



Hulls, P., Money, A., Agius, R., & De Vocht, F. (2018). Work-related Ill Health in UK Radiographers. *Occupational Medicine*.
<https://doi.org/10.1093/occmed/kqy076>

Peer reviewed version

Link to published version (if available):
[10.1093/occmed/kqy076](https://doi.org/10.1093/occmed/kqy076)

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WORK-RELATED ILL HEALTH IN RADIOGRAPHERS

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ABSTRACT

Background: In the UK in 2015/16, 1.3 million workers self-reported a work-related illness (WRI) of which an estimated 41% were due to musculoskeletal disorders (incidence rate 550 cases per 100,000 people) and 37% to stress, anxiety and depression. Little is known about the incidence of WRIs in radiographers.

Aims: To analyse the medically reported incidence of WRIs among radiographers in the UK between 1989 and 2015.

Methods: Incident cases reported by physicians to The Health and Occupation Research network (THOR) through its specialist schemes from 1989 to 2015 were analysed, using the Labour Force Survey as denominator where appropriate.

Results: 218 cases (966 estimated cases) were reported. Of these 190 were in women. The mean age was 40.2 (20-91 yrs) SD \pm 11.8 years. Most cases were reported to the OPRA scheme (n=92). A skin diagnosis was the most frequently reported (n=77), followed by musculoskeletal (n=60). Within the EPIDERM scheme, radiographers had the highest incidence rate when compared to all other occupations.

Conclusions: Radiographers had a higher incidence of WRI compared to all other occupations. The most frequently reported WRI was skin conditions. The observed increase in incidence is likely to be due to the increase in the number of radiographers over that time period, although there was no evidence that WRI within radiographers are declining.

Key words: radiographers, work-related illness, THOR, job, diagnosis, healthcare, occupational health, radiography

INTRODUCTION

As of December 2016, the Health and Care Professions Council (HCPC-UK) recorded that 31,900 radiographers, including diagnostic and therapeutic, were registered (3) of which, as of July 2016, 15,832 were registered within NHS England (85% diagnostic radiographers). Within the NHS as a whole, a rise in work pressure alongside escalating demands has been reported (4). There has been a continuing rise in medical imaging with an increase of 15% in the number of radiographers employed in NHS England between September 2009 and July 2016 (5). In addition, the complexity of clinical investigations is also increasing (6). It is further anticipated that the additional introduction of new early diagnosis screening programmes in dementia imaging and non-oncology positron emission tomography-computed tomography (PET CT), will further impact staff resources.

In 2015, 1.3 million workers in the UK self-reported new or long standing work-related illness (WRI) in the Labour Force Survey, with 25.9 million working days estimated to have been lost as a result of this (1). 41% of WRI were due to musculoskeletal disorders and 37% were related to stress, anxiety and depression (1), and the annual cost to the UK economy was estimated at £14.1 billion in 2014/15.

Occupational stress is both a result and a cause of WRI as a result of staff shortages and increased workload (7). Research based on 1658 UK radiographers concluded that perceived stress significantly correlated with role ambiguity, job uncertainty, lack of time with patient and home versus work life (8). Musculoskeletal injury (MSI) is one of the main occupational diseases in industrial countries, with 80-90% of the population experiencing it at some point in their lives (9). Amongst ultrasonographers MSI has been reported as one of the biggest causes of WRI and injury, with reported causes including poor equipment design and poor posture (10), and in a study of 203 Italian x-ray technologists, 67% reported a MSI in the previous 12 months, with low back pain (60%) being reported the most common, primarily related to physical workload (11).

Respiratory and dermal exposures are the main pathways of exposure to hazardous substances in the workplace. Because of regular glove use, hand washing and contact with exposure agents, skin conditions are a common WRI in healthcare professionals (12); in particular, contact dermatitis accounts for 70-90% of all occupational skin diseases (13). Up to half of workers with contact dermatitis

as a result from their occupation experience adverse effects on their quality of life (14). Radiographers are at increased risk of adverse health effects related to the handling of chemicals, such as glutaraldehyde, formaldehyde and sulphur dioxide, with symptoms including upper respiratory tract irritation and palpitations (15). The prevalence of radiographers reporting three or more work-related respiratory symptoms during the last 12 months was about 3 times higher than that reported by physiotherapists (15), while the prevalence of asthma was also higher among radiographers in comparison to nurses (16). Furthermore, working in a darkroom for more than 30 minutes per shift, which is a specific feature of medical imaging, was significantly associated with an increase in reported work-related symptoms (headaches, sneezing and unexpected fatigue) (16).

Although research on WRI has been conducted for healthcare professionals, (13, 17) few studies (7, 8) have specifically focussed on the profession of radiography, despite its increasing importance in healthcare. This study aimed to assess the medically reported incidence of WRIs among radiographers in the UK.

METHODS

The Health and Occupation Research Network (THOR) is a surveillance scheme that collates medically certified incidence data on new cases of WRI, which is voluntarily submitted. The data are collected from over 1000 specialist physicians and specially trained general practitioners (GPs) within the UK (18). Information and guidance on how to report data is provided to clinicians (19).

We included cases of WRI in medical radiographers' standard occupational classification (SOC) codes 342 and 3214 covering the years 1989 to 2015. Data were selected from six databases which are part of THOR. Consultant dermatologists reporting to the occupational skin surveillance scheme (EPIDERM: 1993-2015); chest physicians reporting to Surveillance of Work-Related and Occupational Respiratory Disease (SWORD: 1989-2015); occupational physicians reporting to the Occupational Physicians Reporting Activity (OPRA: 1996-2015); rheumatologists reporting to the Musculoskeletal Occupational Surveillance Scheme (MOSS: 1997-2009); psychiatrists reporting to the Surveillance of Stress and Mental Illness (SOSMI: 1999-2009); and GPs reporting to The Health and Occupation Research Network in General Practice (THOR-GP: 2006-2015).

Physicians participate on either a continuous monthly basis ('core' reporting) or for one randomly selected month each year ('sample' reporting). Annual estimated cases were calculated by multiplying the number of the actual cases reported by 'sample' reporters by 12, and then adding them to the cases reported by core reporters.

Statistical analysis was completed using Stata 14. Occupation was recoded into five categories; radiography, ultrasonography, other radiography, other profession and senior radiography, based on open text information available in the records. These included both diagnostic and therapeutic radiography, which could not be distinguished. Industry was recoded in three categories; clinical (NHS/private/both), research (healthcare/research) and 'no answer'.

Chi-Square tests, were used to determine associations between gender, job categories and diagnosis categories. A short description of the radiographer job categories used in this study is provided in Table 1. Annual average incidence rates (per 100,000 persons) were calculated for cases reported to the specialist skin and respiratory schemes for radiographers and for all other occupations. Numerators (estimated case counts) were adjusted for the proportion of physicians participating in SWORD and EPIDERM and the proportion responding during their reporting months(s) (12). The denominator was the number of persons employed (1989-2015) according to the LFS. Approximate 95% confidence intervals were calculated using a first order Taylor linearized variance estimator. The standard formulae for calculating confidence intervals for count type data when the data have a multi-level structure, weighted adjustment and requires a finite population correction, is not currently available. Therefore, the sample survey methodology was employed to provide approximate confidence intervals (20).

Multicentre research ethics committee approval has been granted to THOR (MREC 02/08/72).

RESULTS

A total of 218 actual cases (189 women and 28 men [1 unrecorded]) (966 estimated total cases) of WRI were reported for radiographers to the THOR network between 1989 and 2015 (Table 2). The largest proportion of cases were reported to OPRA ($n=92/218 = 42\%$). Of the 218 reported cases (966 estimated), 84% were categorised as radiographers with the remaining 17% being either ultrasonographer, other radiography, other profession or senior radiography.

131 reported cases (119 women and 12 men) worked in clinical practice, 52 (40 women and 12 men) in research and for 35 (30 women, 4 men and 1 undisclosed) this information was not provided (Table 2). 154 women worked in radiography compared to only 24 men, 21 women and 2 men worked in ultrasonography, 5 women (no men) worked in other radiography, 4 women worked in other professions and 3 women and 1 men classified themselves as working as senior radiographers. Cases reported to the MOSS scheme were all women (n=5).

Stratification by diagnostic category and sex indicated that the majority of reported cases were in women and specifically, 88% of musculoskeletal diagnoses, 77% of respiratory diagnoses, 95% of skin diagnoses, 78% of mental health diagnoses and 100% of other diagnoses (Table 2).

Mean age (\pm SD) of all reported cases was 40.2 SD \pm 11.8 years, 39.84 \pm 11.3 and 40.8 \pm 12.0 for women and men, respectively, with the youngest reported case being 20 years and the oldest at 91 years. Six reported cases had missing information on age. Age distributions were comparable for musculoskeletal WRI (39.8 \pm 11.8 years), respiratory (43.3 \pm 10.2 years) and mental health (44.1 \pm 9.5 years) cases. However, those reporting a skin disease were younger on average (36.5 \pm 12.5 years) versus those with a diagnosis classified as 'other' were older (51 \pm 11 years) (data not shown).

The majority of participants had their jobs classified as radiography (182), followed by ultrasonography (23). With respect to diagnostic category, 35% of all cases reported were classified as skin (11% reported via OPRA), 28% were musculoskeletal diagnoses (59% reported via OPRA) and 26% were respiratory diagnoses (10% reported via OPRA).

Table 3 shows the incidence rates for radiographers and all other occupations for cases reported to the EPIDERM (1993-2015) and SWORD (1989-2015) schemes. The incidence of work-related skin diseases (EPIDERM) was higher in radiographers compared to other occupations; 60.2 (95% CI 27.0-93.4) and 19.4 (95% CI 18.2-20.7), respectively. The incidence of work-related respiratory disease (SWORD), in contrast was higher in other occupations compared to radiographers; 16.2 (95% CI 15.3-17.1) and 6.6 (95% CI 2.7-10.6), respectively.

As shown in Figure 1, all 18 cases that had a mental health WRI diagnosis were reported between 2000 and 2014. Reported cases with a skin diagnosis from all schemes were not only the most commonly reported in terms of incidence but also reported across the scheme timeframe (1989 and 2015).

DISCUSSION

This study examined WRI in UK radiographers reported by physicians between 1989 and 2015, during which radiographers had a higher incidence of WRI compared to all other occupations. In total 218 cases of WRI were reported, with the most frequently reported being skin complaints (35% of all reported cases). An incidence in the number of reported cases over time was observed, but this was likely due to the increase in the number of radiographers over that time period. However, there was no evidence that WRI within radiographers were declining.

A strength of this study is that it is based on data collected from physicians from different specialities and not just that from occupational physicians, which would have reduced the number of missed cases. Under-reporting of true incidence may still occur as those with access to both an occupational physician and GP, are more likely to consult their GP, for work-related issues (24). In comparison to the Labour Force Survey in which WRI's are self-reported by patients, these data are voluntarily reported and medically verified. Furthermore, the data collection process has been the same from 1989 to 2015. Within each scheme, only a small proportion of physicians are core reporters who report each month and the remainder are sampled at random to report for one month of each year (19). All GPs reporting to the THOR-GP scheme have the qualifications required (Diploma in Occupational Medicine) and can be expected to more accurately determine whether a case is work-related. THOR is likely to provide more accurate data than other schemes and for skin and respiratory cases of WRI, is the HSE's preferred data source (29).

A limitation of the use of these data is that these do not refer to the total number of cases in the radiographer worker populations, but only to those with a work-related cause or those being aggravated by work. The 'true' proportion of the radiography population consulting about WRI could be higher than this dataset suggests (24). Strengths and limitations of the individual schemes have been described in previous papers (24, 25). A number of assumptions were made in the calculation of incidence rates to adjust for cases not captured due to non-participation of a physician in EPIDERM or SWORD and/or

non-response during their month or participation of sample reporters (one month a year), which has been discussed elsewhere (12).

Although the dataset addresses radiographers in relation to their work, we do not definitively know their employment status at time of diagnosis. We can, however, assume that the vast majority, if not all, will have been employed. We were not able to determine whether length of employment or working hours had a significant influence on the type of WRI.

88% of skin disease cases had a suspected diagnosis of contact dermatitis, with only four cases being men. This supports previous findings that the majority of case reports for contact dermatitis and urticaria were in women employed in health and social work (22). 58% of the suspected agents reported for these cases to the EPIDERM scheme were handwashing and irritation from glove use. The annual number of newly reported cases of occupational skin disease has been declining since 2010, which could be associated with improvements made in the workplace. Alternatively, this could also be influenced by the experience and judgement of the physician on the decision to report the case to the relevant scheme. Since 2005 however, some GP's have been able to report directly to the THOR-GP scheme, but no occupational skin diseases in radiographers have been reported since.

Of the 56 cases reported with respiratory symptoms, 68% had a diagnosis of asthma. From 2008 however, there have been no reported cases of occupational respiratory diseases amongst radiographers. For comparison, the annual incidence rate for the entire UK workforce with access to occupational physicians was 11 per 100,000 in 2005-2007 and 9 per 100,000 in 2008-2010 (24).

Over half of cases in radiographers (n=60) reported to OPRA were musculoskeletal disorders. In contrast to the other WRI, musculoskeletal disorders had a similar gender split in men and women; 28% and 25%, respectively. This absence of between-sex variation has also been documented elsewhere (17). Furthermore, cases were reported across jobs, suggesting that there is no specific job that is at greater risk of suffering from any occupational musculoskeletal diseases. Poor ergonomics, patient handling and repetitive work were commonly reported as the suspected causes of musculoskeletal disorders within this dataset. Of note, previous analyses of the MOSS scheme indicated that recorded cases were more likely to be from repetitive injuries rather than a single injury (25). In the interpretation of these findings it is important to emphasize that it cannot be unambiguously assumed that the

occupation was the cause of all of these musculoskeletal disorders. Here, we observed a decline in the incidence of musculoskeletal disorders from 2002 and 2003. However, this was not only in the radiography profession, but also in the general working population and is discussed in a separate paper (26).

Eighteen cases of poor mental health of radiographers were recorded, with the first case reported in 2000. The absence of cases prior to 2000 may be reflective of the changes in diagnosing mental health problems in the working population between 1993 and 2000 (27). It may also result from the fact that the referral of cases is dependent on the clinician's experience of recognising the influence of occupation on mental health. Furthermore, poor mental health may not only be specifically work-related. Only four cases were reported in males. Between 2013/4 and 2015/16, work-related stress was statistically higher rate in women than in men; 1820 vs 1190 per 100,000 workers, respectively (2).

In conclusion, this study suggests that those working as radiographers are experiencing a higher incidence of WRI than that reported for "all occupations", while there is no evidence that WRI within radiographers are declining.

Key points

- There is a lack of research that specifically focuses on radiographers and work-related ill health.
- The majority of radiographers with work-related illness reported between 1989 and 2015 were women.
- Cases with a skin diagnosis were reported most frequently, followed by musculoskeletal diagnoses.

FUNDING

No external funding was obtained for this study. The Health and Occupation Research network is partly funded by the UK Health and Safety Executive but the views expressed here are exclusively those of the authors and do not necessarily reflect those of the funders.

ACKNOWLEDGEMENTS

The authors would like to thank Alexandra Lipton, Charlotte Beardmore and Rachel Harris from The Society and College of Radiographers for comments on an earlier draft version of this manuscript.

COMPETING INTERESTS

The authors declare no competing interests.

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Table 1: Description of job categories

Job Category	N (reported cases)	Roles
Radiography	182	Qualified radiographers
Ultrasonography	23	Qualified radiographers who identified themselves as ultra-sonographers or sonographers
Other Radiography	5	Those in the radiography workforce, but not reported as radiographers, e.g., x-ray assistants and assistant technical officers
Other Profession	4	Those who work in radiography departments, but identify as a different profession, e.g., nurses
Senior Radiography	4	Those who reported their job as having a senior position within the workforce, e.g., superintendent radiographer

Table 2: Radiographer’s work-related illnesses between 1989 and 2015 from the THOR network

	Total	Skin diagnosis EPIDERM (1993-present)	Rheumatologist diagnosis MOSS (1997-2009)	Occupational physician diagnosis OPRA (1996-present)	Respiratory diagnosis SWORD (1989-present)	GP diagnosis THOR-GP (2005-present)	Psychiatry diagnosis SOSMI (1999-2009)
Number of Cases	218	67	5	92	51	2	1
Number of Diagnoses	222	72		96	54		
Gender							
Female	189	62	5	81	39	1	1
Male	28	4	0	11	12	1	0
NA (No Answer)	1	1	0	0	0	0	0
Job Category							
Radiography	182	63	3	69	44	2	1
Ultrasonography	23	2	1	20	0	0	0
Other Radiography	5	0	1	0	4	0	0
Other Profession	4	1	0	0	3	0	0
Senior Radiography	4	1	0	3	0	0	0
Industry Category							
Clinical (NHS/Private/Both)	131	37	4	76	12	1	1
Research (Healthcare/Research)	52	20	1	16	14	1	0
Other (No Answer)	35	10	0	0	25	0	0
Diagnosis Category							
Musculoskeletal	60	0	5	54	0	1	0
Respiratory	56	0	0	9	47	0	0
Skin	77	67	0	10	0	0	0
Mental	18	0	0	16	0	1	1
Other	7	0	0	3	4	0	0
Estimated number of cases in total radiographers’ workforce							

Estimated Cases	966	111	60	708	84	2	1
Number of Diagnoses based on Estimated Cases	937	116		734	87		

Table 3: Average incidence rates, per 100,000 persons (and 95% confidence intervals) for cases to work-related skin disease (EPIDERM) work-related respiratory disease (SWORD) in radiographers and all other occupations, reported to THOR (1993-2015)

Specialist schemes¹	Occupation category	Incident rate	95% Confidence Intervals)
EPIDERM	Radiographers	60.2	27.0-93.4
	All other occupations	19.4	18.2-20.7
SWORD	Radiographers	6.6	2.7-10.6
	All other occupations	16.2	15.3-17.1

¹: Note that it was not possible to calculate incidence rates for musculoskeletal cases reported to the OPRA scheme because of problems with accurately calculating the denominator.

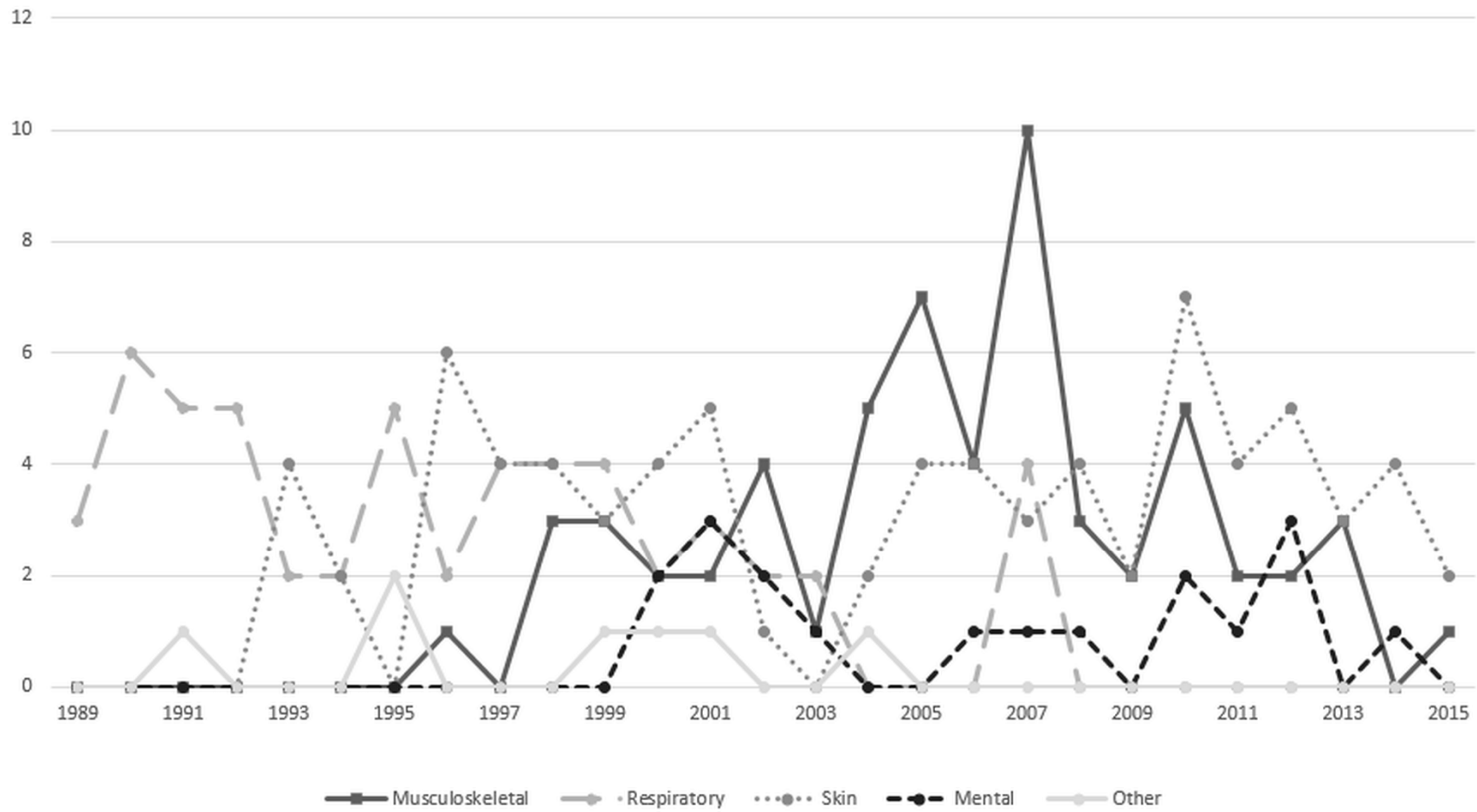


Figure 1: Actual cases by major diagnostic categories of work-related ill-health cases reported to THOR between 1989 and 2015