficient to seek medical advice. Interestingly, although the percentage prevalence of reported pain was higher in farmers than amongst the referent group, this pattern was reversed in relation to having been 'sick-listed' as a result. Such listing is often taken as an indicator of severity but, in this Swedish study, the pattern of results suggests a more complex relationship, perhaps reflecting the general reluctance of farmers, particularly those who are self-employed, to seek medical advice or to take time off work.

Walker-Bone and Palmer next addressed the issue of the subgroup of farmers and farm workers who were regarded as 'tractor drivers' and the prevalence of LBP within this group. The authors suggest that this can at least in part be attributed to exposure to whole-body vibration although other putative risk factors will be present. In the largest UK-based study, (Palmer *et al.*, 1999), a postal survey of over 12,000 men and women of working age, odds ratios of less than one for any LBP or sciatica and only marginally above one for 'troublesome back pain' suggest no increased risk attributable to tractor driving. However, this analysis was not restricted to agricultural use of tractors, but included tractor use in other situations, nor was any account taken of the extent of tractor use. An earlier UK-based study (Sandover *et al.*, 1994), was reported by Walker-Bone and Palmer in which 64% of tractor drivers reported experiencing LBP at some time with 46% reporting it in the past year (compared to 48% at some time and 16% in the past year amongst poultry workers). Again, no details of the specific question asked are provided, or of any exposure assessments.

Neck and Upper Limb Disorders

The prevalence of 'pain preventing normal activity' was reported for farm workers (Walker-Bone and Palmer), in relation to the neck, shoulders, elbows and wrists/hands. Farm workers reported a lower prevalence of all except shoulder pain (over a 12 month period) compared to both blue and white-collar workers although the number of farm workers in the sample was relatively small (122). Neck pain was reported by 4%; elbow pain by 0.9%; and wrist/hand pain by 3.4%. However, 11.8% reported shoulder pain.

In addition to their own original research, presented within the paper and described above, Walker-Bone and Palmer cite one further paper on a UK-based study relating to upper limb disorders. This paper (Palmer, 1996) related to 106 workers in the specific sector of tomato growing. The author reported a high prevalence of upper limb symptoms amongst workers in the tomato growing industry. Across a 12-month period, symptoms were reported in the neck (38%); shoulder (44.4%); elbow (6.5%) and wrist (24.1%). In each case symptoms were more prevalent amongst the subgroup known as 'trainers' rather than 'pickers/deleafers'.

Walker-Bone and Palmer list several non-UK studies of farmers and farm-workers in relation to neck and upper limb complaints although no prevalence values are presented. These suggest an increased risk of selected upper limb problems amongst specific groups within the agricultural sector including shoulder pain amongst orchard farmers, glass house workers and foresters; epicondylitis and carpal tunnel syndrome amongst foresters; and arm pain amongst milkmaids. An approximation to the prevalence among foresters could be provided in the study of forestry chainsaw operators in Wales reported by Hulse *et al.*(1998). Although

respondents were asked about symptoms preventing normal activities, only the prevalence of any symptoms over the last 12 months were reported. Amongst a sample of 36 chainsaw operators (no formal response rate is presented although the authors estimate a population of 80 within the survey area) 41.7% reported hand/wrist symptoms; 27.8% elbow symptoms; and 22.2% shoulder symptoms.

Gray *et al*, (2000) reported the findings of a literature review on the related population of tree harvesters. However, the only indication of any prevalence was a statement in the Introduction that a Forest Enterprise survey had revealed, that 'over one third' of the harvester population, had either verbally or in writing expressed health concerns/complaints regarding the upper limb.

Hagen *et al* (1998) reported the findings of a study of musculoskeletal disorders in the Norwegian forestry industry, comparing 645 manual workers (including chain saw users) and 66 machine operators with 124 administrative (office) staff. Neck/shoulder disorders lasting for more than 30 days within the last year (based on reported symptoms) were reported by 28.8% of manual workers and 34.8% of machine operators compared to 17.7% of administrative staff. Although the researchers used the 'Nordic' questionnaire which includes the question of impaired activity these data are not reported. The prevalence of symptoms amongst manual workers is higher than that reported by Hulse and Gunstone (1998) although this may reflect differences in classification of employees or the introduction of a 30-day criterion. Care should therefore be taken in seeking to relate the values for machine operators to a similar UK population.

Non-UK studies

Other than the work on employees within the forestry sector in Wales and the work cited previously on tractor drivers and tomato growers, no UK-based studies have been found relating to specific work groups within the sector. Use of data from other countries may not be appropriate if working practices are too dissimilar. For example, whilst the work described by Stal *et al* (1996) on Swedish 'milkmaids' (actually using mechanical milking parlours) may not be dissimilar from the UK (a related paper, Stal *et al* (1997) reports 51% indicating pain and discomfort in the wrist), that from Sakakibara *et al* (1987) on orchard workers in Japan describes the task of manually thinning pears and apples on the trees and placing paper bags impregnated with insecticide over those remaining – a practice not believed to take place in the UK, although it clearly has an extensive fruit-growing sector. Although some sectors are clearly not relevant (such as the green tea workers reported on by Mirbod *et al*,(1995)) others may be of some relevance. For example Kato *et al.*,(2002) reported a prevalence rate for (non-specified) musculoskeletal disorders of 80 per 1000 workers in the Californian wine grape industry.

From outside the industry, dairy farming appears reasonably similar in other European countries. Pinzke (2003) reported levels of musculoskeletal symptoms amongst 686 workers who were actively involved in the Swedish dairy industry (Southern Sweden) in 2002. Reporting values according to gender (males first) the author documented the prevalence of symptoms within the last 12 months for the neck (39.8%; 39.1%); shoulders (43.6%; 58.8%); elbows (20.4%; 27.8%); and wrist/hands (24.3%; 46.6%). In each case the gender differences were statistically significant.

Dillon *et al*, (2002) reported the prevalence of self-reported hand and wrist arthritis amongst the population of the USA. They documented an increased risk amongst workers in 'agriculture, forestry and fisheries', represented by an odds ratio of 3.6 compared to the population as a whole. However, prevalence was reported as an estimated number in the whole population. Without a value for those employed in agriculture it is not possible to determine a prevalence among this group.

Koskimies *et al.* (1990) reported a 20% prevalence of clinically diagnosed carpal tunnel syndrome amongst Finnish forestry workers reporting a minimum of 500 hours chain saw use over the preceding three years. Whilst chainsaws are used in UK forestry it is not known how the pattern and extent of use compares with this population group.

Hildebrandt (1995) reported the findings of a postal survey of musculoskeletal symptoms amongst 2580 workers in twelve branches of agriculture in Holland. The questionnaire used was described as comparable to the Nordic questionnaire for questions on symptoms. The prevalence of symptoms over a 12-month period is reported. However, as the data are presented graphically numbers cannot be reported accurately here. The twelve branches of agriculture presented, and the estimated percentages of respondents reporting symptoms for neck/shoulders and elbows/wrists/hands are presented in Table 6.

Table 6 The estimated prevalence of musculoskeletal symptoms amongst workers in twelve sectors of Dutch agriculture

Sector	***Percent reporting symptoms***	
	Neck/shoulders	***Elbows/wrists/hands***
Dairy	26	16
Poultry	32	17
Agriculture 'sensu strictu'*	40	24
Mushrooms	34	32
Pigs	32	21
Protective vegetables	50	20
Cut flowers	36	16
Pot plants	34	21
Bulbs	38	18
Fruit	36	41
Arboriculture	54	39
Contract work	39	22

** This term is not explained in the text.*

Holness *et al.* (1995) reported the prevalence of 'accidents and other musculoskeletal problems' amongst 606 hog farmers in the Canadian province of Ontario. It is not known how comparable the Canadian industry is to anything similar in the UK. According to the authors, 71% of respondents reported backache and 36% reported problems with their knees. However, the paper is based upon responses to questionnaires handed out at meetings with no semblance of a random sample. Although a rough estimate of 14,000 hog farmers is given there is no documentation of the number of questionnaires distributed. Given the self-selected nature of the sample, care should be taken in interpreting these data or in applying them to a UK population.

Table 7 Summary of the reported prevalence of musculoskeletal disorders amongst farmers and farm workers in the UK and overseas

Disorder	*UK prevalence*	*Overseas prevalence (no UK)*
General MSDs attributed to work.	3.4-3.8 per 100	
Osteoarthritis of the hip	13-14%, 1+ years exposure, age 60-70 years; 23.6%, 1+ years exposure, age 70+ years.	
Osteoarthritis of the knee		Sweden, 0.3% hospital in-patient, 10+ years exposure, age 35-75 years.
Troublesome low back pain	41.3%	
Low back pain in past year	46%, tractor drivers	
Neck pain in last year	4% overall 38% tomato growers	Sweden, 39.8% males, 39.1% females, dairy workers
Shoulder pain/symptoms in last year	11.8% overall 44.4%, tomato growers 22.2%, chain saw operators	Sweden, 43.6% males, 58.8% females, dairy workers
Neck/shoulder disorders, 30+ days in year		Sweden, 28.8% manual forestry workers (incl. chain saw users); 34.8% forestry machine operators.
Elbow pain/symptoms in last year	0.9% overall 6.5%, tomato growers 27.8%, chain saw operators	Sweden, 20.4% males, 27.8% females, dairy workers
Wrist/hand pain/symptoms	3.4% overall 24.1%, tomato growers	Sweden, 24.3% males, 46.6% females, dairy workers
Hand/wrist symptoms in last year	41.7%, chain saw operators	
Upper limb complaints	More than 33%, tree harvester operators	
Carpal tunnel syndrome		Finland, 20%, chain saw users (500+ hours in 3 years)

4.4 PHYSICAL AGENTS

4.4.1 Background

Little information was identified on the frequency of occupational diseases in agriculture due to physical agents. Much of that found reported the occurrence of hand-arm vibration syndrome (HAVS) in forestry workers, with scarce data on other exposures or conditions in farming and related activities. Most of the reports of HAVS in forestry workers were dated and unlikely to be representative of current conditions, or from non-UK workers, or both.

Physical agents likely to be encountered in agriculture include:

- Non-ionising radiation (ultraviolet light, sunlight)
- Extremes of temperature (heat, cold)
- Noise
- Hand-transmitted vibration
- (Whole body vibration with musculoskeletal conditions – discussed earlier under MSD)

4.4.2 Non-ionising radiation

Neoplasia

The principal source of information on neoplasia was the Decennial Supplement on Occupational Health in England and Wales published in 1995 (Office of Population Censuses and Surveys *et al.,* 1995). This report analysed cancer incidence in men and women aged 20 to 74, for the years 1979-80 and 1982-90.

Significantly raised proportional registration ratios (PRR) for cancers of the skin other than melanoma (ICD=173) were found in male farmers in England and Wales (PRR 118, 95% CI 110-127; 745 cases), although there was no excess for females (PRR 80, CI not reported; 39 cases). In addition, a meta-analysis of cancer in farmers reported no excess relative risk (RR) for skin cancer other than melanoma (RR 1.04, 95%CI 0.93-1.16; 8 studies, 348 cases); and an increased risk of melanoma (RR1.15, 95%CI 1.04-1.28; 11 studies, 374 cases) (Blair *et al.,* 1992). A Swedish study (Linet *et al.,* 1995) suggests a possible role for chronic sunlight exposure in the aetiology of cutaneous melanoma: significantly higher standardized incidence ratio for malignant melanoma of routinely exposed areas (face, neck and scalp) was identified in the 'farming, forestry, hunting and fishing' industries, with non-significantly reduced ratios for the trunk, arms and legs; and a significantly reduced ratio overall. There was no significant excess of skin cancers or melanoma in a study of farmers in the US (Blair *et al.,* 1993).

The Decennial Supplement on Occupational Health also reported a significant risk of cancers of the lip in men (PRR 288, 95% CI 212-283; 47 cases, no data for women reported) (Office of Population Censuses and Surveys *et al.,* 1995). There was a suggestion that smoking-related cancers were less common in male farmers (PRR oral cavity 68, larynx 90, lung 92) (Office of Population Censuses and Surveys *et al.,* 1995), thus making the excess of cancers of the lip less likely to be due to smoking and more likely to be due to other aetiologies, perhaps sunlight or ultraviolet light.

Similar excess mortality due to cancers of the lip were found in white male farmers in the US (proportional cancer mortality ratio PCMR 2.31, 95% CI 1.43-3.53) with no significant excess in white women or nonwhite men or women (Blair *et al.,* 1993). As with the English and Welsh data, there was a significant deficit of oropharyngeal and lung cancers, suggesting that smoking was less common than in the general population. In the meta-analysis of farmers an increased risk for cancers of the lip (RR 2.08, 95%CI 1.80-2.40,8 studies) was also found (Blair *et al.,* 1992).

In conclusion there is good evidence for an increased risk of cancers of the lip in farming, and that this is unlikely to be attributable to smoking. It may result from exposure to sunlight. There is weaker evidence of an increase in skin cancers other than melanoma, and also of melanoma, with limited evidence that the latter may be associated with chronic exposure to sunlight in farmers, foresters, hunters and fishermen.

There is minimal information about the risks from ultraviolet light or sunlight to agricultural workers other than farmers. It is reasonable to expect an increased incidence of cancers of the lip in other agricultural workers exposed to similar amounts of sunlight, and possible that these groups would have a higher incidence of melanoma and other skin cancers.

4.4.3 Extremes of temperature (heat and cold)

Although it is likely that both heat stress (work in glasshouses, vehicle cabins and animal sheds; labouring wearing weatherproof clothing; during stubble or heather burning) and cold

stress (due to work in cold and wet weather) will be encountered, no references were identified which reported these exposures in agriculture in the UK. There was also no evidence of ill health from such exposures.

4.4.4 Noise and hearing loss

Farming
No information about the frequency of noise-induced hearing loss (NIHL) in farmers in the UK was identified. A survey (Talamo *et al.,* 1989) of noise exposure in UK farming between 1985-87 (and hence prior to the introduction of Noise at Work Regulations 1989) estimated that approximately:

18.4% were exposed to levels above 85dB(A)
8.7% were exposed to levels above 90dB(A)
0.9% were exposed to levels above 100dB(A)

They estimated the full-time workforce in farming at 364,000. Exposure above 90dB(A) over a 45 year working life will result in significant hearing impairment in over 50% exposed (Lutman, 2000).

Forestry
No information about the frequency of noise-induced hearing loss (NIHL) in forestry workers in the UK or elsewhere was identified. In Japan, significantly greater hearing loss was found in forestry workers with symptoms of hand-arm vibration syndrome than in those without symptoms (Miyakita *et al.,* 1987); this study is dated and methodologically weak; extrapolation of their findings to UK forestry workers should be done with caution.

4.4.5 Hand-arm vibration syndrome (HAVS) and vibration white finger (VWF)

The term hand–arm vibration syndrome has been used for those studies using the Stockholm workshop scale for the classification of cold-induced Raynaud's phenomenon in the hand-arm vibration syndrome (Gemne *et al.,* 1987), and vibration white finger for those that use this term or that only report finger blanching (secondary Raynaud's syndrome).

No recent studies of decent quality were found that report the frequency of HAVS or VWF symptoms in the UK agricultural sector.

The most relevant and recent study of the likely magnitude of the problems arising from hand-transmitted vibration (HTV) in the UK agricultural sector is that of Palmer *et al* (2000a). This self-reported assessment of exposure has been validated (Palmer *et al.,* 2000b); the sources of recent vibration exposure were reported with reasonable accuracy, but the durations of exposure were systematically overestimated. The former study estimated the numbers exposed to HTV in agriculture as 219,000 (95% Confidence Interval (CI) 194,000 to 244,000), with those exposed above the current suggested action level (equivalent to 2.8 ms^{-2}) estimated at 38,000 (95% CI 15,000 to 61,000) for farm owners, farm managers and horticulturalists; 31,000 (95% CI 17,000 to 45,000) for gardeners and groundsmen; and 71,000 (95% CI 60,000 to 134,000) for agriculture, hunting and related service activities. It is likely that the exposure to HTV and subsequent risk of HAVS in UK agriculture are significant.

Information of the frequency of HAVS / VWF in forestry workers in the UK is scarce and dated (Taylor *et al.,* 1971). This study reported the prevalence of VWF as 44% in those who

used chain saws (n = 142) and 18% in those who did not (n = 569). The most recent study identified (Bovenzi, 1998) estimated the prevalence of VWF in Italian forestry workers as 23% (n = 165). Although numerous other studies were identified, methodological weaknesses, or non-applicability to the current UK forestry industry have made inclusion here uninformative.

4.4.6 Conclusions

Little good quality data on the frequency of occupational ill health due to physical agents was identified. It is likely that exposure to noise, HTV and sunlight result in an appreciable morbidity for a large number of UK agricultural workers.

4.5 OTHER DISEASES

4.5.1 Eye Irritation

There is little information available about the occurrence of eye irritation among those in the agriculture industry. Cuthbert *et al,* (1984) reported that seven of 290 farmers (a prevalence of 2.4%) from three areas of Scotland had conjunctivitis related to exposure to storage mites in hay, while an additional 61 had rhinitis with or without conjunctivitis (no further breakdown was given). No information on a control population was available. A study of 106 farmers and their spouses in three counties of Norway found that 9% often and 32% seldom had eye irritation or red eyes (Eduard *et al.,* 2001).

4.5.2 Bee keepers allergy

No relevant studies of beekeepers or bee venom allergy were available for the UK, although it is known that in the general population less than 1% of individuals are allergic to wasp and bee stings. A study of farmers exposed to pesticides in Italy, between 1990 and 1992, reported that 0.4% of the study population (426 farmers) were found to have bee venom allergy manifested by angioedema (swelling) (Cellini *et al.,* 1994). A 1993 study of beekeepers in Finland (Annila *et al.,* 1996) found that 26% of the 218 respondents had systemic bee sting reactions, with 38% experiencing large local reactions. It is not clear to what time period this referred. Reactions were more common in subjects with a history of atopic symptoms. The study quoted previous rates of systemic reactions of between 14% and 42% from earlier research in Europe; and rate of large local reactions of 9% to 12% reported among beekeepers in France and USA. An earlier study of 222 beekeepers in Lombardy found large local reactions in 14% of respondents and systemic reactions in 9% (Pastorello *et al.,* 1988).

4.5.3 Dermatitis

The main causes of skin problems in the agriculture industry are damage to the skin from cuts or abrasions, exposure to cold and wet resulting in dryness and chapping, exposure to chemicals or to plant materials causing contact dermatitis, and exposure to sunlight associated with increased risk of skin cancer (this latter is covered in section 4.4.3).

Meyer *et al,* (2000) reported the findings for occupational contact dermatitis from the EPIDERM and OPRA reporting schemes. The annual incidence of workers employed in agriculture (SIC codes 1 and 2) with contact dermatitis was just less than 10 per 100,000 (data collected over 3 year period from 1996-1999). The incidence of contact dermatitis in gardeners ranged from 11.8-12.7 per 100,000 in reports from dermatologists and occupational

physicians respectively. These compare to average incidence rates for all occupations combined of 6.4 per 100,000 for dermatologist reports and 6.5 per 100,000 for occupational physician reports.

More recent figures from EPIDERM estimate an annual incidence of contact dermatitis as reported by dermatologists of 10 per 100,000 among workers in the agriculture, hunting and forestry sectors.

It is probable that these figures from EPIDERM and OPRA are underestimates of the true incidence of dermatitis in agriculture as only the more severe cases are likely to be reported to occupational physicians or dermatologists.

The Labour Force Survey of self-reported work-related illness in 1993 reported annual prevalence rates of skin disease in agriculture workers (including fishing) of 270 per 100,000 in males and 530 per 100,000 in females of which 180 per 100,000 in males and 530 per 100,000 in females were reported to be caused by work (Hodgson *et al.*, 1993). The higher figures for the Labour Force survey compared to the reporting schemes are likely to be due to a number of factors, the reporting schemes comprise only more serious cases, the Labour Force Survey reports prevalence rather than incidence and relies on self-reports of illness, regardless of whether or not the subject attended a doctor.

4.5.4 Poisonings/Pesticide related disease

In an in-depth review of work with pesticides and organophosphate sheep dips, Coggon (2002) reported that severe acute poisoning from occupational exposure to pesticides or veterinary medicines is extremely rare. National data on occupational mortality in England and Wales indicated only three deaths from pesticide poisoning among male farmers during an 11-year period (1979-1980, 1982-1990). Coggon noted that the incidence of non-fatal poisoning was not so well defined. In a cross-sectional study of 84 agricultural workers from Hampshire, 15% reported that they had at some time suffered an accident or health problem involving the use of an agricultural chemical. Four of these workers had consulted a doctor as a consequence (Avory *et al.*, 1994).

The Veterinary Products Committee (VPC) has a voluntary reporting scheme for human Suspected Adverse Reactions (SAR) to Veterinary Medicines. Their annual report for 2003 included 90 reports of human SARs during the year. A summary of these is shown in Table 8 (taken from VMD Annual Report, 2003).

Table 8 Human SAR reports received by the VMD in 2003

Product type	*Serious SAR*	*Non-serious SAR*	*Total*
Ectoparasiticides – Non OP (small animal)	6	27	33
Ectoparasiticides – Non OP (large animal)	0	8	8
Ectoparasiticides – OP sheep dips	3	0	3
Ectoparasiticides – OP not sheep dip	1	1	2
Vaccines	3	19	22
Other animal medicines	4	18	22
Total	17	73	90

Between 1985 and 2003, the VWD received 2055 reports of SARs. There was a substantial increase between 1990 and 1992 in the number of reports due to increased media interest in human SARs and the establishment of a separate section for human SARs. The number of reports declined steadily between 1997 and 2002, and although it increased in 2003, it is

thought that there is still marked under-reporting of incidents. The report does not specify whether the incidents are occupational, though it is probable that most of them are.

In the year from 1 April 2003 to 31 March 2004, the HSE Field Operations Directorate investigated 62 reported pesticide incidents involving allegations of ill health. This was very similar to the number of reports in the immediately preceding years. These 62 incidents plus 3 incidents forwarded by local authorities were reviewed by the Pesticides Incident Appraisal Panel (PIAP), who concluded that 3 of the reports should not be classified as ill health incidents. Only six of the incidents involved employees or self employed workers, and these six incidents involved a total of 15 workers. Of the 6 incidents, 1 was judged to be unrelated to pesticides, 2 had insufficient information and 3 are still pending while further medical or exposure information is sought.

Other publications were not specific to the UK. A meta-analysis of Parkinson's disease (PD) and exposure to pesticides (Priyadarshi *et al.*, 2000) found an elevated risk of PD with exposure to pesticides in a majority of the 19 studies included, with an OR of 1.94 (95% CI 1.49-2.53). Priyadarshi noted that although the risk of PD increased with increased duration of exposure to pesticides, no significant dose response relation was established and no specific type of pesticide was identified. A study in the Netherlands of acute work-related poisoning, reported in 1997, found that 37 of 54 cases of possible acute work-related pesticide poisoning showed a direct relation between exposure to pesticides and acute health problems (Meulenbelt *et al.,* 1997). However, no information was given on the size of the population studied. A study from the United States reported an incidence of acute occupational pesticide related illness of 18.2 per 100,000 employed in agriculture (Calvert *et al.,* 2004).

4.5.5 Respiratory disease

No published information on incidence of respiratory disease was identified during the study. This section summarises the information found on respiratory disease prevalence. Illing (1997) quoted prevalence from the Labour Force Survey of self-reported work-related illness (Hodgson *et al.,* 1993) for workers in 'farming, forestry and fishing:

All asthma (caused or made worse by work):

35 per 10,000 in males
53 per 10,000 in females

Asthma cases (caused by work):

17 per 10,000 in males
25 per 10,000 in females

All lower respiratory disease (caused or made worse by work):

99 per 10,000 in males
0 per 10,000 in females

Lower respiratory disease cases (caused by work):

56 per 10,000 in males
0 per 10,000 in females

These results compare to a rate for all occupations combined for lower respiratory disease (caused or made worse by work) of 55 per 10,000 for males and 11 per 10,000 for females. Equivalent prevalence for asthma for all occupations was around 24 per 10,000 for males aged and 10 for females.

Results from the European Farmers' project (Radon *et al.*, 2002) showed that 33% of the 131 UK farmers included had work related respiratory symptoms (defined as wheezing, breathlessness and/or cough without phlegm during work). Overall prevalence in agricultural workers across Europe (7752 subjects) was 22% ranging from 18% to 33% with the highest prevalence among the UK population. Examination of prevalence for Europe as a whole, subdivided by type of work within agriculture showed prevalence ranging from 22% among cattle farmers to 27.5% among flower farmers.

Linaker *et al*, (2002) in a review of respiratory disease in agricultural workers, reported that "the prevalence of work-related respiratory symptoms such as wheeze, cough and dyspnoea is unusually high among farmers (23 – 50%)" although none of the referenced papers were from studies of UK farmers. The review contains very little recent information from the UK. It notes that of 38 notifications to the SWORD reporting scheme for respiratory disease by farmers in 1997, 17 were for asthma and 20 were for allergic alveolitis.

An earlier study of the prevalence and predictors of work related respiratory symptoms in 1032 workers exposed to organic dusts (Simpson *et al.*, 1998) found prevalences of lower respiratory tract symptoms, upper respiratory tract symptoms, chronic bronchitis, byssinosis and organic dust toxic syndrome (ODTS) as shown in Table 9 (extracted from their paper). No additional control population was studied.

Table 9 Prevalence (%) of respiratory symptoms in 1032 workers exposed to organic dusts (taken from Simpson et al, 1998)

	LRTS	***URTS***	***Chronic bronchitis***	***Byssinosis***	***ODTS***
Mushroom	14.8	32.8	1.6	0	2.5
Swine	23.3	34.9	9.3	2.3	0
Grain	20.3	40.6	5.8	0	4.3
Poultry	38.1	45.2	15.5	0	5.9
Saw mill	12.9	20.8	5	0	0
Cotton	15	20.4	4.4	4	1
Wool	8.6	10.1	2.9	0	0
Animal feed	11.8	38.2	0	0	0
Weaving	15.4	29.4	2.3	0	0
Total	16.5	26.9	4.6	1	1.3

LRTS = lower respiratory tract symptoms
URTS = upper respiratory tract symptoms
ODTS = organic dust toxic syndrome
Chronic bronchitis = a cough producing sputum for most days for 3 months of ≥ 2 consecutive years
Byssinosis = chest tightness worse on the first working day improving as the week went on

Restricting this table to the agricultural occupations only (i.e. excluding saw mill, cotton, wool and weaving) gives total prevalence as follows:

- LRTS: 22.2%
- URTS: 38.1%
- Chronic bronchitis: 6.5%
- Byssinosis: 0%
- ODTS: 2.8%

4.5.6 Farmer's lung

Little information exists on the prevalence or incidence of farmer's lung. As a prescribed disease, the HSE notes that the general trend of farmer's lung is downward, with around 5 new cases of the disease reported annually since 1991, with a few years of higher levels (10 in 1994 and 15 in 1999), but with nil or negligible reports in more recent years 2000, 2001 and 2003. Six deaths attributable to farmer's lung and other occupational allergic alveolitis were reported in 2002, with seven being reported in each of 2000 and 2001. HSE again notes that "as the disease only rarely progresses to a life-threatening level, this suggests that there are substantially more cases than those receiving compensation" (www.hse.gov.uk/statistics/causdis/othresp.htm)

Prevalences from earlier published papers are unlikely to be relevant to the current situation. For example, Boyd (1971) reported a prevalence of 110 per 100,000 farmers per year in Caithness and Watkins-Pitchford (1966) reported 193.1 cases per 100,000 farmers per year in Wales and 11.5 cases per 100,000 per year in East Anglia. In contrast a pilot study of prevalence of farmers lung disease in Scotland, reported in 1972 (Grant *et al.*, 1972) reported prevalences of 8,600 per 100,000 farmers in Orkney and Ayrshire (reducing to 4,300 and 3,600 per 100,000 respectively if cases with a negative farmer's lung hay precipitin test were excluded). These figures were noted to be 20 times higher than any figure previously reported for the prevalence of farmer's lung in Britain.

4.5.7 Cancer

The key sources for cancer incidence and mortality data in the UK were studies by Inskip *et al.* (1996) and Simpson *et al*, (1999). Inskip *et al* analysed cancer mortality in England and Wales from 1979 to 1990 (excluding 1981 when industrial action meant that death registrations were unreliable) among farmers and farmers' wives. Because of a lack of baseline population data, only proportional mortality could be studied. This showed an excess of prostatic cancer, based on 1361 deaths of the 60,268 studied, a PMR of 112 with a 95% C.I. (106, 118). An excess of oesophageal cancer was also seen, principally in those areas where cider was produced. Alcohol is a known cause of oesophageal cancer and consumption of cider and other apple based alcoholic drinks had been associated with a high risk of the disease in France.

A review of the available epidemiological and other research to identify if there were any potential chemical exposures which might be associated with prostrate cancer was carried out by the Committee on Carcinogenicity. Overall, the committee agreed that there was some evidence to suggest an association between farmers/farm workers, exposure to pesticides and increased risk of prostate cancer. The conclusion was based on results of a number of studies across Europe and North America and in particular a meta-analysis of occupation related pesticide exposure and cancer of the prostate by Van Maele-Fabry *et al*, (2003). This meta-analysis of 22 studies reported an increased meta-rate ratio of 1.13 (95% CI 1.04, 1.22) for prostate cancer incidence in workers exposed to pesticides in pesticide related occupations, and noted that this was very similar to four earlier meta-analyses of prostate cancer in farmers and farm workers. It was additionally noted that excesses of prostate cancer were higher in North America than in Europe, possibly due to greater usage of pesticides.

There was some evidence of a proportional excess among cancers of cancer of the brain, non-Hodgkin's lymphoma, myeloma and leukaemia (Inskip *et al.*, 1996). These increases were significant for brain cancer in male farmers (PCMR = 112; 95% C.I. (102,122)), non-Hodgkin's lymphoma in male farmers (PCMR = 114; 95% C.I. (104, 125)) and in farmers' wives (PCMR = 112; 95% C.I. (100, 126)), myeloma in male farmers (PCMR = 117; 95% C.I. (104, 132)) and leukaemia in male farmers (PCMR = 114; 95% C.I. (104, 125)) and in

farmers' wives (PCMR = 112; 95% C.I. (100, 125)). (Skin cancer has been discussed in more detail in the section on physical agents.) .

Simpson *et al,* (1999) reported on a study of cancer registrations among female agricultural workers, again using proportional ratios, and found an excess of non-Hodgkins lymphoma based on 61 cases between 1971 and 1990. The PRR (proportional registration ratio) was 164 with 95% C.I. (126, 211). Many other studies of cancer mortality and registrations in other countries in Europe, and elsewhere, have been published but none express the results as prevalence or incidence figures, being in the main case-control studies or proportional mortality studies.

4.5.8 All cause mortality

Inskip *et al,* (1996) reported on a mortality study of farmers and farmers wives based on mortality between 1979 and 1990 (excluding 1981 because of unreliable data). The analysis examined proportional mortality due to the lack of suitable baseline population data. They found an excess of deaths from pesticide poisoning (PMR = 1455, 4 deaths), inguinal and other hernia (PMR = 191 and 149 respectively, based on 41 deaths from each cause). Excess mortality from influenza (PMR = 163, 46 deaths), farmer's lung disease (PMR = 1089, 56 deaths), other and unspecified allergic pneumonitis (PMR = 548, 8 deaths) was also reported.

4.5.9 Summary of results

Table 10 summarises the findings of the review of diseases in this section.

Table 10 Summary findings of prevalence of 'other' diseases

Disease	***Estimated Prevalence/Incidence (UK)***	***Estimated Prevalence/Incidence (non-UK)***
Eye irritation/Conjunctivitis		9% often, 32% seldom (Norway)
Bee keepers allergy		Systemic reactions : 14%-42% (Europe); Large local reactions 9%-12% (France&USA)
Dermatitis/Skin disease	Dermatitis: 10 per 100,000 workers in agriculture (incidence). Skin disease: 27 per 10,000 in agriculture (incl fishing) (prevalence)	
Poisoning	15% accident/health problem related to chemicals 'at some time'	
Respiratory disease	Wheeze/cough/dyspnoea: 33% Specific agricultural occupations – see table 6.	Wheeze, cough, dyspnoea: 22% (Europe, ranging from 18% to 33% across countries)
Farmers lung	Rare	
Cancer	No prevalence data. Proportional excesses seen for prostatic, non-Hodgkins lymphoma, myeloma, leukaemia	
Mortality	No prevalence data. Proportional excesses seen for pesticide poisoning, hernia, influenza, farmers lung disease and unspecified allergic pneumonitis	

4.6 SUMMARY RESULTS

We present here a brief overview of the information review and a summary of the findings. Table 11 summarises the prevalence and incidence of the diseases considered across the study as a whole. This section is provided to give the reader a brief overview of the study results. For interpretation of the findings, and of their reliability, and to put the findings in context, the more detailed results sections should be consulted.

4.6.1 Infections

Zoonoses: The main source of information is a report by the HSE in 1993. Most infections are relatively rare. The most frequent is Q fever, followed by Lyme disease. Investigation of zoonoses in the general population which have sources in farming reveal a massive endemic of Salmonella infections and increasingly frequent cases of E.coli infections. The frequency of these infections among agricultural workers is not known, although workers are likely to be highly exposed.

Non-zoonotic infections: There is some evidence from Europe of increased respiratory infections in farming occupations, perhaps due to exposure to inclement weather, but no data are available for the UK. Mortality from infections of skin, joints and bones was increased in male farmers in England and Wales, with an SMR (Standardised Mortality Ratio) of 181.

4.6.2 Musculo-skeletal

General musculoskeletal disease: Estimates suggest a prevalence of approximately 3.5% for general MSDs. This compares to data collected using similar survey methods of 2% in the general population suggesting an increased risk amongst the farming occupations. The values are likely to be underestimates of the actual levels because the survey in question focussed on MSDs which the respondent believed to have been caused or exacerbated by work.

Osteoarthritis: There is evidence of an increased risk of hip osteoarthritis (odds ratio 2.0) with variations about this figure for types of employment within the sector. No prevalence or incidence data were reported. The prevalence of hip osteoarthritis amongst those who had farmed for at least one year has been reported as 13% (60-70 years of age) increasing to 23.6% for those above 70 years. In comparison prevalence amongst controls was 1.6% (60-70) rising to 5% for those over 70 years.

On balance the evidence would appear to support an increased risk of knee OA amongst farmers, although no incidence or prevalence data are available for UK farmers or farm workers or others within the agricultural sector.

Back Pain: Estimates of levels of LBP (41.3% of farm workers; 37.5% of blue collar workers; and 26.7% of white collar workers) suggest that there may be a slight excess of ‘troublesome’ pain amongst farm workers.

There is conflicting evidence as to whether or not tractor driving leads to an increased risk of back pain.

Neck and shoulder pain: No data are available from UK farm workers regarding levels of neck and shoulder problems. Data from a survey of Dutch workers suggest levels ranging from 26%-56% depending upon the type of work within the agricultural sector. No formal incidence or prevalence data are provided.

Upper limb complaints: No data are available from UK farm workers regarding levels of elbow, wrist or hand complaints. Data from a survey of Dutch workers suggest levels ranging from 16%-41% depending upon the type of work within the agricultural sector. No formal incidence or prevalence data are provided.

4.6.3 Physical agents

Neoplasia: There is evidence for increased risk of cancers of the lip in farming, maybe resulting from exposure to sunlight. There is weaker evidence of an increase in skin cancer and melanomas, again with limited evidence of an association with chronic exposure to sunlight.

Hand-arm vibration syndrome/Vibration white finger: The extensive exposure to hand transmitted vibration in UK agriculture is likely to result in significant risk of hand-arm vibration syndrome, although no information on current frequency is available. Among forestry workers, there is a high prevalence of hand-arm vibration syndrome and vibration white finger, particularly among chainsaw operators.

4.6.4 Other Diseases

Eye irritation/Allergies: Little or no UK information was available for these outcomes.

Dermatitis: Annual incidence of contact dermatitis, as recorded by reporting schemes is high among agricultural workers compared to other occupations. It is believed that these schemes tend to underestimate disease incidence, and record only more severe occurrences. Self-reported prevalence of skin conditions suggest higher levels of disease.

Poisoning: In a small cross-sectional study of agricultural workers, 15% of subjects reported having at some time suffered an accident or health problem involving the use of an agricultural chemical. UK reporting schemes for pesticide related ill health recorded 17 serious and 73 non-serious Suspected Adverse Reactions in 2003 and 6 reported incidents involving allegation of ill health in workers involving a total of 15 workers.

Respiratory disease: Workers in agriculture show high prevalences of work-related symptoms such as wheeze, cough and dyspnoea. Results from the Labour Force Survey show higher self-reports of asthma and lower respiratory disease among workers in farming, forestry and fishing than among all other occupations combined.

Cancer: Proportional increases in cancer mortality and incidence were found for prostate cancer among farmworkers. Increases were also found for brain cancer, non-hodgkins lymphoma, myeloma, leukaemia, skin and lip cancer. No baseline population data were available and so information on rates was not available.

Mortality: Proportional excesses in mortality were seen for pesticide poisoning, hernia, influenza, farmer's lung disease and unspecified allergic pneumonitis. Information on death rates was not available.

Table 11 Summary results

Disease/Condition	*Prevalence*	*Incidence/yr*	*Occupations*	*Comments*
Zoonoses				
Anthrax		0.1		1 in 10 years
Bovine TB		40		1998
Brucellosis		7		1984
Hantavirus		0		
Hydatid		20		
Leptospirosis		50		1983-88
Lyme disease		100		
Newcastle disease		0		
Orf		50		
Chlamydiosis (ovine)		0		
Chlamydiosis (psitticosis)		0		
Q Fever		185		1998
Ringworm		?		
Streptococcus suis		1.5		
Musculo-skeletal				
Musculo-skeletal disorders	3.4%			
Osteoarthritis	13%			Aged 60-70
Low Back Pain	41%			
Low Back Pain in last year	46%		Tractor drivers	
Neck pain in last year	4%			
Neck pain in last year	38%		Tomato growers	
Shoulder pain in last year	44%		Tomato growers	
Shoulder pain in last year	12%			
Shoulder symptoms in last year	22%		Chain saw operators	
Elbow pain in last year	1%			
Elbow pain in last year	6%		Tomato growers	
Elbow symptoms in last year	28%		Chain saw operators	
Wrist/Hand pain	3%			
Wrist/Hand pain	24%		Tomato growers	
Hand/wrist symptoms in last year	42%		Chain saw operators	
Disease due to physical agents				
Hearing Impairment	4%			
HAVS/VWF	44%		Forestry chainsaw users	
	18%		Other forestry	
Other diseases				
Eye irritation	2.4%			
Dermatitis		0.01%		
Skin disease	0.18%			males
	0.53%			females
Adverse reaction to chemicals	15%			
Respiratory symptoms	33%			
Lower Respiratory Tract Symptoms	22%			
Upper Respiratory Tract Symptoms	38%			
Chronic bronchitis	6%			

Disease/Condition	*Prevalence*	*Incidence/yr*	*Occupations*	*Comments*
Byssinosis	0%			
Organic Dust Toxic Syndrome	3%			
Farmer's Lung	Rare			
Cancer				
Prostate Cancer	PMR=112			
Oesophageal Cancer			Cider production	
Brain Cancer	PCMR=112			
Non-Hodgkins Lymphoma	PCMR=114			males
Myeloma	PCMR=117			males
Leukaemia	PCMR=114			males
Skin Cancer	PRR=118			males
Lip Cancer	PRR=288			males

5 DISCUSSION

5.1 SCOPE OF THE SEARCH AND RELIABILITY OF FINDINGS

The information search for this study was wide ranging in scope, and it was necessary to define the search parameters carefully before commencing the process. In order to achieve this, a detailed matrix of diseases by occupation within the agricultural sector was drawn up, and modified to identify those occupation/disease combinations which were judged to be 'relevant' (e.g. brucellosis from cattle is relevant to cattle farmers but not to sheep farmers). This approach was used to help to focus the scope of the search and to assist in the identification of information gaps. However, there were also potential drawbacks to the approach, which would necessitate careful interpretation of the results. In particular, exclusion of occupations judged to be 'not relevant' to a specific disease may lead to an underestimation of disease incidence or prevalence, due to the omission of additional cases which may occur in those with incidental exposure to the disease source (in the above example, individuals working as sheep farmers may occasionally also come into contact with cattle). In the event, the large majority of information sources identified during the study referred to disease incidence or prevalence among farmers generally, rather that in specific occupations within farming.

The search strategy used was designed to carry out a wide scan of potential information in the first phase, guided by the search terms identified in the disease by occupation matrix, followed by a filtering process to select the most relevant publications and information sources. Judgements on which were the relevant publications were taken by members of the study team with extensive experience in the subject area – primarily by occupational physicians and by a senior ergonomist with particular expertise in musculo-skeletal conditions. We are confident that this strategy, and the wide range of database and internet sources included in the searches, led to the identification of a large proportion of the available data on occupational ill health in agriculture.

5.2 GAPS IN INFORMATION/IDEAS FOR FURTHER STUDY.

5.2.1 Overview

Overall, this review has shown that there is very little current information available on the prevalence or incidence of occupational ill health in the agriculture industry. In the course of the study many hundreds of papers and reports were identified. However, relatively few of these contained UK data, many were case studies or were focused on agriculture in other European or North American countries. In some cases, the published information available was more than 20 years old.

Nevertheless, some relevant data have been found and extracted, and these are summarised in Table 11 in section 4.6 of this report. Incidence data are available only for zoonoses and skin disease, with some prevalence data available primarily for musculo-skeletal and respiratory conditions. Mortality data and cancer data are invariably reported as proportional increases rather than as death or incidence rates, because of a lack of baseline population data.

Of the zoonoses reported, Lyme disease and Q Fever are the most frequent, with incidence rates of 100 and 185 cases per year respectively. Musculo-skeletal conditions are also relatively prevalent, particularly low back pain (41%). Using the current information on the number of agricultural workers in the UK (table 3, section 2.4) we can estimate that this is equivalent to almost 200,000 cases of low back pain.

Chain saw users are at high risk of upper limb complaints, including shoulder, elbow and hand/wrist complaints with prevalence of over one third. This group of workers has also prevalence of 44% for HAVS/VWF. Data shown in table 4 (section 2.4) suggest that around 5000 workers in the UK are involved in tree harvesting – suggesting around 2000 to 2500 cases across the country.

Respiratory disease generally, and particularly upper respiratory tract infections symptoms are reported by just under 40% of farm workers exposed to organic dusts.

5.2.2 Priority diseases

Table 12 attempts to classify the disease seriousness and frequencies, to aid assessment of priorities. The groupings are arbitrary, particularly the frequencies. Nevertheless the table gives a rough guide to the disease impacts.

Serious diseases with high frequencies include lip cancer, Q fever, Respiratory symptoms, Lyme disease, lower respiratory tract symptoms and Leptospirosis. Exposure to sunlight is suggested as a cause of the lip cancer excess, and this could be reduced by protective measures. Respiratory disease is likely to be the result of exposure to many airborne allergens and irritants. Lyme disease is also related to agricultural occupations. Q fever occurs mainly in members of the public, Leptospirosis in water, sewage and ditch workers.

Table 12 Arbitrary classification of seriousness (worst cases) and frequency of diseases (from Table 11)

Disease impact	***Frequency***				
	Prevalence 1-9% or Incidence 1-49 or PMR 101-119	***Prevalence 10-19% or Incidence 50-99 or PMR 120-129***	***Prevalence 20-29% or Incidence 100-149 or PMR 130-139***	***Prevalence 30-39% or Incidence 150-199 or PMR 140-149***	***Prevalence 40+% or Incidence 200+ or PMR 150+***
Serious or (potentially) fatal	Bovine TB. Brucellosis. Hydatid. Streptococcus suis. Chronic bronchitis. Organic dust toxic syndrome. Farmer's lung. Prostate cancer. Oesophageal cancer[1] (unknown frequency). Brain cancer. Non-Hodgkins lymphoma. Myeloma. Leukaemia. Skin cancer.	Leptospirosis.	Lyme disease. Lower respiratory tract symptoms.	Q fever. Respiratory symptoms.	Lip cancer.

[1] *Cider producers*

Disease impact	*Frequency*				
	Prevalence 1-9% or Incidence 1-49 or PMR 101-119	***Prevalence 10-19% or Incidence 50-99 or PMR 120-129***	***Prevalence 20-29% or Incidence 100-149 or PMR 130-139***	***Prevalence 30-39% or Incidence 150-199 or PMR 140-149***	***Prevalence 40+% or Incidence 200+ or PMR 150+***
Potentially disabling	Musculo-skeletal disorders. Hearing impairment.	Osteoarthritis.	Elbow symptoms.[2]	Neck pain.[3] Upper limb complaints.[4]	Low back pain.[5] Shoulder pain.[6] Hand/wrist symptoms.[7] HAVS/VWF.[8]
Non-disabling or transient	Eye irritation.		Orf.	Upper respiratory tract symptoms.	

Potentially disabling diseases with high frequencies include low back pain, shoulder pain, hand/wrist symptoms, HAVS/VWF, neck pain, upper limb complaints, elbow symptoms (all in specific occupations), and osteoarthritis. These all are putatively caused by physical stresses (HAVS definitely by vibration), and in theory amenable to intervention.

Other infections are relatively rare. The other (except for lip) cancer excesses are relatively small. The causes and possible interventions are unknown, except for a general control of exposures to potentially harmful chemicals.

5.2.3 Information needs

It is clear that agricultural workers suffer a large number of occupational conditions, with high frequencies in some occupations. In most cases the information on frequency of these diseases is weak, and is unsatisfactory as a baseline for measuring the effect of interventions. The above priorities do however show where interventions are required.

Good information on frequency can best be obtained by specially designed studies. It would be convenient, if it were possible, to link to ongoing studies, such as the HSE series of self-reported work-related illness (SRWRI), or the THOR series of physician reporting schemes.

As currently designed, SRWRI studies linked to the Labour Force Surveys would not be suitable for this purpose because the survey is random, and would not include enough agricultural workers to give a statistically reliable result. Extension of the design to include a larger number of agricultural households would be valuable, if this is possible.

[2] *Chain saw operators*
[3] *Tomato growers*
[4] *Tree harvester operators*
[5] *Tractor drivers*
[6] *Tomato growers*
[7] *Chain saw operators*
[8] *Chain saw operators (18% in other forestry)*

The THOR series of physician-reporting schemes also suffers from small numbers, and is limited by the tendency of farm workers to avoid doctors. Expansion of these schemes in agricultural areas might be possible.

Information is less satisfactory for Leptospirosis and Lyme disease, zoonoses that are relatively frequent in the general population, but are sourced originally from farm animals, rats or vegetation. Information is needed on the frequencies in agricultural workers. The CDSCs could be approached with a view to obtaining occupational information.

Frequencies of pneumonia and other non-zoonotic infections in agricultural occupations in the UK are unknown, but the mortality data indicates that they are increased, and agricultural workers are heavily exposed to pathogenic bacteria. Some more detailed analysis of the mortality data would clarify the need for a special study of the frequency of infections in agricultural workers.

These apart, specific studies would be necessary, and we suggest that these could be focussed on specific high risk groups, with a view to assessing the baseline frequency, and measuring the success of interventions over a period. Forestry workers and tomato growers are obvious possibilities, and the relatively small number of employers would make studies easier to conduct than studies of multiple small farms.

5.2.4 Musculoskeletal problems : 'Fit 3' priorities for research

Musculoskeletal disorders are widely recognised as one of the biggest causes of work-related sickness absence in any sector. The data identified during this study is strongest where disease outcome can be objectively assessed. Thus degenerative osteoarthritis, established by X-ray, is relatively well-researched whereas so-called soft tissue injuries such as back pain have been less extensively studied.

Osteoarthritic degeneration of the skeletal system is, to some extent, an inevitable outcome for the majority of the population with evidence that some forms (e.g. osteoarthritis of the lumbar spine) affect between 80-90% of the population by the age of sixty. However, it is well established (e.g.Hult, (1954)) that the progression of such degeneration is more rapid amongst those engaged in heavier physical work.

The contribution of agricultural work to osteoarthritic degeneration is well-recognised, particularly in relation to osteoarthritis of the hip which is a prescribed disease for those working in agriculture. It is no coincidence that the parts of the skeletal system most-frequently affected by osteoarthritis are those which are load-bearing with the knee, hip and spine (particularly lumbar and cervical) most susceptible. Although clear epidemiological evidence has not been found it is likely that the prevalence of degenerative change in joints other than the hip will also be elevated amongst farmers.

In the context of 'Fit 3' this has potentially serious consequences. Agricultural work remains a relatively physical occupation. Many farmers and farm workers, particularly those working in relatively small units, have little option but to continue to perform general farming duties to the best of their abilities despite increasing pain and disability. Traditionally farmers and farm workers have also tended to accept a more extended working life.

Where continuing to work is possible this extends the period of exposure to occupational risk factors for osteoarthritis, increasing the probability of serious disability either ultimately curtailing working life or markedly impairing mobility and quality of life in retirement.

Not all osteoarthritic degeneration apparent on X-ray is symptomatic. A number of studies, particularly examining lumbar osteoarthritis, have demonstrated that asymptomatic degeneration is not uncommon (and that, in some instances, symptoms can be advanced beyond that which would be anticipated for a given level of apparent degenerative change).

Degenerative osteoarthritis affecting various load-bearing joints undoubtedly has a significant negative impact on the 'Fit 3' parameters. Research is needed to better understand the contribution of heavy physical work to such degeneration and to provide some insight into the factors which render such degeneration symptomatic.

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Appendix 1 : SIC classification

From the ITT: "Industry is defined by reference to Section A of the UK Standard Industrial Classification of Economic Activities 1992 (as amended) i.e. includes agriculture, horticulture, forestry and related activities"

SECTION A:

AGRICULTURE, HUNTING AND RELATED SERVICE ACTIVITIES
Growing of crops; market gardening; horticulture
Growing of cereals and other crops not elsewhere classified
Growing of vegetables, horticultural specialities and nursery products
Growing of fruit, nuts, beverage and spice crops
01.13/1 Growing of wine grapes and table grapes and production of wine from self-produced grapes
01.13/9 Growing of other fruit, nuts and spice crops; growing of other beverage crops

Farming of animals
Farming of cattle, dairy farming
Farming of sheep, goats, horses, asses, mules and hinnies
Farming of swine
Farming of poultry
Other farming of animals

Growing of crops combined with farming of animals (mixed farming)
Growing of crops combined with farming of animals (mixed farming)

Agricultural and animal husbandry service activities,
Agricultural service activities
Animal husbandry service activities, except veterinary activities
01.42/1 Animal boarding and care
01.42/9 Animal husbandry services, except veterinary activities, not elsewhere classified

Hunting, trapping and game propagation including related service activities
Hunting, trapping and game propagation including related service activities

FORESTRY, LOGGING AND RELATED SERVICE ACTIVITIES
02.0 Forestry, logging and related service activities
- 02.01 Forestry and logging
- 02.02 Forestry and logging related service activities

NOTES:

Section 01.25 includes bee keeping, breeding of pet animals, raising of fur animals
Section 01.41 includes crop treatment and spraying, pest control in connection with agriculture, tree pruning and hedge trimming, operation of irrigation systems
Section 01.50 includes hunting and trapping of animals for food, fur, skin, or for use in research, in zoos or as pets, catching of sea mammals such as walrus and seal.

Appendix 2: Occupation and disease matrix

SIC code	Occupations	Infections: Zoonoses							
		Brucellosis, Undulant fever	Tick-borne disease, Q fever, Ricketsia Burnetti, Lyme Disease	Cow pox	Ringworm	Cryptosporidium	Hydatid	Leptospirosis, Weil's Disease	Ovine chlamydiosis
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand								
01.11	Hop growers								
01.12	Mushroom farmers Vegetable growers Growing herbs								
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager								
01.21	Beef and dairy farmer Cowman								
01.22	Sheep farmer Shepherds								
01.22/ 01.42/9	Sheep dippers Sheep shearers								
01.23	Pigman/woman								
01.24	Poultry farmer Duck/Geese farmers								
01.25	Beekeepers								
01.25/ 01.50	Gamekeepers								

SIC code	Occupations	Infections: Zoonoses							
		Brucellosis, Undulant fever	Tick-borne disease, Q fever, Ricketsia Burnetti, Lyme Disease	Cow pox	Ringworm	Cryptosporidium	Hydatid	Leptospirosis, Weil's Disease	Ovine chlamydiosis
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener								
01.42	Animal husbandry								
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers								
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman								
02.02	Forestry Officer Tree surgeon								

SIC code	Occupations	Infections: Zoonoses		Other Infections					
		Meningitis, Streptococcus Suis	Psittacosis	Tuberculosis	Tetanus	Enteritis, Colitis, Diarrhoea, E coli, Salmonella, Typhoid	Staphylococcus, Impetigo, Boils	Pneumonia	BSE, Encephalopathy, Encephalitis, Dementia
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand								
01.11	Hop growers								
01.12	Mushroom farmers Vegetable growers Growing herbs								
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager								
01.21	Beef and dairy farmer Cowman								
01.22	Sheep farmer Shepherds								
01.22/ 01.42/9	Sheep dippers Sheep shearers								
01.23	Pigman/woman								
01.24	Poultry farmer Duck/Geese farmers								
01.25	Beekeepers								
01.25/ 01.50	Gamekeepers								

SIC code	Occupations	Infections: Zoonoses		Other Infections					
		Meningitis, Streptococcus Suis	Psittacosis	Tuberculosis	Tetanus	Enteritis, Colitis, Diarrhoea, E coli, Salmonella, Typhoid	Staphylococcus, Impetigo, Boils	Pneumonia	BSE, Encephalopathy, Encephalitis, Dementia
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener								
01.42	Animal husbandry								
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers								
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman								
02.02	Forestry Officer Tree surgeon								

SIC code	Occupations	Other infections	Diseases from Chemicals							
		Warts	Dippers' Flu	Endotoxin fever	Silo-fillers disease (NO_2 poisoning)	Asthma	Occupational Asthma	Bronchitis: Acute, Chronic	Eye Irritation, Conjunctivitis, Blepharitis	General Poisoning: Acute, Chronic
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand									
01.11	Hop growers									
01.12	Mushroom farmers Vegetable growers Growing herbs									
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager									
01.21	Beef and dairy farmer Cowman									
01.22	Sheep farmer Shepherds									
01.22/ 01.42/9	Sheep dippers Sheep shearers									
01.23	Pigman/woman									
01.24	Poultry farmer Duck/Geese farmers									
01.25	Beekeepers									
01.25/ 01.50	Gamekeepers									

SIC code	Occupations	Other infections	Diseases from Chemicals							
		Warts	Dippers' Flu	Endotoxin fever	Silo-fillers disease (NO_2 poisoning)	Asthma	Occupational Asthma	Bronchitis: Acute, Chronic	Eye Irritation, Conjunctivitis, Blepharitis	General Poisoning: Acute, Chronic
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener									
01.42	Animal husbandry									
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers									
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman									
02.02	Forestry Officer Tree surgeon									

SIC code	Occupations	Diseases from Chemicals			Diseases from allergens and organic materials				
		Peripheral Neuropathy, Trophic ulcers	Dermatitis, Eczema	Cancers: Lung cancer Mesothelioma	Alveolitis: Extrinsic, Allergic Farmer's Lung, Bird Breeder's Lung, Pigeon fancier's Lung	Silo Fillers Disease (allergy)	Rhinitis: Allergic, Seasonal, Perennial, Chronic. Hay Fever,	Allergic reactions, Anaphylactic Shock, Allergy (Bee or wasp sting)	Grain Fever
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand								
01.11	Hop growers								
01.12	Mushroom farmers Vegetable growers Growing herbs								
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager								
01.21	Beef and dairy farmer Cowman								
01.22	Sheep farmer Shepherds								
01.22/ 01.42/9	Sheep dippers Sheep shearers								
01.23	Pigman/woman								
01.24	Poultry farmer Duck/Geese farmers								
01.25	Beekeepers								
01.25/ 01.50	Gamekeepers								

SIC code	Occupations	Diseases from Chemicals			Diseases from allergens and organic materials				
		Peripheral Neuropathy, Trophic ulcers	Dermatitis, Eczema	Cancers: Lung cancer Mesothelioma	Alveolitis: Extrinsic, Allergic Farmer's Lung, Bird Breeder's Lung, Pigeon fancier's Lung	Silo Fillers Disease (allergy)	Rhinitis: Allergic, Seasonal, Perennial, Chronic. Hay Fever,	Allergic reactions, Anaphylactic Shock, Allergy (Bee or wasp sting)	Grain Fever
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener								
01.42	Animal husbandry								
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers								
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman								
02.02	Forestry Officer Tree surgeon								

SIC code	Occupations	Diseases from Physical Agents					Musculo-skeletal		
		Noise Induced Hearing Loss, Industrial Deafness	Hand-arm vibration syndrome, Vibration White Finger, Raynauds	Heat stress, Heat exhaustion, Dehydration, Hyperthermia, Hypothermia, Burns	Sunburn	Skin cancer: Melanoma, Epithelioma, Malignant, Benign	General musculo-skeletal disorders	Work-related lower limb disorders: Hip Knee	Back pain, Intervertebral disc, Sciatica, Lumbosacral disc, Neck pain
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand								
01.11	Hop growers								
01.12	Mushroom farmers Vegetable growers Growing herbs								
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager								
01.21	Beef and dairy farmer Cowman								
01.22	Sheep farmer Shepherds								
01.22/ 01.42/9	Sheep dippers Sheep shearers								
01.23	Pigman/woman								
01.24	Poultry farmer Duck/Geese farmers								
01.25	Beekeepers								
01.25/ 01.50	Gamekeepers								

SIC code	Occupations	Diseases from Physical Agents					Musculo-skeletal		
		Noise Induced Hearing Loss, Industrial Deafness	Hand-arm vibration syndrome, Vibration White Finger, Raynauds	Heat stress, Heat exhaustion, Dehydration, Hyperthermia, Hypothermia, Burns	Sunburn	Skin cancer: Melanoma, Epithelioma, Malignant, Benign	General musculo-skeletal disorders	Work-related lower limb disorders: Hip Knee	Back pain, Intervertebral disc, Sciatica, Lumbosacral disc, Neck pain
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener								
01.42	Animal husbandry								
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers								
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman								
02.02	Forestry Officer Tree surgeon								

SIC code	Occupations	Musculo-skeletal								
		Work-related upper limb disorders: Shoulder Elbow, Wrist	Repetitive Strain Injury	Osteoarthritis	Arthritis	Rheumatic complaints, Rheumatism	Lateral Epicondylitis	Carpal Tunnel Syndrome	Tenosynovitis	Tendinitis
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand									
01.11	Hop growers									
01.12	Mushroom farmers Vegetable growers Growing herbs									
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager									
01.21	Beef and dairy farmer Cowman									
01.22	Sheep farmer Shepherds									
01.22/ 01.42/9	Sheep dippers Sheep shearers									
01.23	Pigman/woman									
01.24	Poultry farmer Duck/Geese farmers									
01.25	Beekeepers									
01.25/ 01.50	Gamekeepers									

SIC code	Occupations	Musculo-skeletal								
		Work-related upper limb disorders: Shoulder Elbow, Wrist	Repetitive Strain Injury	Osteoarthritis	Arthritis	Rheumatic complaints, Rheumatism	Lateral Epicondylitis	Carpal Tunnel Syndrome	Tenosynovitis	Tendinitis
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener									
01.42	Animal husbandry									
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers									
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman									
02.02	Forestry Officer Tree surgeon									

SIC code	Occupations	Musculo-skeletal		
		De Quervain's	Rotator Cuff syndrome	Bursitis
01.10	Horticulture Gardeners Market gardeners Horticulture nursery workers Tractor driver Combine harvester driver Green/Glasshouse workers Hort. research institutes Horticultural nursery hand			
01.11	Hop growers			
01.12	Mushroom farmers Vegetable growers Growing herbs			
01.20	Farmers Farm workers Stock farmer Farmer's wives Herdsman/woman Farm manager			
01.21	Beef and dairy farmer Cowman			
01.22	Sheep farmer Shepherds			
01.22/ 01.42/9	Sheep dippers Sheep shearers			
01.23	Pigman/woman			
01.24	Poultry farmer Duck/Geese farmers			
01.25	Beekeepers			
01.25/ 01.50	Gamekeepers			

SIC code	Occupations	Musculo-skeletal		
		De Quervain's	Rotator Cuff syndrome	Bursitis
01.41	Agricultural institute Agriculture Groundsmen Crop sprayer Agricultural pest control ops. Greenkeeper Turf cutter Landscape gardener			
01.42	Animal husbandry			
01.42/1	Kennelman/maid Stablehand Kennel manager Stable manager Animal handlers			
02.01	Forestry Foresters Lumberjack Timber Feller Woodman/woman			
02.02	Forestry Officer Tree surgeon			

Appendix 3: List of bibliographical tools and search terms used in agriculture searches

CCOHS OSH REFERENCES Databases (Canadian Center for Occupational Health and Safety) – web access. This consists of the following databases:

OSHLINE with NIOSHTIC® (and NIOSHTIC-2)

NIOSHTIC® provides international coverage of documents on occupational health and safety and related fields. It contains abstracts of more than two hundred thousand articles, reports and other publications produced over the last century. The database was discontinued in 1988.

OSHLINE covers the post 1998 literature in health and safety

HSEline

This database, supplied by HSE, includes in excess of 180,000 citations, with abstracts to worldwide literature. It covers all UK HSE and HSC publications in addition to other books, articles, reports, legislation and conference proceedings.

CISILO

This bilingual, bibliographic database, produced by the International Occupational Safety and Health Information Centre (CIS) in Geneva provides references to international occupational health and safety literature. The database includes references to publications from 1974 to the present, sourced from more than four hundred journals.

Canadiana

This database provides references to occupational health and safety documents published in Canada, and includes references to reports, articles, conference proceedings and books.

NATIONAL LIBRARY OF MEDICINE'S DATABASES

Toxline

Toxline is NLM's database for toxicology. It provides bibliographical information on the effects of drugs and other chemicals, and contains more than three million bibliographic references.

PubMed/MEDLINE

Pub Med includes more than fifteen million citations for biomedical literature from the 1950's to the present. They are extracted from Medline and life science journals.

Search terms used (searches included the terms below and other synonyms identified by the search engines):

Occupational terms:
Agricultural institute
Agricultural pest control operators.
Agriculture
Agriculture worker
Amenity horticulture
Animal handlers
Animal husbandry
Arable
Beef and dairy farmer
Beekeeper
Chainsaw operator
Combine harvester driver
Cowman
Crop sprayer
Duck farmer
Equine
Farm manager
Farm owner
Farm worker
Farmer's spouse
Farmer's wife
Farmers
Foresters
Forestry
Forestry officer
Forestry worker
Gamekeeper
Gardener
Geese farmer
Glasshouse worker
Greenhouse worker
Greenkeeper
Groundsman
Groundswoman
Herb grower
Herdsman
Herdswoman
Hop growers
Horticultural nursery hand
Horticultural research institute
Horticulture
Horticulture nursery worker
Kennel manager
Kennelmaid
Kennelman
Landscape gardener
Livestock
Lumberjack
Market gardener
Mushroom farmer

Mushroom grower
Pigman
Pigwoman
Poultry farmer
Sheep dipper
Sheep farmer
Sheep shearer
Shepherd
Shepherdess
Stable manager
Stablehand
Stock farmer
Timber feller
Tractor driver
Tree surgeon
Turf cutter
Vegetable grower
Woodman
Woodwoman

Health terms

Infections
Boils
Bovine spongiform encephalopathy
Brucellosis
BSE
Colitis
Cow pox
Cryptosporidium
Dementia
Diarrhoea
E coli
Encephalitis
Encephalopathy
Enteritis,
Hydatid
Impetigo
Leptospirosis
Lyme disease
Mad cow disease
Meningitis
Ovine chlamydiosis
Pneumonia
Psittacosis
Q fever
Ricketsia Burnetti
Ringworm
Salmonella
Staphylococcal infections
Staphylococcus
Streptococcus Suis
Tetanus
Tick-borne disease
Tuberculosis

Typhoid
Undulant fever
Warts
Weil's disease

Diseases from chemicals
Acute bronchitis
Acute poisoning
Asthma
Blepharitis
Bronchitis
Cancer
Chronic bronchitis
Chronic obstructive lung disease
Chronic poisoning
Conjunctivitis
Dermatitis
Dippers' flu
Eczema
Endotoxin fever
Eye irritation
General poisoning
Lung cancer
Mesothelioma
Occupational asthma
Peripheral neuropathy
Respiratory disease
Respiratory illness
Silo-fillers disease (NO_2 poisoning)
Trophic ulcers

Diseases from allergens and organic materials
Allergic alveolitis
Allergic rhinitis
Allergy (bee or wasp sting)
Alveolitis
Anaphylactic shock
Bird Breeder's lung
Chronic rhinitis.
Extrinsic alveolitis
Farmer's lung
General allergic reactions
Grain fever
Hay fever
Perennial rhinitis
Pigeon fancier's lung
Rhinitis
Seasonal rhinitis
Silo Fillers disease (allergy)

Diseases from physical agents
Benign melanoma
Burns
Dehydration
Dermal cancer
Epithelial
Epitheliod
Epithelioma
Hand-arm vibration syndrome
HAVS
Heat exhaustion
Heat stress
Hyperthermia
Hypothermia
Industrial deafness
Malignant melanoma
Melanoma
Noise induced hearing loss
Raynaud's
Skin cancer
Sunburn
Vibration white finger
VWF

Musculoskeletal problems
Arthritis
Back pain
Bursitis
Carpal tunnel syndrome
De Quervain's
Epicondylitis
General musculo-skeletal disorders
Intervertebral disc
Lateral
Lumbosacral disc
Neck pain
Repetitive strain injury
Rheumatic complaints
Rheumatism
Rotator cuff syndrome
RSI
Sciatica
Tendinitis
Tenosynovitis
Work-related lower limb disorders (hip, knee)
Work-related upper limb disorders (shoulder, elbow, wrist)
Osteoarthritis

Appendix 4: Critical Review Form

P863: BASELINE ILL HEALTH IN AGRICULTURE

CRITICAL REVIEW FORM

Overall category:
key interesting not relevant

Title:

Author:

Reference:

Disease:	**Occupations:**
Occupational?:	

Type of study (e.g. case study, review, epidemiology study, other (expand)):

Geographical Area:

Causal agent:

Any data (in terms of numbers, prevalence/incidence, exposures etc)?:

Results/No. of Cases/Incidence/Prevalence:

Reliability:

Originality:

Other comments (e.g. study design issues etc):

Further reading:

Appendix 5: Annotated Bibliography

Infections:

Current UK information (published since 1989)

Loss Prevention Council (1994). Infectious diseases at work. (SHE 12)
Review. No frequencies for farming. Some useful references. Lyme disease in forestry workers (100 cases of Lyme disease overall pa in UK)), Leptospirosis in dairy farm workers, abattoir, fish, vets refers to PHL Communicable diseases reports. Says frequencies are geographically related to local infective conditions (eg hydatid in S Wales (dogs)).

Snashall D. (1996). Occupational infections. British Medical Journal (313), 551-554.
Teaching review. UK. No data. Useful for disease/occupation relations. Also refers to CCDCs starting to report occupational infections (quarterly reports)

Aylin P., Bunting, J., De Stavola, B., and Coleman, M.P. (1999). Mortality from dementia in occupations at risk of exposure to bovine spongiform encephalopathy: analysis of death registrations. British Medical Journal (318), 1044-1045.
Mortality from Creutzfeldt-Jacob disease and dementia in farmers, farm workers, butchers, abattoir workers and vets; between 1979-80 and 1982-96 proportional mortality ratio in men for dementias increased from 62 to 119, not significant. Only 12 deaths from Creutzfeldt – Jacob disease in farmers and farm workers. More details given in paper. Read reports of National CJD Surveillance unit. (National CJD surveillance unit (1997). Creutzfeldt-Jacob disease surveillance in the UK. (Sixth Annual Report.)

HSE (1993). The occupational zoonoses.
Useful general information. Some frequencies given, but no references to sources.

Anthrax; one case in the last ten years. Continuing risk. Agricultural workers, abbattoir workers, bone/bone meal processing, vets, knackermen, stock farming/breeding, butchery, wool industry, hair and bristle processing, and tanneries

Bovine tuberculosis; In the past through drinking raw milk from infected cows, now handling infected animals. Virtually eradicated in cows in UK, but occasional breakdowns occur. In badgers and deer.

Brucellosis; From drinking raw milk from infected cows. Handling infected animals and their tissues, inc foetuses, membranes and fluids. Human cases fell from 600 pa in the early 70's to 7pa in 1984. This coincided with the B. Abortus eradication programme. Recently less than a dozen cases pa reported to CDSC, nearly all in farmers of vets. Occupations; agricultural, dairy, meat workers, vets, lab staff.

Cryptosporidiosis; in calves, lambs. Human lab reports more than doubled between 1988 and 1998. (9147 cases in GB in 1989). Diarrhoea. Mostly children. Sources; infected animals, contaminated drinking water, milk from infected animals, bottle feeding new-borne lambs. Farm workers, vets, laboratory staff.

Hantavirus disease; From field mice, bank voles, rats. Aerosols from infected animals. Farm workers, etc

Hydatid disease; From faeces of infected dogs. Cycle between dogs and sheep. 177 occupationally acquired infections between 1978 and 1989. 20 new each year, half from Welsh farming areas.

Leptospirosis (Weil's disease); 50 cases a year to PHLS, mostly not farming. Rats or rat urine. Fish farmers. (Canoeists Eskimo rolls)

Leptospirosis (cattle form); 50 pa between 1983 and 1988. 18 in 1989. Dairy farm workers. Other farm workers, farmers and market traders. Cattle handlers, lab workers, vets and knackermen.

Lyme disease; tick-borne; from deer. Forestry and agricultural workers.

Newcastle disease; from all domesticated and many wild birds. Rare in UK. Poultry cleaning and preparation.

Orf; from sheep and goats. Pox virus. 50 cases per year, peaks in May and Autumn. Not notifiable.

Ovine chlamydiosis; Infrequent. Severe illness resulting in abortion. Not notifiable.

Psittacosis (ornithosis); From infected birds. Ducks, turkeys, pigeons, possibly other poultry. 157 in 1978, 532 in 1998. 2561 cases 1978-1984 in England and Wales. 1230 in Scotland 1967-1987

Q fever; From sheep and cattle, maybe goats, small mammals and ticks. Animals usually asymptomatic but shed large numbers at parturition. 31 in Scotland in 1989, 154 in E&W 1989. Under-reporting. Airborne exposures, dust.

Rabies; dog and fox. None reported contracted in GB

Ringworm; Bovine animals.

Streptococcus suis; From pigs. 1 or 2 cases per year on average. Handling pigs and pork production, farmers, abattoir, knackermen, butchers.

Brown N.M.o.A.F.a.F. (2000). Bovine spongiform encephalopathy in Great Britain.
Total UK vCJD cases 51 to December 1999. BSE Enquiry Phase II in progress

MAFF and et al (1998). Zoonoses report UK 1998.
Mycobacterium Bovis infections 40 in 1998.
vCJD deaths 3,10,10,
No occupational information

Department for Environment F.a.R.A., Scottish Executive Environment and Rural Affairs Department, Welsh Assembly Government, Department of Agriculture and Development, N.I., Department of Health, and Food Standards Agency (2004). Zoonoses report. United Kingdom 2002.
No occupational information

Linaker C. and Smedley, J. (2002). Respiratory illness in agricultural workers. Occupational Medicine (52), 451-349.
Review; respiratory illness in agricultural workers. Infections section; Bovine TB 40 cases in 1999. Refers to DEFRA Zoonoses report and SWORD.

Scottish Executive Environment and Rural Affairs Department, Welsh Assembly Government, Department of Agriculture and Rural Development, N.I., Department of

Health, Food Standards Agency, and Department for Environment, F.a.R.A. (2004). Zoonoses report. United Kingdom 2002. (Product code PB9248. ISBN 0-85521-055)
The main source of information on zoonoses. Gives no information on occupation
Lists:
Campylobacter
Salmonella
Vero cytotoxin producing E.Coli 157
Cryptosporidium
Bovine tuberculosis
Brucellosis
Anthrax
Rabies
BSE
Foot and mouth disease
Hantavirus disease
Hydatid
Leptospirosis
Listeriosis
Lyme Borreliosis
Orf
Pasteurellosis
Psittacosis
Q fever
Ringworm
Streptococcus suis
Tapeworm
Toxocariasis
Toxoplasmosis
Trichinellosis
Yersiniosis

Office of Population censuses and Surveys (1995). Occupational Health Decennial Supplement. (no. 10)
Farmers' excess mortality from Farmers' lung, other and unspecified allergic pneumonitis, inguinal hernia, other hernia, infections of skin, joint and bone, off-road motor vehicle accidents, animal transport accidents, pesticide poisoning, poisoning by other gases, slipping and tripping, injury by animals and plants, injury by falling objects, injury by machinery, injury by firearms, injury by electric current, suicide.

Guy E.C., Bateman, D.E., Martyn, C.N., Heckels, J.E., and Lawton, N.F. (1989). Prevalence and clinical importance of Borrelia burgdorferi specific IgG in forestry workers. Lancet (1), 484-486.
40 Foresters, 2 had antibodies to Borrelia bergdorferi. Only two had a history of classical symptoms, and two of possible symptoms.

Baird A.G., Gillies, A.G.M., Bone, F.J., Dale, B.A.S., and Miscampbell, S.T. (1989). Prevalence of antibody indicating Lyme disease in farmers in Wigtonshire. British Medical Journal (299), 836-837
101 farmers, foresters, gamekeepers. 12 serologically positive for Borrelia bergdorferi (Lyme disease), including farmers. 11 of these had history of symptoms possibly attributable to Lyme disease.

Thomas D.Rh., Salmon, R.L., Coleman, T.J., Morgan-Capner, P., Sillis, M., Caul, E.O., Morgan, K.L., Paiba, G.A., Bennett, M., Ribiero, D., Lloyd, G., Kench, S.M., Meadows, D., Softley, P., and Chalmers, R.M. (1999). Occupational exposure to animals and risk of zoonotic illness in a cohort of farmers, farmworkers and their families in England. Journal of Agricultural Safety and Health (4), 373-382
Serological study of 606 farmers, farmworkers and their families. Antibodies to Lyme disease rare, Q fever , toxoplasmosis high. Q fever associated with exposure to cattle, cowpox with rats, orf with sheep and rats, ringworm with cattle.

Davies T.R., Edwards, Y., Morgan, A., and Caul, E.O. (1997). Prevalence of Q fever in a rural practice. Journal of Public health Medicine (19), 324-327
Serological study in rural subject in West Wales. 8% seropositive to Coxiella burnetti (Q fever). Odds ratio farmers to non-farmers 4.

Historical UK information

James E.F. (1967). Respiratory hazards of modern farming. Trans.Soc.Occup.Med. (17), 148-151
Ancient. Overview of farmer's lung. No data. Not useful

Cliff K.S. (1981). Agriculture - the occupational hazards. Public Health, London (95), 15-27
Review 1981. UK. Historical. Gives fatal accident rates in the 70s. Quotes Hearn; poisonings 48%, eye injuries 23%, dermatitis 22%, chemical burns 7%. Cases 296, no denominator. Lists: Farmers' lung, Brucellosis, Anthrax, tetanus, Tuberculosis, Rabies, Hydatid, Psittacosis, Histoplasmossis, Louping ill, Ringworm, Actinomycosis, Orf, Campylobacter, Deafness, Rheumatism and arthritis.

Non-UK sources

Donham K., Haglind, P., Peterson, Y., Rylander, R., and Belin, L. (1989). Environmental and health studies of farm workers in Swedish swine confinement buildings. Brit.J.industr.Med. (46), 31-37
High COPD symptoms and lung function impairment in swine building workers. Swedish. Also search for Cotton dust workers, and grain handlers. Also read: *Haglind P., Rylander, R., and Clarke, C.S. (1984). Respiratory function among workers in swine confinement buildings. In: Bernard, G, Gee, L., Morgan, W. K. C., and Stuart, M. Occupational lung disease. New York. Raven Press. 228* and *Holness D.L., O'Blenis, E.L., Sass-Kortsak, A., Pilger, C., and Nethercott, J.R. (1987). Respiratory effects and dust exposures in hog confinement farming. Am J Ind Med (11), 571-580* Classify under chemicals, not infections.

Lings S.(1982). Pesticide lung: a pilot investigation of fruit-growers and farmers during the spraying season. Brit.J.industr.Med. (39), 370-376
USA. Found an index case of pulmonary fibrosis in a fruit sprayer. Found then 10 more cases of transient pulmonary infiltrations. Inadequate control group. Some exposed to Paraquat. Classify under chemicals, not infections.

Wilks C.R., Abraham, G., and Blackmore, D.K. (1989). Bovine pestivirus and human infection (letter). Lancet 107
New Zealand. Tested for bovine pestivirus antibodies in human serum. Negative result. Not relevant.

Baader E.W. (1961). Bovine tuberculosis as an occupational risk. Industrial and Medicine and Surgery 334-336.
Bovine TB in Germany 1961. Interesting historical article. Massive problem in the past.
Quotes figure for TB in dairy and cattle farmers of
Denmark, 43% in 1942
Sweden 51% in 1939
Germany 83% in 1955
England 4.7 to 16.4%

Masley M.S., Semchuk, K.M., Senthilselvan, A., McDuffie, H.H., Hanke, P., Dosman, J.A., Cessna, A.J., Crossley, M.F.O., Irvine, D.G., Rosenberh, A.M., and Hagel, L.M. (2000). Health and environment of rural families: results of a community canvass survey in the prairie ecosystem study (PECOS). Journal of Agricultural Safety and Health (6), 103-115
Canadian. General health survey of farmers and non-farmers in the prairie. Not much difference in respiratory symptoms in farmers and non-farmers (more "bronchitis" in farmers, more breathlessness in non-farmers). Not very useful.

Neukirch F., Perdrizet, S., Bouvier-Colle, M.H., and Pariente, R. (1983). Mortalite par maladies respiratoire chez les travaileure en milieu agricole et non agricole en France de 1970 a 1974. Rev.fr.Mal.Resp. (11), 47-55
French. Refers to 1970-74 mortality. Excess of deaths from acute and chronic respiratory infections

West A.M., Martin, W., McEwen, S.A., Clarke, R.C., and Tamblyn, S.E. (1988). Factors associated with the presence of *Salmonella spp*. in dairy farms in Southwestern Ontario. Canadian Journal of Public health (79), 119-123
Canadian. Dairy farmers. Salmonella contamination of bulk milk tank associated with at least one family member carrying the same organism. Drank raw milk. 1988 paper

Cisak E., Sroka, J., Swolinski, J., and Uminski, J. (1998). Seroepidemiological study of tick-borne encephalitis among forestry workers and farmers from the Lublin region (Eastern Poland). Ann Agric Environ Med (5), 177-181
Eastern Poland 1998. Seropositive reactions to tick-borne encephalitis virus in 20% of forestry workers, and 32% of farmers. Over 5 years, nine and 14 clinical cases in forestry workers and farmers respectively

Rhodes C.S. (1995). Health concerns in large animal veterinarians.
Canada. 1995. Discussion, no numbers. Vets exposed to trauma, needle sticks, formalin, ammonia, hydrogen sulphide, carbon monoxide, and prostaglandins absorbed through the skin.

Valentino M. and Rapisarda, V. (2001). Tetanus in a central Italian region: scope for more effective prevention among unvaccinated agricultural workers. Occup.Med. (51), 114-117
Italy 2001. High incidence (relatively) of tetanus in agricultural workers. Weak immunisation programme.

Steel J.H. (1968). Occupational health in agriculture. Archives of Environmental Health (17), 267-285.
General review. Numbers for anthrax and brucellosis, tularaemia. US orientation. Some interesting history. 1968

Crespy J., Olagnier, E., Rey, P., and et al. (1982). Frequence des verrues et des allergies dans un population de consultants en medicine du travail. Arch.mal.Prof. (43), 185-190
Warts in French food industry workers. 1982. Higher in butchers, not other food industry workers. Poor article.

Gallagher R.P., Threlfall, W.J., Spinelli, J.J., and Band, P.R. (1984). Occupational mortality patterns among British Columbia farm workers. Journal of Occupational Medicine (26), 906-908
Canadian, Mortality study 1950-78. Farm labourers; excess mortality from accidents (railroad. Motor vehicle, burns, environmental factors, drowning), homicide, pneumonia. Not from heart disease or bronchitis and emphysema.

Anon. (1986). Joint FAO/WHO Expert Committee on Brucellosis. Sixth Report. (No. 740)
Review. No prevalences given.

Physical Agents

Papers citing frequency of disease or exposure estimates in agriculture:

Blair A, Dosemeci M, Heineman EF. (1993). Cancer and other causes of death among male and female farmers from twenty-three states. American Journal of Industrial Medicine; 23: 729-742.
Death certificate data from 23 US states 1984-88. 119 648 deaths in white men, with excess mortality due to cancers of the lip (proportional cancer mortality ratio PCMR 2.31, 95% CI 1.43-3.53). No significant excess of skin cancers or melanoma. Other smoking related cancers uncommon.

Blair A, Zahm SH, Pearce NE, Heineman EF, Fraumeni JF,Jr. (1992). Clues to cancer etiology from studies of farmers. Scandinavian Journal of Work, Environment & Health; 18: 209-215.
Meta-analysis of 21 studies reporting cancer morbidity or mortality. No excess relative risk (RR) reported for skin cancer other than melanoma (RR 1.04, 95%CI 0.93-1.16, 8 studies); an increased risk of melanoma (RR1.15, 95%CI 1.04-1.28, 11 studies) and an increased risk for cancers of the lip (RR 2.08, 95%CI 1.80-2.40,8 studies).

Bovenzi M. (1998). Vibration-induced white finger and cold response of digital arterial vessels in occupational groups with various patterns of exposure to hand-transmitted vibration. Scandinavian Journal of Work, Environment & Health; 24: 138-144.
Cross-sectional study vibration exposed workers. Italian workers. 165 forest workers, A(8) 4 ms^{-2} , prevalence VWF 23% (referents 1.1%)

Drever F, ed. (1995). Occupational Health: The Registrar General's decennial supplement for England and Wales. DS no.10. London: HMSO.
England only. Cancer registration data, 371 890 patients 1981 – 1987. Proportional registration ratio (PRR) for cancers of the skin other than melanoma (ICD=173), men, PRR 80 women. PRR cancer of lip 288, men only, no CI but significant excess. Smoking-related cancers significantly reduced in male farmers.

Linet MS, Malker HS, Chow WH, McLaughlin JK, Weiner JA, Stone BJ, Ericsson JL, Fraumeni JF,Jr. (1995). Occupational risks for cutaneous melanoma among men in Sweden. Journal of Occupational and Environmental Medicine / American College of Occupational and Environmental Medicine; 37: 1127-1135.
Swedish cancer registry data. 3850 cutaneous melanoma 1961-79. Standardized incidence ratio 0.8 all anatomical sites (n=513), not statistically significant, and 1.2 (n=143), statistically significant, for melanoma of face, neck and scalp for farming, forestry, hunting, fishing.

Miyakita T, Miura H, Futatsuka M. (1987). Noise-induced hearing loss in relation to vibration-induced white finger in chain-saw workers. Scandinavian Journal of Work, Environment & Health; 13: 32-36.
Cross-sectional study, 499 chain-saw operatives. Own scale of severity VWF. Exposures similar, significantly greater hearing loss reported for those with current VWF.

Palmer KT, Griffin MJ, Bendall H, Pannett B, Coggon D. (2000a). Prevalence and pattern of occupational exposure to hand transmitted vibration in Great Britain: findings from a national survey. Occupational and Environmental Medicine; 57: 218-228.
Postal survey of UK workers with 12 907 usable responses. Self-reported work with vibrating tools in past week by occupation and industry. Well designed and validated survey.

Talamo JDC, Stadie AL, Whyte RT. (1989). A survey of exposure to noise in agriculture. Bootle: HSE. 1989/18.
Field measurements of noise exposure (excluding tractor driving) in UK farming. Estimates of duration of exposure made from various estimates of time required to farm a particular crop; estimates of numbers exposed from MAFF (Ministry of Agriculture, Fisheries and Food) statistics. Predates Noise at Work regulations.

Talamo JDC, Staynes RM, Smith DW, Baker NR. (1988). A review of agricultural tractor noise test procedures and measured levels. Bootle: HSE. 7/1988.
Noise levels measured in operator's position in agricultural tractors. Methodological problems with this identified (dependent upon test standard being applied). For tractors with cabs noise levels were measured at 81.1 dB(A) (95% CI 80.1-82.1) by 1985. No more recent data available. Predates Noise at Work regulations.

Taylor W, Pearson J, Kell RL, Keighley GD. (1971). Vibration syndrome in Foresty Commission chain saw operators. British Journal of Industrial Medicine; 28: 83-89.
Cross-sectional study 711 men, 142 using chain saws. 'Vibration syndrome' poorly defined, prevalence 44% chain saw workers & 18% other workers.

Supportive references for physical agents:

Anonymous. Noise at Work Regulations 1989. Statutory Instrument 1989/1790.

Gemne G, Pyykko I, Taylor W, Pelmear PL. (1987). The Stockholm Workshop scale for the classification of cold-induced Raynaud's phenomenon in the hand-arm vibration syndrome (revision of the Taylor-Pelmear scale). Scandinavian Journal of Work, Environment & Health; 13: 275-278.
Introduction of Stockholm workshop scale for staging of hand-arm vibration syndrome.

Lutman ME. (2000). What is the risk of noise-induced hearing loss at 80, 85, 90 dB(A) and above? Occupational Medicine (Oxford, England); 50: 274-275.
Likelihood of noise-induced hearing loss at different levels of exposure over 45 year period.

Palmer KT, Haward B, Griffin MJ, Bendall H, Coggon D. (2000b). Validity of self reported occupational exposures to hand transmitted and whole body vibration. Occupational and Environmental Medicine; 57: 237-241.

Validation of self-reported exposure to HTV. Self-reported levels of exposure before and after observation were compared to those obtained by observation. Sources of vibration were accurately identified, duration of exposure (particularly intermittent exposure) overestimate by a median factor of 2.5 (ie 60% overestimate of dose).

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