Exploration of the relationship between regional fatal injury rates and differences in industry composition

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Introduction

Employers have a legal duty to report fatal injuries arising from a workplace accident to the relevant enforcing authority[1] through the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR). Statistics based on these reports are published by HSE to contribute to our understanding of the main drivers of risk of fatal injury.

In order to make comparisons of risk between sub-groups of different sizes, fatal injury rates are calculated which account for variations in the number of people in work in the different groups[2]. Data published at www.hse.gov.uk/statistics/tables/ridreg.xlsx show variation between the different regions and countries of Great Britain, with some having statistically significantly higher rates than others.

Intuitively, there should be no inherent difference in risk between similar jobs in different regions. Previous research has suggested that the variation in overall regional workplace fatal injury rates is driven largely by differences in the **types of work** being undertaken in each region or country. The RIDDOR reports do not contain codified information about the deceased person's specific occupation but there is detailed information about the industry sector in which they worked. This report updates the previous analysis and explores whether this relationship has continued to hold in more recent years.

1 Depending on the industry sector, the relevant enforcing authority may be HSE, a local authority or the Office of Rail and Road.

2 Injury rates are calculated as injuries per 100,000 workers, using employment estimates taken from the Annual Population Survey (APS).

Methods

Using RIDDOR and employment data from the Annual Population Survey (APS) data, injury rates can be constructed for different regions, industry sectors and combinations of region and sector. This analysis uses rates of injuries reported over a five-year period covering 2015/16 to 2019/20 inclusive. Over this period there were 675 fatal injuries to workers in Great Britain for which the region in which the worker was employed was known (from a total of 683 deaths).

The analysis first explores simple correlations between regional fatal injury rates and the proportion of workers in higher risk industry sectors in those regions, to provide an illustration of the effect. A statistical model has then been constructed to standardise regional rates for differences in industry composition and this is used to assess whether statistically significant differences between countries and regions remain.

Summary

It is clear that those countries and regions with a greater proportion of workers in higher risk sectors are the ones with higher fatal injury rates. Standardising the fatal injury rates to account for differences in industry composition has the effect of shifting the highest and lowest regional rates closer towards the average, demonstrating that industry composition does have an effect. However, even after standardisation, the rates for some countries and regions do remain statistically significantly different from the Great Britain average. Industry standardisation will not have fully corrected variations in industry mix since there may be differences within an industry (for example in the Agriculture sector, different types of farming are more prominent in different areas of Great Britain) and it is also likely that industry composition works in tandem with other factors to affect the rates.

Fatal injury rates and workforce composition by industry and region

Fatal injury rates vary markedly across industries, as shown in Table 1, with the rate in the highest risk industry (Agriculture) over 150 times higher than that of the lowest risk industries (Public Services).

Table 1. Fatal injuries to workers in Great Britain, by industry sector, 2015/16 to 2019/20

Industry (SIC section)	Number of fatal injuries	Rate of fatal injuries per 100,000 workers
Agriculture, forestry and fishing (A)	134	7.73
Mining and quarrying (B)	11	1.70
Manufacturing (C)	102	0.71
Electricity, gas, steam and air conditioning supply (D)	6	0.64
Water supply; sewerage, waste management and remediation activities (E)	46	4.18
Construction (F)	186	1.64
Wholesale and retail trade; repair of motor vehicles and motorcycles; accommodation and food service activities (G, I)	47	0.16
Transportation and storage (H)	69	0.88
Information and communication; financial and insurance activities; real estate activities; professional, scientific and technical activities; administrative and support service activities (J-N)	46	0.13
Public administration and defence; compulsory social security; education; human health and social work activities (O-Q)	25	0.05
Arts, entertainment and recreation; other service activities; activities of households as employers; undifferentiated good-and-services-producing activities of households for own use; activities of extraterritorial organisations and bodies (R-U)	11	0.11
All industry (A-U)	683	0.42

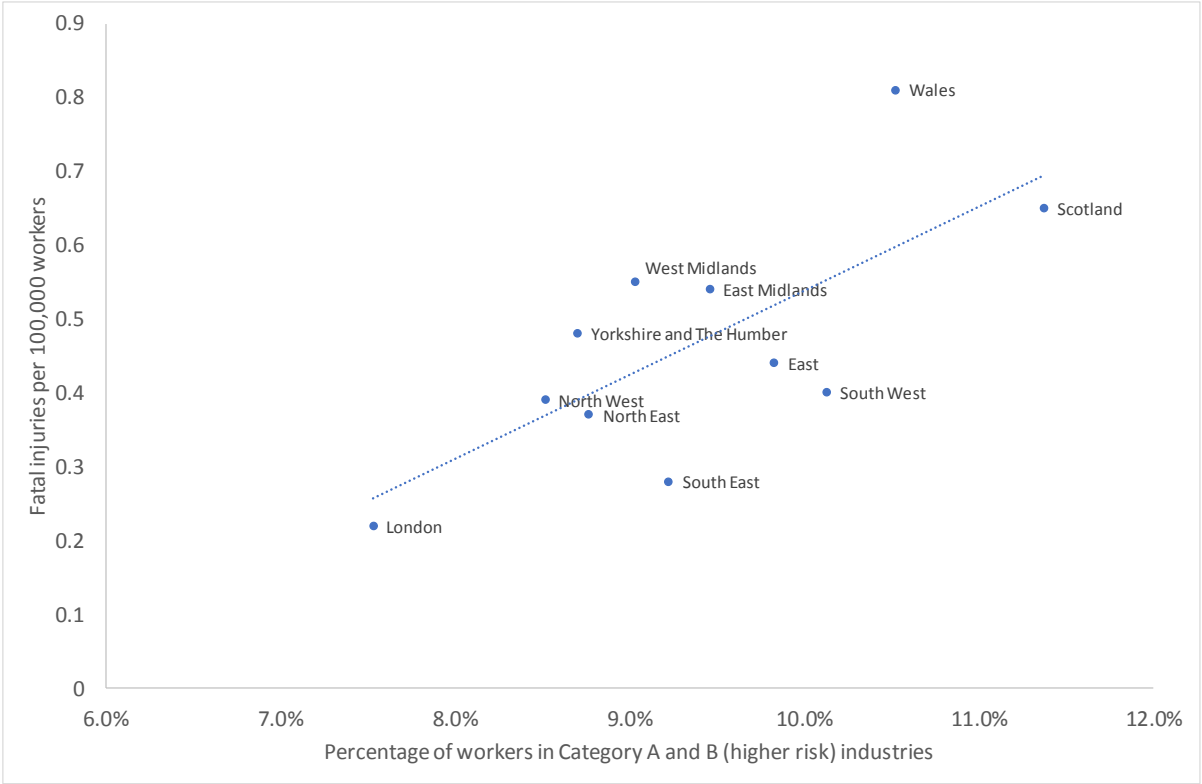
In order to compare the different degrees of risk across regions, industries have been grouped into four risk categories based on the fatal injury rates in Table 1. Category A, the highest risk group, includes those industries with rates above 2; Category B includes those with rates between 1 and 2; Category C includes those with rates above 0.5; and Category D, the lowest risk group, includes those with rates below 0.5. The cut-off points between categories have been chosen essentially arbitrarily but in such a way as to reflect obvious clusters of industries with similar levels of risk.

Regional fatality rates are presented in Table 2 alongside the proportion of workers in each of the risk categories defined above. Figure 1 shows the same data as a scatterplot, displaying the fatal injury rate against the proportion of workers in Category A and B industries, with a line of best fit illustrating the correlation between these two measures.

Table 2. Regional fatality rates 2015/16 to 2019/20 and proportion of workers in industries belonging to each risk category

Country/region	Fatal injuries per 100,000 workers	Percentage of workers in industries of each risk category (A = highest risk; D = lowest)			
		A	B	C	D
North East	0.37	1.5%	7.2%	15.7%	75.6%
North West	0.39	1.7%	6.8%	16.0%	75.5%
Yorkshire and Humber	0.48	1.7%	7.0%	17.1%	74.2%
East Midlands	0.54	2.1%	7.3%	20.2%	70.3%
West Midlands	0.55	2.0%	7.0%	18.4%	72.6%
East of England	0.44	2.0%	7.9%	15.2%	74.9%
London	0.22	0.4%	7.1%	9.1%	83.4%
South East	0.28	1.5%	7.7%	13.3%	77.5%
South West	0.40	2.8%	7.4%	13.3%	76.5%
Wales	0.81	3.4%	7.1%	14.9%	74.6%
Scotland	0.65	2.5%	8.9%	13.2%	75.5%

Figure 1. Fatal injury rates and percentage of workers in higher risk industries, by region/country, with a line of best fit



The table and figure do appear to provide some evidence of a correlation between fatal injury rates and industry composition. Wales and Scotland have the highest rates and also have the highest percentages of workers in risk categories A and B. Conversely, London is the region with the lowest fatal injury rate and also has the lowest percentage of workers in risk categories A and B.

It seems reasonable to conclude that industry composition has some effect on regional fatal injury rates and to consider whether standardised rates, accounting for differences in industry composition, would present a more sensible way of comparing regional rates.

Standardisation of fatal injury rates by industry

HSE has previously developed a statistical model to standardise regional fatal injury rates by adjusting for differences in industry composition. Results from an analysis of data over the period 2010/11 to 2014/15 were published at www.hse.gov.uk/statistics/adhoc-analysis/standardised-fatals.pdf?pdf=standardised-fatals. Results from this analysis showed that the highest fatality rates were reduced after standardisation. In particular, over that time period the rates for Scotland and Wales were statistically significantly different from the Great Britain figures prior to standardisation but were no longer statistically significantly different after adjusting for industry composition.

The same model has now been applied to the 2015/16 to 2019/20 data and the results are shown in Table 3. The methodology behind the adjustments and the associated statistical significance tests is outlined in the technical annex at the end of this report.

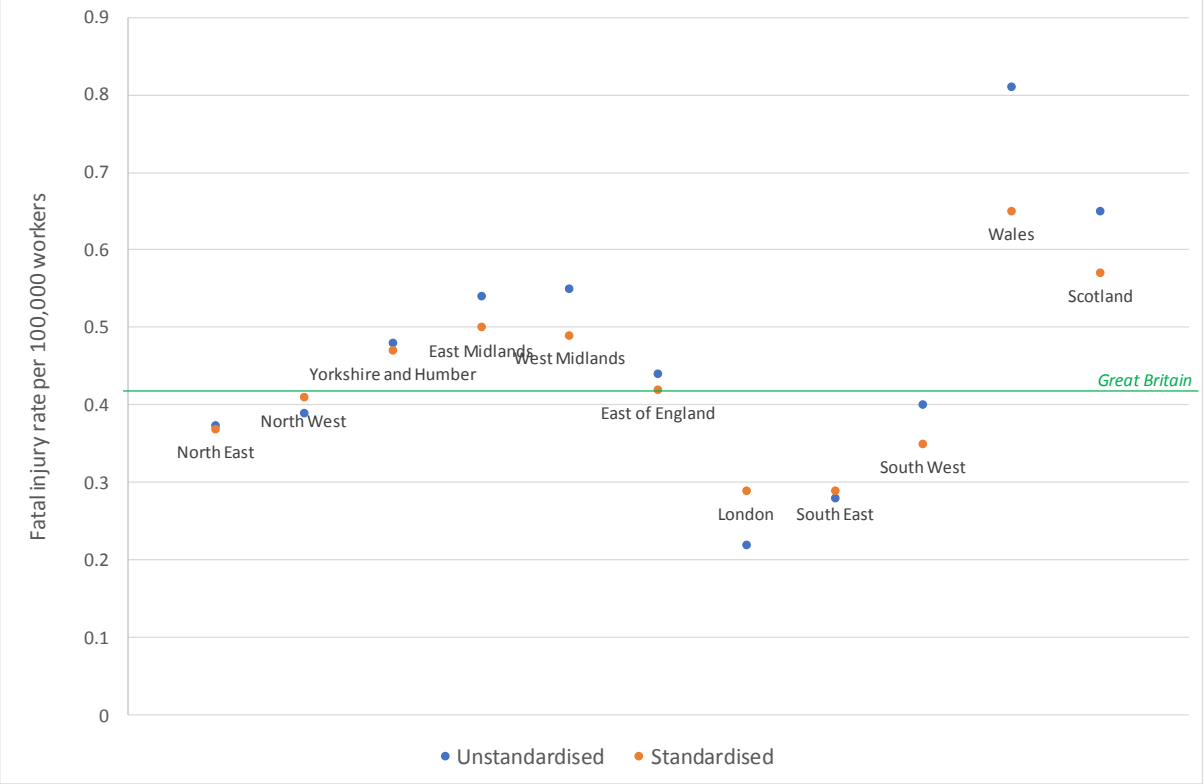
Table 3 shows the number of fatalities over the period 2015/16 to 2019/20 and the un-standardised and standardised rates per 100,000 workers. Rates which are statistically significantly different from that of Great Britain are asterisked and highlighted with the colour green for lower rates and red for higher rates. Figure 2 graphically illustrates the same data and highlights the fact that changes are most pronounced for Wales and Scotland.

The standardisation exercise provides further evidence that **differences in job types between regions is an important factor in explaining variations in the fatal injury rates.** While this analysis shows that standardising the employment profile between regions reduces regional variations, some statistically significant differences remain. However, it should be noted that adjusting by industry profile of employment in this way will not have fully adjusted for job types between regions. Further differences in job type may remain (e.g. there may be a difference in the types of farming being undertaken in one region compared to another) which it has not been possible to control for. Whereas the previously published analysis concluded that standardisation removed the significant difference between Scotland and Wales and the GB average, this is no longer the case and Scotland and Wales fatality rates remain significantly higher.

Table 3. Number and rate of fatal injuries per 100,000 workers: un-standardised and standardised, by country and region over the period 2015/16 to 2019/20

Country/ region	Number of fatal injuries to workers	Rate per 100,000 workers		Statistically significantly different from GB average?	
		Un-standardised	Standardised	Un-standardised	Standardised
North East	22	0.37	0.37	No	No
North West	68	0.39	0.41	No	No
Yorkshire and the Humber	63	0.48	0.47	No	No
East Midlands	61	0.54	0.50	No	No
West Midlands	75	0.55	0.49	No	No
East of England	62	0.44	0.42	No	No
London	57	0.22	0.29	Lower	Lower
South East	63	0.28	0.29	Lower	Lower
South West	58	0.40	0.35	No	No
Wales	58	0.81	0.65	Higher	Higher
Scotland	88	0.65	0.57	Higher	Higher
Great Britain	675	0.42	0.42	No	No

Figure 2. Fatal injury rates per 100,000 workers by region: un-standardised and standardised



Discussion

The method used for this standardisation was based on adjusting across all industries, such that the entire composition of industry for a given region is comparable to that of Great Britain. However, it is possible that this is too blunt an instrument in the sense that it could just be the concentration of workers in the very highest risk industries that are driving the regional differences.

Indeed, it is notable that the areas where standardisation achieves the biggest reduction (Scotland and Wales) are those with the highest concentration of workers in higher risk sectors. There may therefore be alternative standardisation methods that adjust only for the concentration of workers in the highest risk sectors, that provide better estimates of the underlying regional risks.

Given the uncertainty over the best way to model the data, it is safest to conclude only that industry composition has *some* effect and that the underlying risk in Scotland and Wales in particular is likely to be not as high as the raw data suggests.

Technical Annex

Standardised rates

Standardised rates are computed using the following method:

(i) Derive a weighting for each industry section by calculating employment in that industry as a proportion of the overall employment across Great Britain.

(ii) For each region or country, multiply each of its industry-specific fatal injury rates by the weighting computed in (i)

(iii) Sum the weighted industry-specific fatal injury rates to produce a new, weighted, fatal injury rate for each region or country.

As an example, this weighting will have the effect of reducing the contribution of agriculture fatalities to the overall rate for regions or countries which have higher proportions of agriculture workers than GB.

Significance tests

The total fatal injury count is subject to a degree of chance and randomness; if exactly the same conditions were present in two different regions it is still likely that the counts will differ due to natural variation. Tests of statistical significance at the 95% confidence level are used to judge whether differences between groups are likely to be explained by natural variation alone or whether they represent statistically significant differences. Note that statistical significance is a technical term that should not be confused with the significance of each injury – every casualty is a tragedy and has both a social cost and a personal cost to those directly affected.

A significance test for the difference between two rates (in this case a regional rate versus the GB rate) is based on the standard error of the difference which is calculated using:

$SE=\sqrt{\frac{r1(1-r1)}{n1}+\frac{r2(1-r2)}{n2}}$, where *r1 and r2* are the fatality rates, and *n1 and n2* are employment counts. The rates are significantly different (at 95% level) if difference between rates > 1.96 x SE.

National Statistics

National Statistics status means that statistics meet the highest standards of trustworthiness, quality and public value. They are produced in compliance with the Code of Practice for Statistics, and awarded National Statistics status following assessment and compliance checks by the Office for Statistics Regulation (OSR). The last compliance check of these statistics was in 2013.

It is Health and Safety Executive's responsibility to maintain compliance with the standards expected by National Statistics. If we become concerned about whether these statistics are still meeting the appropriate standards, we will discuss any concerns with the OSR promptly. National Statistics status can be removed at any point when the highest standards are not maintained, and reinstated when standards are restored. Details of OSR reviews undertaken on these statistics, quality improvements, and other information noting revisions, interpretation, user consultation and use of these statistics is available from www.hse.gov.uk/statistics/about.htm

A detailed account of the latest fatal injury statistics can be found at http://www.hse.gov.uk/statistics/fatals.htm

An account of how the figures are used for statistical purposes can be found at www.hse.gov.uk/statistics/sources.htm.

For information regarding the quality guidelines used for statistics within HSE see www.hse.gov.uk/statistics/about/quality-guidelines.htm

A revisions policy and log can be seen at www.hse.gov.uk/statistics/about/revisions/

Additional data tables can be found at www.hse.gov.uk/statistics/tables/.

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