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Review Article

Cardiometabolic risk factors among commercial farmers: a narrative review with systematic methodology

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Abstract

Introduction: Farmers and agricultural workers are a socioeconomically vital rural group who live with an unnecessary burden of ill health. This review aims to summarise current research addressing risk factors for farmers of cardiometabolic disease (CMD), which is relevant to primary care.

Methods: We searched PubMed, MEDLINE and CINAHL for peer-reviewed articles published between January 1990 and January 2025 combining terms for CMD risk factors, and 'farmers' and 'agricultural workers'. Grey literature searching and manual citation searching from included studies was also incorporated.

Results: We identified 22 studies addressing CMD risk factors among farmers alongside references from agricultural, environmental, health and social care research, and government policy resources for context and comparison. Farmers in the UK and Republic of Ireland are aging and predominantly male and appear to carry a higher proportion of CMD risk compared to other occupational groups. Influencing factors include job insecurity and precarious incomes, barriers to accessing rural health care, rising mental ill health, hazardous alcohol consumption, and disruption to diets and physical activity. There is mixed or limited evidence about behavioural and demographic trends available in the UK and Republic of Ireland. There are limited data to describe how and when farmers interact with healthcare providers who can assess overall CMD risk.

Conclusion: This review demonstrates that CMD risk assessment among UK and Republic of Ireland farmers requires consideration

of complex socioeconomic and behavioural determinants alongside established clinical risk factors. It also highlights the importance of cross-sectoral solutions in mitigating CMD risks among farmers. It is, at present, unclear how transferable international agromedicine study findings are to farmers in the UK and Republic of Ireland. Future primary care research of CMD risk factors in the UK and Republic of Ireland could inform the development of collaborative approaches to caring for farmers.

Keywords

agriculture, cardiometabolic risk factors, cardiovascular, farmers, metabolic syndrome, socioeconomic factors.

Introduction

Globally, one in four people work in agriculture[1]. The sector is undergoing rapid change as global environmental and food production targets evolve[2-4]. Mechanisation[5], robotic automation and digitalisation have reduced the labour intensity needed in the sector and the physicality of agricultural work[6,7]. In many developed European countries, urbanisation[1,2,5,7], unpredictable climate[8], necessary dual employment due to low wages[7], long working days[8] and social isolation[6,8,9] have influenced health and generational renewal on farms [2,7,10]. The workforce is therefore shrinking and aging[11], with agriculture accounting for just 2.9% of total employment in high-income nations[1]. Despite these trends, the agrarian myth that 'farmers live healthier and happier lives than city folk'[12,13] persists. In the UK and Republic of Ireland, this is in part due to subsumption in wellbeing statistics[14], which use rural versus urban comparisons[15] and lack the granularity required to make comparisons between types of rural communities[16,17]. Reviews have also highlighted that farmer health research is concentrated in 'hotspots' such as pesticide exposure, primary cancers and injuries[18,19], with resultant gaps in chronic non-communicable diseases, which are of increasing concern[20]. There is a suggestion that further research is needed regarding non-communicable diseases among farmers[20]. Healthcare providers also recognise the increasing influence of socioeconomic determinants on health outcomes[21].

Agricultural workforces in developed nations are aging[10]. Despite the Common Agricultural Policy (CAP) 2023–2027, which promotes generational renewal, European countries are not shielded from this global trend. The CAP, first introduced in 1992, aimed to 'strengthen the socioeconomic fabric of rural areas'[4]. In the European Union (EU), an estimated 8.7 million people work in agriculture, of which 23.5% work 49 hours or more per week. Compared to the general public (10.8%), 15.8% of farmers report a work-related health problem[11]. Farm family members are often pluri-active, with part-time 'dual employment' to provide necessary off-farm income[7,11]. Family farming remains dominant; however, small to medium farms continue to decline in number as land is consolidated into larger businesses[11]. These overall trends are cited as evidence that CAP has distributed greater benefits to more productive areas and widened socioeconomic inequality[22].

Within the UK, a commercial farm is defined as larger than 5 hectares of agricultural land or more than 10 cattle, 50 pigs, 20 sheep, 20 goats or 1000 poultry. Farmers are defined as those 'holding' these enterprises, which cover 71% of the UK land area[23]. At the last count (2016), 472,000 farm holders in the UK[23] were predominantly 'sole holders' (97%) and male (84%)[24]. Overall, within the UK and Republic of Ireland, agriculture employs more people aged over 55 years than any other occupational group[25,26]. A large proportion of farmholders were aged over 65 years (40%) while just 2% were under 35 years[24]. Like the wider EU workforce, the majority of additional labour on farms in the UK is made up of family members who are predominantly female[24]. The UK is currently transitioning out of EU agricultural policy, and direct food production payments will cease in 2027[27]. The agricultural sector in the Republic of Ireland is male-dominated (86.7%), aging and family-based also, although policy reform remains within the EU[26].

Globally, cardiometabolic diseases (CMDs) are rising in prevalence. CMDs include, among others, cardiovascular disease (CVD), diabetes mellitus, chronic renal failure and fatty liver disease[28]. European populations are disproportionately burdened by CMD compared to other regions[29]. CMDs develop for many reasons but an important driver is overnutrition and physical inactivity, which results in metabolic syndrome. Although widely debated and refined internationally, the presence of metabolic syndrome is generally agreed to be diagnostically attributable if a patient has three out of five cardiometabolic risk factors. In brief these are hypertension, impaired glucose control, hypercholesterolaemia, hypertriglyceridaemia and central obesity[30], all of which can be objectively measured and managed according to national clinical guidelines[31-37]. The more of these risk factors that a patient has in the ideal target range, the lower the risk of CMD[38,39].

Public health policies therefore recommend tackling several CMD risk factors at once. Despite this proposed multi-target approach and the heavy burden of CMDs on health services, there is no conclusive evidence supporting blanket screening. This is due to the risks and costs posed by the resultant unnecessary investigations and psychological stress[40]. Clinical judgement is vital to ensure patients are appropriately screened for risk factors that may lead to CMD only when it is in their best interest[41].

In the UK and Republic of Ireland, appointments in primary care represent more than 90% of healthcare consultations, and include preventative care and chronic disease monitoring[41]. These are mostly conducted by GPs. During these consultations, behavioural risk factors including smoking, increased alcohol intake, low physical activity levels and poor dietary choices can be subjectively assessed. Other sociodemographic risk factors include advancing age, male sex, ethnicity, socioeconomic deprivation and family history of CMD[28,41]. A GP will generally enquire about risk factors specific to a patient's occupation at the end of a consultation, when 'social history' is customarily explored as a 'footnote'[42]. Among other clinical details, the importance of including a patient's social history depends on individual GP attitudes and knowledge[41-43] during typically time-pressured clinical appointments. GPs, also known as family medicine doctors, therefore have a unique role in weighing up the risks and benefits of assessing CMD risk factors[41,43].

This review aims to critically summarise the current research addressing risk factors for CMD among farmers, which is relevant to primary care in the UK and Republic of Ireland.

Methods

Narrative review methods are flexible and suited to under-researched areas[44], which can inform co-design of future study questions to minimise research waste[45]. The socioeconomic context of evidence can be chronicled within evidence across a range of disciplinary areas alongside relevant grey literature[46]. Pre-

formulated restrictive questioning, a requirement of systematic and scoping reviews, may neglect several regulatory and policy-level complexities associated with this subject area[46,47].

In this review, evidence was eligible for inclusion if the information reported on the presence or development of a cardiometabolic risk factor (eg disrupted diet, alcohol intake) or a consequence of CMD (myocardial infarction, diabetes) among farmers. Studies in which participants were exclusively employed as agricultural workers were excluded as their socioeconomic context is not comparable to farmers as head of holdings[48]. Studies published over the past 35 years (January 1990 to January 2025) were included to coincide with a growth in agromedical research[49] and the socioeconomic impact[3] of major agricultural policy shifts in Europe[4]. Studies of comparable farming demographics and mechanised agricultural sectors (North America, Australasia and Europe) were prioritised.

Search strategy

While research is ongoing into markers of CMD, traditional CVD risk factors – namely hypertension, diabetes mellitus and dyslipidaemia – remain accepted key predictors[50]. PubMed, MEDLINE and CINAHL databases were searched using relevant search terms as per the inclusion criteria and database algorithms. Search terms were 'cardiovascular' or 'angina' or 'heart' or 'ischaemia' or 'myocardial infarction' or 'cerebrovascular' or 'cardiac' or 'coronary'; 'blood pressure' or 'hypertension' or 'essential hypertension'; 'cholesterol' or 'hypercholesterolaemia' or 'lipid'; 'diabetes' or 'diabetes mellitus' or 'glucose' or 'hyperglycaemia' or 'impaired glucose tolerance' and 'farmer' or 'agricultural* worker*' or 'farm'. Article titles and abstracts were screened for inclusion according to the inclusion criteria. For further context, the search was extended to grey literature including UK, Republic of Ireland and European government reports. The reference lists of included articles were also reviewed. After compiling all eligible references, duplicate records were identified and removed. Following this, abstracts were screened and included full articles reviewed by the first author (RO). Narrative integrative summary was used to conduct joint synthesis of qualitative and quantitative primary studies to produce a summary table[46]. Thematic analysis was used to organise the data, identify prominent themes and interpret the nature of the knowledge base that currently might inform clinical practice[45]. RO conducted initial analysis, and preliminary data description was then reviewed by HR, MT and NH. Potential discrepancies and inconsistencies were consensually resolved by the authors. In keeping with established methods[46], additional citations were then used for context and comparison alongside systematically selected studies.

Ethics approval

As this review analysed existing published data and did not directly involve participants, ethics approval was not required.

Results

We identified 1178, 346 and 109 papers from searches of PubMed, MEDLINE and CINAHL respectively (Fig1). Following title review, 149 unique articles were selected for abstract review. Twenty-two studies from agricultural, sociology, occupational and public health research were included and then described within UK and Republic of Ireland clinical and agricultural contexts (Table 1). The results are organised into two broad areas contributing to CMD risk: agricultural socioeconomic and behavioural determinants, and demographic and occupational determinants.

Table 1: Summary of published studies included in narrative literature review[12,48,49,51-71]

First author, year	Participants	Setting	Aim(s)	Study type	Relevant results	Study limitations
Alavanja et al, 1996[49]	Over 89,000 farmers	US	Examine long-term health effects of farming exposures.	Prospective cohort	Landmark study. 17% of farmers are current smokers, lower than the rate for the US as a whole (28%).	Focussed on pesticide exposures. Self-reported data. Incomparable farming system. Association with later studies of mortality[69,70].
Baker et al, 2011[71]	91 female and 95 male farmers	Australia	Determine prevalence of CVD risk factors and assess knowledge of local health services.	Cross-sectional, mixed methods	Farmers had lower smoking rates, increased rates of cardiovascular risk factors (obesity).	Small cohort. Non-randomised selection. Partly self-reported data. No comparison to general population.
Barnes et al, 2020[51]	5110 adults	New Zealand	Assess CVD risk factors in a range of occupational groups.	Retrospective cohort	Agricultural and fishery workers, less likely to be diagnosed with hypertension, diabetes, hypercholesterolaemia.	Data relied upon attendance or diagnosis. Privately controlled primary care data was not included.
Blackburn et al, 2009[52]	58 female and 70 male farmers	Australia	Assess CVD risk factors and effect of intervention (Sustainable Farm Families project).	Prospective cohort, intervention	Reduction in cardiovascular risk factors of BMI, cholesterol, blood glucose, blood pressure, with targeted health education.	Self-selected cohort. Lack of control group. Limited sample size. Short (2-year) follow-up period.
Brumby et al, 2009[53]	88 farmers and healthcare providers	Australia	Explore farmer health behaviour with reference to cardiovascular risk factors in rural settings.	Qualitative	Enhanced training for nurses resulted in high participation, positive evaluation and improved health indicators among farmers.	Qualitative data reported. Limited reproducibility, incomparable geography and non-specific risk factor outcomes.
Brumby et al, 2011[54]	Farmers	Australia	Assess the effect of physical activity on CVD risk factors in farmers.	Prospective cohort, intervention	Farming Fit intervention study protocol reporting summary data correlating psychological distress to risk factors of CMD including obesity, impaired glucose tolerance, hypertension and dyslipidaemia.	Protocol report to be read in association with later studies[12,55,57]. Limited transferability to UK and Republic of Ireland setting.

Brumby et al, 2011[12]	1813 farmers	Australia	Describe CVD risk factors and association with psychological distress and physical activity.	Cross sectional, quantitative	64.3% of farm men and women were either obese or overweight, significantly higher than current age-standardised Australian national averages($p<0.05$). Association between psychological distress and abdominal adiposity.	Data reported were preliminary findings. Setting of extreme climate-related health inequalities.
Brumby et al, 2012[55]	835 female and 957 male farmers	Australia	Assess CVD risk factors and association with psychological distress.	Cross-sectional, quantitative	Higher prevalence of overweight, obesity, abdominal adiposity, hypertension and diabetes risk in the farming cohort compared with national data. Positive association between psychological distress and risk of developing CVD.	Non-randomised selection. Partially self-reported data. Measures clinical indicators over a period of 6 years which are not validated in UK or Republic of Ireland setting. Associated with later publication[57].
Brumby et al, 2013[56]	29 female and 43 male farmers	Australia	Assess effects of exercise on mental distress, obesity and cortisol.	Case-control	Intervention group (6-month physical activity program) showed significant reductions in body weight and waist circumference.	Non-randomised selection due to rural population location. Descriptive data analysis. Short follow-up period. Extreme weather may have influenced results.
Brumby et al, 2013[57]	835 female and 957 male farmers	Australia	Explore relationships between farmers' physical and mental health and alcohol consumption.	Cross-sectional, quantitative	Higher prevalence of short-term, high-risk alcohol consumption (56.9% in men and 27.5% in women) compared with national data. Positive association between the prevalence of high-risk alcohol consumption and obesity, abdominal adiposity in psychologically distressed participants.	Non-randomised selection. Partially self-reported data. Measures clinical indicators over a period of 6 years.
Katikireddi et al, 2017[48]	N/A	UK	Assess mortality by occupation in the UK.	Longitudinal study	Age-standardised mortality rates per 100,000 person years by occupation reported for England and Wales, Scotland and Northern Ireland indicate male farmers have mid to high levels of mortality.	Occupational codes based on self-reported main occupation. Unable to compare accurately between regions and internationally.
Desai et al, 2022[58]	N/A	US	Review literature pertaining to heart disease in rural male farmers over the age of 45 years.	Literature review	Male farmers over 45 years at higher risk of CVD. Summarises holistic, multifaceted interventions that include stress management and community–based strategies to reduce risk.	Included studies from US only, broad scope, limited pool of evidence.
Gerrard, 1998[59]	150 farmers	UK	Assess occupational health concerns of farmers.	Cross-sectional, qualitative	Limited input into farmers' occupational health, not sufficiently adapted to the problem, lack of healthcare provider knowledge of occupational risks. Limited contact with primary care.	Limited sample geographically, outdated data. Self-reported questionnaire.
Haider et al, 2022[60]	10,053 farmers	Austria	Compare obesity, fruit and vegetable intake and physical activity patterns.	Cross-sectional, mixed methods	Compared to the general Austrian population, farmers showed a higher prevalence of overweight and obesity (42.8% v 36.5%; 18.8% v 17.1%), as well as hypertension, hypercholesterolemia and diabetes mellitus.	Self-reported questionnaire collected by insurance company may bias results. Fruit and vegetable intake used as proxy for dietary sample.
Kavanagh et al, 2022[61]	30 farmers	Ireland	Assess effect of intervention on cardiovascular fitness, lower limb strength endurance and diet.	Pre–post observational	Significant improvements ($p<0.05$) were found for BMI, waist and hip circumferences, cardiovascular fitness, systolic blood pressure and cholesterol. Adherence rate of 75%.	Limitations of point-of-care diagnostics. Small sample size. Short follow up time.
Kim et al, 2024[62]	N/A	International	Assess farming as a risk for cardio-cerebrovascular diseases	Scoping review	Farming is a high-risk occupation for cardio-cerebrovascular diseases due to long working hours; night work; exposure to hazardous gases, pesticides and dust (particulate matter, silica and organic dust); exposure to a hypoxic environment; and job-related stress.	Majority of primary studies from an incomparable demographic (Asia). Not all evidence applicable to self-employed farmers.
Loughman et al, 2022[63]	29 farmers	Ireland	Assess physical activity patterns of farmers.	Cross-sectional observational	Farmers are fit, have positive perceptions of exercise, complete large quantities of physical activity, but not in a CVD-protective pattern. CVD risk can be reduced by encouraging them to sit less, have moderate–vigorous intensity physical activity in bouts of ≥10 minutes.	Small convenience sample. Study conducted during summer over short time period. Relied upon data collected with accelerometer, which may underestimate activity.
Peres et al, 2017[64]	1502 farmers	France	Determine prevalence of dementia and cognitive impairment in older farmers.	Prospective cohort	Cognitive impairment with disability diagnosis rates increased between 1988 and 2008. Decrease in dementia symptoms between 1988 and 2008 suggesting population-benefiting treatment improvements.	Diagnostic threshold had decreased by 2008. Differing follow-up periods in each cohort.
Rose et al, 2023[65]	N/A	UK	Study series that explores stressors and wellbeing during and post-pandemic.	Qualitative, mixed methods	Timely special issue highlighting that stressors on farmer wellbeing are highly context-dependent according to place-based social, environmental, economic and political issues.	Complex synthesis of series of articles to be read in context of COVID-19 pandemic.
van Doorn et al, 2017[66]	310 male farmers	Ireland	Measure cardiovascular risk factor prevalence among farmers.	Cross-sectional	One in two (46%; $n=140$) farmers had high blood pressure (≥140/≥90 mmHg), and 46% ($n=140$) had elevated total cholesterol. One-third of farmers were found to be obese (35%; $n=110$). The vast majority (83%; $n=255$) had at least four risk factors for CVD based on the outcomes of the heart screening.	Limited to livestock farmers. Convenience sample. Existing treatment not accounted for. Non-fasting blood samples. Partly self-reported data included.

van Doorn et al, 2018[67]	314 male farmers	Ireland	Explore relationship between farming and male farmers' self-reported health outcomes.	Cross-sectional	57% had attended doctor services in the past year. 20% smoked. 53% had attended preventative health screening. Younger farmers(<45 years) were more likely to engage in harmful health behaviours such as smoking and binge drinking.	Convenience sample. Self-reported data.
van Doorn et al, 2019[68]	310 male farmers	Ireland	Assess health behaviour change after cardiovascular screening.	Retrospective cohort	32% had acted on intervention advice to see their doctor. Participants most in need of health behaviour change based on adverse health screening results were, paradoxically, the least likely to contemplate or engage in health behaviour change.	No comparison group. Convenience sample. Partly self-reported data. There was a lack of follow-up support post-intervention.

CVD, cardiovascular disease. N/A, not applicable.

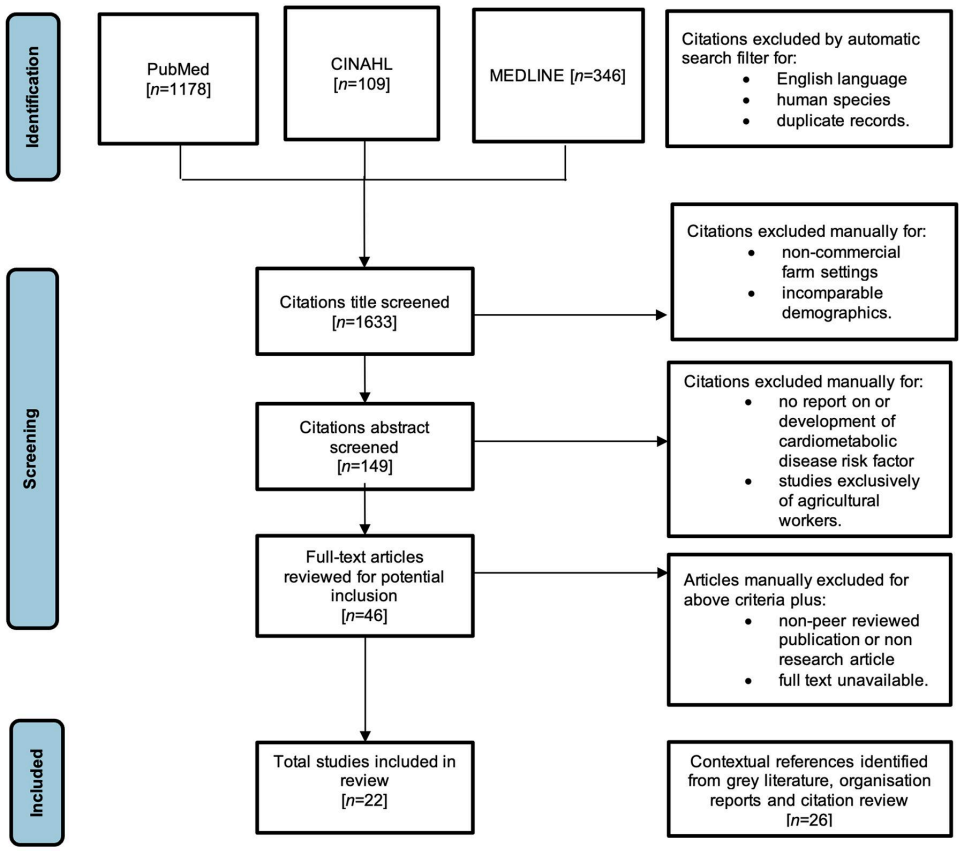


Figure 1: Flowchart illustrating literature selection process.

Agricultural socioeconomic and behavioural determinants of cardiometabolic disease

Job insecurity and unpredictable income

Full-time older Irish farmers(>45 years) self-reported more adverse health outcomes[67] than part-time farmers. In keeping with continent-wide data[11,22], part-time Irish farmers reported working long hours through necessary 'double jobbing', which caused sleep deprivation[9]. The business of farming involves acceptance of unpredictable incomes[23], lack of autonomy[9,65], and poor occupational health and safety[59,72], which by definition[73] leads to precarious employment[19,74,75]. Precarious, insecure employment is a recognised socioeconomic determinant of CMD[48].

Barriers to healthcare access

Farmers, as rural dwellers, travel further and for longer to receive medical advice, alongside other well-evidenced inequalities in rural healthcare provision[15,76,77]. Studies[52,53,59,68,71,78] and services[79] exist that demonstrate the need and benefit of giving tailored advice to farmers regarding CMD risk factors. Uptake of these opportunities can be variable[80], despite services being provided where farmers are (eg at livestock auctions). While it was not always a reported outcome[52] participation in interventions was generally aided by industry collaboration[68,81]. Limited evidence exists in the UK and Republic of Ireland of healthcare provider knowledge of agriculture. A qualitative study based in northern England found 61% (*n*=150) of farmers had little to no contact with their GP and commented that healthcare providers believe farming to be healthy, and showed little interest in their occupation[59]. Similar sentiments existed in an Australian study[12] where increased healthcare provider knowledge of agriculture significantly contributed to farmer-centred recognition of CMD risk factors[53].

Mental ill health

There is a strong 'bidirectional relationship' between depression and CVD[82]. Overwhelmingly, studies in the UK and Republic of Ireland have found that farmers have increased rates of anxiety, depression and suicide[8,83,84]. The COVID-19 pandemic[65], workload, finances[8,77] and relationship problems[77] increased mental ill health in farmers, with similar findings internationally[55,85]. A literature review in 2005 by Fraser et al commented that it is unclear whether farming communities experience increased rates of mental ill health when usage of services is compared between farming and non-farming communities, due to incomparable help-seeking behaviours[77].

Other environmental factors contribute to a complex landscape[85], which are also specific to the sector farmed. Given their role in society, farmers feel under pressure to 'keep going', with Meredith et al describing farmers as 'essential but vulnerable'[86].

Alcohol and substance misuse

Alcohol misuse is a recognised risk factor for CMD[31,38,39]. The relationship between European farmers and alcohol has been long recognised, with agrarian areas being commonly associated with 'home brewing'[87]; however, a large North American cohort study reported lower alcohol consumption when compared to the general population[49]. Later studies in Ireland and Australia both demonstrate that younger farmers tend to self-report 'dangerous drinking'[57,67] when assessed using validated questionnaires. A recent scoping review found that farmers had a higher prevalence of risky alcohol consumption patterns than non-farmers, which was exacerbated by financial stress, depression and male gender. Farmers also consumed more alcohol than farm workers, although less is known about other types of substance misuse[88].

Smoking and inhaled irritants

Respiratory symptoms due to inhaled irritants are highly prevalent among UK farmers, with asthma and allergic alveolitis the most diagnosed diseases[89,90]. Patients with chronic obstructive airway disease caused by inhaled irritants are two to three times more likely to develop CVD[91]. Smoking rates measured by self-report among farmers were found to be lower than national averages[49,66,71].

Physical inactivity and diet

The supposition that mechanisation and technological advances have resulted in a more inactive role for farmers exists; however, the effects and scale of this change remain unquantified[56]. An Austrian study demonstrated farmers ate less fruit and vegetables, and had higher rates of diabetes and obesity, compared to the general public[60]. A study in Ireland observed that farmers do still complete large amounts of physical activity compared with other occupational groups but crucially it was not in a cardio-protective manner[63]. A small (n=30) physical activity program showed benefit for farmers at risk of CMD risk[61], with similar positive results in Australia[56].

Demographic and occupational determinants

Aging and male traits

It is widely accepted that advancing age is a risk factor for CMD[39]. The average age of farmers is rising both in the UK and Republic of Ireland at the ages of 59 and 58 years, respectively, and they are predominantly male[23,26]. Peters et al state this will have implications for CMD prevention in agriculture, and offer an overview of suggested steps to take at individual and community levels[10]. Farmers are known to have a strong work identity[9]. The sociological construct of hegemonic masculinity provides an explanatory theory for the observation that males tend to be stoic, self-sufficient and heterosexually dominant over females[92]. Overall, in Ireland, adverse health behaviours such as under-reporting and delaying presentation are more prevalent among males[93]. While they may make poor wellbeing choices, those in male-dominated workforces do report being motivated to improve their health[71] but experience barriers in doing so.

Occupational determinants

The landmark Agricultural Health Study is a large prospective North American cohort study, commenced in the 1990s[49]. Using these data, Waggoner et al conducted a study of the previously enrolled 89,656 farmers and their spouses over an extended time period (1993–2007)[69]. They found that standardised mortality ratios were less than expected (0.54 (95% confidence interval 0.52–0.55)) for CVD[70]. A similar, more in-depth, study using the same data supported these findings[94]. The results were attributed to lower smoking rates, healthier diets and increased physical activity factors listed in the original enrolment profile[49].

One study based in Australia specifically compared CVD risk factors in agricultural workers to their surrounding general rural population. They found that farmers did not suffer disproportionately from increased CVD risk based on evaluation of risk factors between cohorts[94]. Aligning with the Agricultural Health Study, the teams suggested that this was due to healthier dietary habits and lower reported alcohol consumption. They went further to state that cardiac prevention programs targeting farmers are therefore unwarranted and could widen health disparities between rural and urban dwellers. Around the same time, a prospective study specifically of farmers (n=1220) in Sweden was conducted. This team also found that farmers enjoyed lower rates of mortality compared with their urban peers. Morbidity for all causes aside from musculoskeletal disorders was lower in farmers[95].

A New Zealand-based retrospective cohort study[51] compared specific occupational groups' CVD risk factors. They used a self-reported survey to assess smoking, obesity and deprivation. A government-integrated dataset including routinely collected hospital health data was used to assess if an individual had been diagnosed with high blood pressure, high cholesterol or diabetes. They found that agricultural and fishery workers were less likely to have been diagnosed with these conditions than other occupational groups. The data had many limitations, not least that diagnosis was reliant on attendance with a healthcare professional and that privately controlled primary care data were not included.

Mortality trends

Detailed assessments of mortality and cause of death by occupation are scarce within the UK and Republic of Ireland. Mortality statistics suggest farmers experience unnecessary ill health compared to their employed peers[20,48,62]. Farmers were found to have the fourth highest all-cause mortality rate in a study comparing UK occupational groups[48]. In Northern Ireland, farmers ranked seventh highest[48]. Interestingly, the wider group of those employed within an agricultural trade did not rank as highly[48]. Arguably, they have similar occupational exposure risk in the context of chemical, biological and environmental hazards. This highlights complex areas such as status, pay, education and lifestyle, which may hold the key to understanding these differences. Farmers in Republic of Ireland, as an occupational group, represent a high-risk group for ill health[13,57,66], with farmers twice as likely to die of CVD compared to their employed peers[20]. This demonstrates a reversal of trends in rural male CVD mortality observed over the past few decades[13], which has also been observed in Australia[93] and Sweden[95]. Several studies conducted by Brumby et al and others conclude that Australian farmers should be considered a high-risk group for CMD[12,54-57,96].

Specific to the UK and Republic of Ireland, Smyth et al (2013) found that a cohort of Irish farmers (2000–2006) were 5.1 times more likely to die of any cause of death than their peers and were seven times more likely to die of CVD than all other salaried employees[13].These findings prompted a more detailed investigation of CMD risk in Irish farmers through a male-specific convenience sample study (n=310). Almost one in two had hypertension, 46% had raised cholesterol and 36% were obese[66,68]. As advocated by Fang et al, an evaluation of a

combination of CMD risk factors found that 81% had four or more CVD risk factors[38]. In total, 79% of study participants were referred to their GP while only 32% heeded this advice when follow-up was sought by the same team. The team also demonstrated the intervention applied did not result in sustainable behavioural change[68]. A prospective cohort study among elderly farmers in France also reported changing trends in evidence over recent decades. It concluded the prevalences of obesity, diabetes and hypercholesterolaemia were higher while alcohol consumption and smoking had reduced in a 2008 cohort of farmers compared to 1988[64]. The study design used treatment for these conditions as a proxy for diagnosis and therefore these trends may be confounded by the increased recognition of CMD risk factors among clinicians over time.

Discussion

The evidence reviewed demonstrates that UK and Republic of Ireland farmers at risk of CMD are underserved by primary care research. While mental health challenges have been well evidenced[8,9], important physical health predictors of CMD including diabetes are under-researched[41]. CMD is a significant and growing contributor to ill health[20]; however, granular data relevant to rural, remote and agricultural communities remain limited in the UK and Republic of Ireland[14-17]. Studies specifically targeting farmers are often compared with population workforce studies in which forestry and fishing workers are also included, which makes reliable comparisons more difficult[48]. Primary care data and advancing technology may present opportunities to examine farmer health outcomes more accurately[18].

Literature from other male-dominated workforces may inform understanding of the socioeconomic CMD risk factors reported by older farmers. A UK study of workers aged 50–64 years revealed evidence of depression and obesity among those also working long and irregular hours[97]. In other occupations, such as truck-driving[98], people also experience barriers to lifestyle change due to work environments and may ignore symptoms that may necessitate time off work[99].

Studies demonstrating that farmers who embrace 'systems thinking' were more likely to take up screening opportunities[80] suggest that tailored interventions help only those farmers who already have good health literacy and are at least risk of socioeconomic deprivation[41], which could confound the results of existing studies.

This review was conducted to inform the design of empirical research by both farmers and GPs. The diverse range of evidence selected for review also emphasises the limitations of healthcare providers to intervene in farming CMD risk factors without addressing factors outside of clinical interventions. This review may be useful for healthcare providers in future consultations with farmers who are at risk of CMD. For those outside of health care, this review also summarises the current understanding of how GPs evaluate CMD risk factors clinically.

This review has several limitations. It is acknowledged that this review has a broad scope and may lack transparency through less specific search strategies, cherry-picking of evidence and unintended omissions[45,46]. For example, by excluding studies involving solely agricultural workers, evidence relevant to environmental exposures recognised to be linked to CVD (eg heat, pesticides) may have been omitted. The continents from which evidence was selected share similar demographics to the UK and Republic of Ireland; however, differences in agricultural practices are acknowledged. For example, North American agriculture is generally large-scale, intensive and commercialised. This contrasts with smaller, part-time, grass-based family farms seen in the UK and Republic of Ireland. There is a limited and mixed pool of evidence in this subject area. Several studies cited used small convenience samples. This review intentionally includes a wide range of study types; however, the necessary review method does limit the authors' scope to quantitatively assess study quality and bias[45-47].

Conclusion

This review summarises the changing socioeconomic and environmental contexts in which UK and Republic of Ireland farmers work. Existing studies have been limited by inaccurate or absent coding of occupation across data systems. To advance this subject area, researchers have a responsibility to urgently address this through advocacy for accurate clinical coding of occupation in primary care in digitalised healthcare information systems. Future studies should consider targeting those farmers who are least likely to take up an opportunity to mitigate their CMD risk. These ambitions will require close interdisciplinary collaboration between agriculture and health care. The authors hope this review may expedite this knowledge exchange to sustainably reduce and manage CMD risk factors among this important socioeconomic group.

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Conflicts of interest

Rebecca Orr is a part-time farmer. All other authors report there are no competing interests to declare.

AI disclosure statement

We, the authors of this article, declare that no AI or AI-assisted technologies were used in the development of the article.

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