HSE Workplace Health Expert Committee (WHEC)

Work–related suicide

WHEC–18 (2021)
WHEC Report

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Workplace Health
Expert Comittee

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Completed January 2021

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Foreword

The development of policy in HSE needs to be informed by the best available contemporary scientific evidence. In 2015, HSE formed the Workplace Health Expert Committee (WHEC) to provide independent expert advice to them on:

- New and emerging workplace health issues

- New and emerging evidence relating to existing workplace health issues

- The quality and relevance of the evidence base on workplace health issues

Questions about workplace health issues come to WHEC from many sources, which include HSE, trade unions, employers, interested individuals and members of WHEC. WHEC's responses to these questions are published online as reports to HSE, as position papers following investigation, or as a briefer response where the current evidence is insufficient to warrant further investigation. In cases where the evidence-base is limited WHEC will maintain a watching brief and undertake further investigation if new and sufficient evidence emerges.

In its formal considerations, WHEC aims to provide answers to the questions asked based on the available evidence. This will generally include review of the relevant scientific literature, identifying the sources of evidence relied on in coming to its conclusions, and the quality and limitations of these sources of evidence.

The purpose of WHEC reports is to analyse the relevant evidence to provide HSE with an informed opinion on which to base policy. Where there are gaps in the evidence, which mean that this is not possible, WHEC will identify these and, if appropriate, recommend how the gaps might be filled.

Executive Summary

- There is strong evidence of variation in suicide risk between occupations. The determinants of this are complex, encompassing societal, cultural and individual factors which probably change with time.
- Currently, the occupations with the highest absolute and relative risks of suicide are chiefly those employing workers in low skilled, and some skilled, positions. The likely correlates are precarious employment with episodic unemployment, a predominantly male workforce, a relatively high incidence of workplace accidents, lack of consistent social support and high rates of alcohol and drug misuse.
- Proportional mortality rates are high in some occupations – veterinary practice, farming, dentistry, hospitality and cultural work - where the factors above may be less relevant than access to means of suicide and selection of vulnerable individuals.
- The evidence for a direct role of psychosocial work stressors, including social isolation, bullying and job strain, on the risk of suicide is limited and somewhat inconsistent.
- While suicide not infrequently occurs in spatio-temporal clusters, it appears that this has not been studied in the context of individual workplaces or employers.
- Some jurisdictions – notably those in Japan, the US and France – formally recognise a category of work-related suicide; this is not the case in the UK.
- There are, in the UK, no systematic methods of collating employee suicides within an organisation or workplace.

Introduction

Following external communication with the HSE, the WHEC was asked to consider the occupational factors that may contribute to the risk of suicide.

Suicide is, globally, an important cause of premature death with an estimated 800,000 suicides each year, or 1.5% of all deaths (1). Suicide is not a disease caused by clear-cut pathological mechanisms but is usually the outcome of a complex interaction of socio-environmental, behavioural, and psychiatric factors. The relevant literature is very large and it is clear that the determinants, or correlates, of occupational risk are not only a complex, but also a kinetic, mix of the above factors. Here we focus on (near-)contemporary evidence from the UK with additional reference to data derived from research in broadly similar cultures.

1. Incidence of suicide in the UK by sex, age, year and region[1]

In 2018, there were 6,507 suicides registered in the UK[2], an age-standardised rate of 11.2 deaths per 100,000 population. Three-quarters (4,903) of these deaths were among men in whom the rate (17.2 deaths/100,000) was three times higher than in women (5.4/100,000). In both sexes, there were two peaks of high incidence, in those aged 40-54 and in those aged over 80 years (Figure A1, Appendix); 5227 deaths (80%) occurred in those aged 20-64 years.

Among women, age-specific rates have remained steady for all age groups since the mid 1990's, following the steep declines in those aged 45 years or more that occurred in the previous decade (Figure A2a, Appendix). Temporal trends in men have been generally downward over the same period with the exception of rates among those aged 45-64 years which have risen slightly since 2006 (Figure A2b, Appendix).

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[1] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/suicidesintheunitedkingdom/2018registrations

[2] Data for 2019 are available only for England and Wales

The Office for National Statistics (ONS) notes that "whenever a change in suicide rates occurs, the reasons are complex" and they may include procedural changes such as in the coding of deaths of 'undetermined intent' or in the lowering of the standard of proof of a suicide that occurred in England and Wales (but not Scotland[3]) in July 2018. Further complexity is introduced by 'registration delay', the interval between death and registration of death. The latter, in England and Wales, must follow a coroner's investigation which may take place many months after a suicide. In Scotland, unexpected deaths are investigated by a procurator fiscal and registration delays are far shorter. The ONS reports on suicide using date of registration.

There are significant differences in the rates of suicide between the countries of Great Britain. In 2018, men in Scotland had the highest suicide rate in Great Britain with 16.1 deaths per 100,000 persons (784 deaths), followed by men in Wales with a rate of 12.8 per 100,000 (349 deaths) and in England with the lowest rate (10.3 deaths per 100,000; 5,021 deaths). Within England the areas with the highest male suicide rates in 2018 were the North East and Yorkshire/Humber (Figure A3a, Appendix); these rates were significantly higher than those for men living in London, the area – together with the South East - with the second lowest suicide rate for males. Regional numbers of deaths in women were too low for meaningful comparison but again the lowest rate was in London (Figure A3b, Appendix).

2. Associations between suicide risk and occupation in the UK

Before embarking on a discussion of relative suicide risks by occupation, it is worth a reminder that there are two common indices used in such comparisons:

A. **Standardised mortality rate (SMR)**
    SMRs provide a comparison of suicide mortality for a specific occupational group with the corresponding general population after adjustment for age and, often, sex. In this way comparisons between occupations are not affected by their different age structures. SMR's are robust but require data from separate sources; while mortality data are available every year, numbers (and ages) of people working in each occupational group are, generally, estimated only at national census points. Of note, occupational information from death certificates may differ in quality from that collected at census.

B. **Proportional mortality rate (PMR)**
    Measures of suicide risk are frequently expressed using the PMR which estimates whether, within an occupational group, the proportion of total deaths ascribed to suicide is higher (or lower) than the proportion in the wider population. It has an advantage that it can be derived from a single source of data (the death certificate) and can be calculated for years between censuses. As a means of making comparisons between occupations, however - and particularly comparisons between sectors with high socio-economic disparity - the PMR can be misleading because a high value may reflect a low risk of death from other, natural causes[4]. Nonetheless, the PMR is a useful way of highlighting the high burden of suicide in some occupations.

Note also that estimates of risk are generally made for the working-age population, since studies of occupational risk are difficult in people of older ages. One, perhaps important, implication is that we know nothing about whether the variations in risk between occupations persist beyond retirement. A further problem arises from the occupation recorded on a death certificate being the 'last known' occupation, thus obscuring any subsequent period of unemployment or retirement.

[3] or Northern Ireland

[4] Roberts and colleagues give the example of male dentists and printers who, in the early 1980's, had very similar SMRs for suicide (239 and 241 respectively). Dentists however had a PMR (256) twice that among printers (131), reflecting the lower mortality from 'socio-economic diseases' during working life in the former group (Roberts S et al. Psychological Medicine 2013; 43:1231)

Suicide in different occupational groups

It is well established that there are variations in the rates of suicide between different occupational groups. In 2017, for example, the ONS produced and subsequently published (2) a detailed analysis of suicide rates by occupation for England between 2011 and 2015. Using occupational data recorded on 13,232 death certificates (10,688 for men) and population-level information from the 2011 census, the paper reports SMRs for the age range 20-64 years.

Among men, there were significantly increased SMRs for those in 'low-skilled' or 'skilled trades' occupations and for those working as process or plant workers (Figure 1). These patterns were similar for women although the numbers in each group were far smaller and the associations may have arisen through chance.
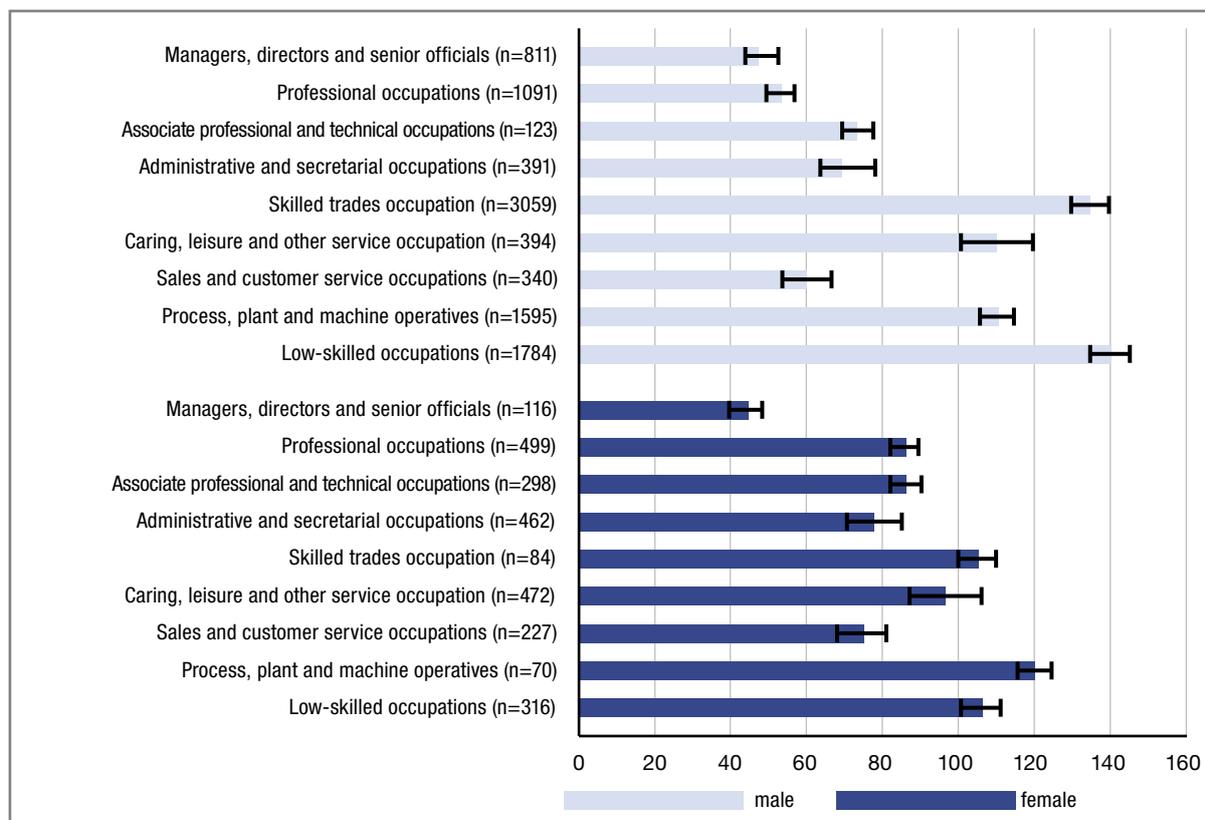

Figure 1. Suicide standardised mortality ratios for the nine major occupational groups, 2011-2015 from Windsor-Shellard B, Gunnell D. Occupation-specific suicide risk in England: 2011–2015. The British Journal of Psychiatry. 2019;215(4):594-9 (2) reproduced with permission.

These findings are in keeping with those from other parts of the world. Milner et al. undertook a systematic review and meta-analysis of 34 occupation-specific studies published between 1979 and 2012 (3); all were set in high-income countries, although none in the UK. Their findings are highly heterogenous but suggest that the risks of suicide are systematically higher in those working in less skilled occupations; the association was essentially confined to suicides in men, with limited power to examine it among women.

Using a more detailed occupational coding, the table below displays all specific occupations with a significantly increased suicide SMR in England 2011-2015, separately for men and women (2). It indicates high risks among those in certain construction trades and in care workers but also in those working in some creative and hospitality jobs, which may share characteristics of job and financial precariousness.

Rank[a]	Code	Description	Suicides (n)	SMR (95% CI)
Table 1 Suicide Standardised Mortality Ratios (SMRs) for specific occupations				
Males aged 20-64 years				
1	9120	Low-skilled construction occupations	380	369 (333-409)
2	7211	Call and contact centre occupations	37	290 (204-399)
3	5313	Roofers, roof tilers and slaters	103	266 (217-323)
4	8141	Scaffolders, stagers and riggers	58	260 (198-337)
5	3415	Musicians	54	252 (189-328)
6	3413	Actors, entertainers and presenters	45	241 (176-322)
7	5321	Plasterers	92	234 (188-287)
8	9231	Window cleaners	56	224 (170-291)
9	9111	Farmworkers	53	221 (165-289)
10	3411	Artists	38	215 (152-295)
11	8125	Metal working machine operatives	239	207 (182-235)
12	5432	Bakers and flour confectioners	27	205 (135-298)
13	5323	Painters and decorators	214	204 (177-233)
14	5215	Welding trades	96	202 (164-247)
15	5113	Gardeners and landscape gardeners	186	201 (173-232)
16	6145	Care workers and home carers	185	192 (165-221)
17	3443	Fitness instructors	25	186 (120-275)
18	8222	Forklift truck drivers	99	185 (150-225)
19	9235	Refuse and salvage occupations	52	184 (137-241)
20	9236	Vehicle valeters and cleaners	35	179 (125-249)
Females aged 20-64 years				
1	3411	Artists	20	399 (244-616)
2	9274	Bar staff	30	182 (123-260)
3	6145	Care workers and home carers	231	170 (149-194)
4	9273	Waitresses	27	156 (103-226)
5	2315	Primary and nursery education teaching professionals	102	142 (116-172)
6	2231	Nurses	148	123 (104-145)
For clarity we excluded individual occupations that specified 'not elsewhere classified' in the title.				
a. We ranked occupations with at least 20 deaths				
b. Only six occupations among females had SMRs whose 95% CIs excluded 100.				

Table 1; 4-digit SOC codes with significantly increased SMRs for working-age suicide in England, 2011-2015 from Windsor-Shellard B, Gunnell D. Occupation-specific suicide risk in England: 2011–2015. The British Journal of Psychiatry. 2019;215(4):594-9 (2) reproduced with permission.

Temporal trends in these patterns are difficult to judge because of changes in occupational classifications and because reports have used different measures of risk that are not necessarily comparable between occupations or across time. Both SMR and PMR are measures at a point in time that are relative, respectively, to a general population and mortality from all other causes. As these points of reference change over time, neither measure is appropriate to examine temporal trends. For example, as discussed by Meltzer *et al.* (4), the observation that the SMR of male doctors fell from 172 in 1981 to 69 in 2001 informs us only that the position of doctors relative to all other occupations in England and Wales had fallen over the interim; the change does not tell us whether the risk among doctors had decreased (or even increased).

To assess temporal changes, serial measurements of (age-specific) suicide rates by occupation are required. Roberts and colleagues (5) undertook such an analysis of deaths across a 20 year period (1979-1983 vs 2001-2005) in England and Wales, noting that the rates expressed in this way correlated well with SMR (0.90) but only moderately with PMR (0.68). Figure 2 below displays the 30 occupations with the highest suicide rates in each time period. It is of note that relatively few of the occupations currently with high SMRs appear in the earlier period.
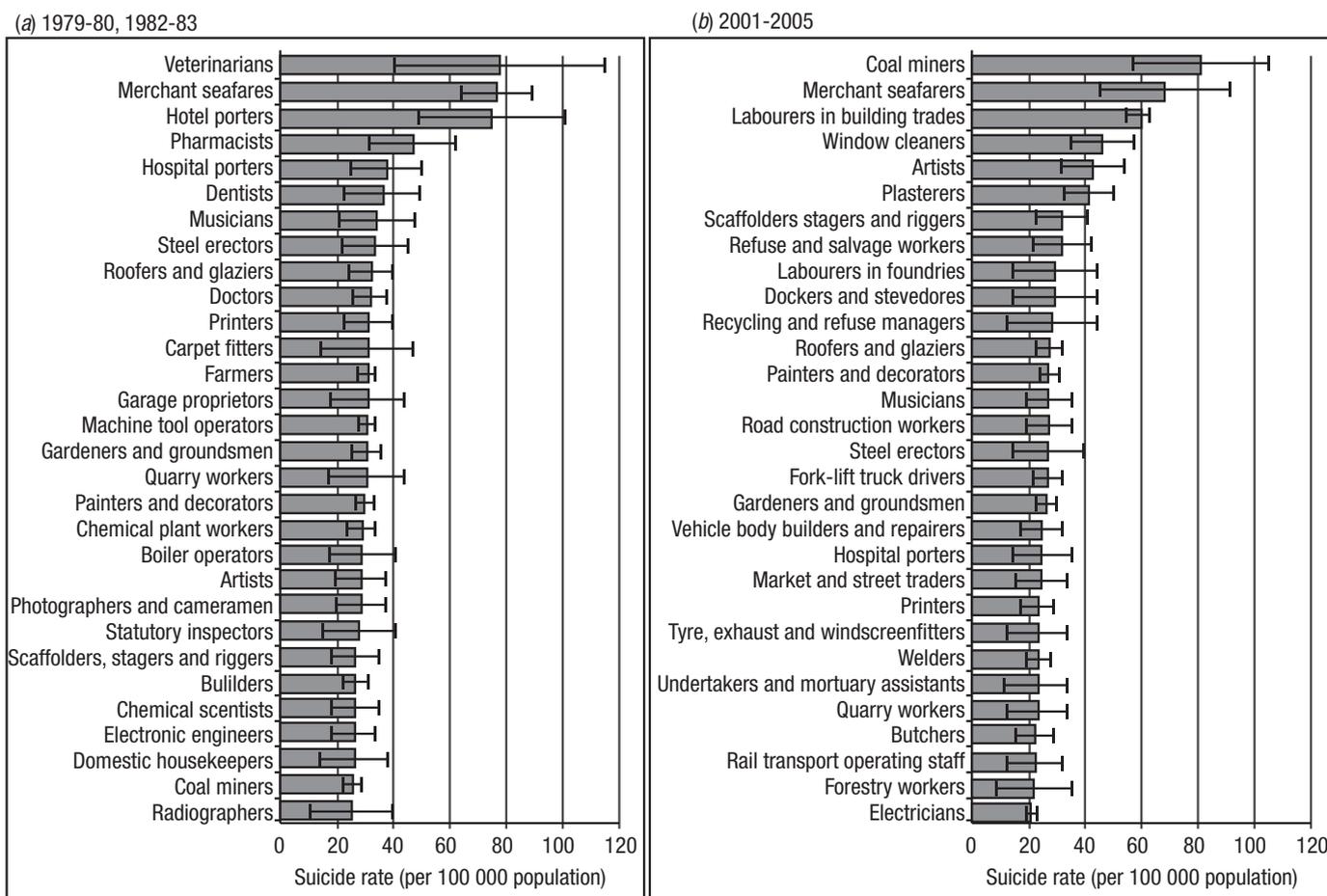

Figure 2. Suicide rates for the 30 occupations with the highest suicide rates in (a) 1979-1980, 1982-1983 and (b) 2001-2005 (from (5))

As noted above, the PMR can be useful in highlighting occupations in which suicide is, relative to other causes of death, an important problem. The tables below (4) list, for 2001-2005, the occupations in men and women aged 20-64 in England and Wales with the highest PMRs.

Rank	Code	Occupation	Suicides, *n*	PMR (95% CI)	SMR (95% CI)
1	2215	Dental practitioners	18	292 (173-461)	112 (67-178)
2	5111	Farmers	119	189 (157-227)	135 (111-161)
3	6222	Beauticians an related occupations	10	297 (143-547)	758 (364-1395)
4	1239	Managers and proprietors in other services not elsewhere classified	190	151 (130-174)	135 (116-155)
5	2211	Mecial practitioners	58	165 (125-214)	69 (52-89)
6	3411	Artists	44	171 (124-229)	315 (229-422)
7	8212	Van drivers	275	127 (112-143)	108 (96-122)
8	9231	Window cleaners	65	144 (111-183)	259 (200-300)
9	9219	Elementary office occupations not elsewhere classified	24	169 (109-252)	91 (58-135)
10	3119	Science and engineering technicians not elsewhere classifield	73	136 (107-171)	54 (42-68)
11	8125	Metal working machiner operatives	264	114 (106-130)	111 (98-125)
12	3211	Nurses	69	135 (105-171)	124 (97-157)
13	2314	Secondary education teaching professionals	115	125 (103-151)	82 (67-98)
14	9139	Labourers in process and plant operations not elsewhere classifield	365	118 (102-136)	209 (188-231)
15	9121	Labourers in building and woodworking trades	679	111 (101-129)	351 (325-378)
16	5113	Gardeners and groundsmen	195	118 (100-155)	161 (139-185)

Table 2a. Occupations with the highest suicide proportional mortality ratios, with corresponding standardised mortality ratios, for men in England and Wales, 2001-2005 from Meltzer H, Griffiths C, Brock A, Rooney C, Jenkins R. Patterns of suicide by occupation in England and Wales: 2001-2005. Br J Psychiatry. 2008;193(1):73-6 (4) reproduced with permission.

Rank	Code	Occupation	Suicides, *n*	PMR (95% CI)	SMR (95% CI)
1	2216	Veterinarians	5	609 (198-1422)	431 (140-1005)
2	3441	Sports players	3	899 (185-2627)	1737 (358-5076)
3	2211	Medical practitioners	25	264 (171-390)	152 (98-224)
4	9139	Labourers in process and plant operation not elsewhere classifield	63	196 (150-250)	263 (202-336)
5	4137	Market research interviewers	3	643 (133-1880)	83 (17-242)
6	3211	Nurses	167	141 (120-164)	115 (98-134)
7	9224	Waitresses	29	168 (113-242)	112 (75-160)
8	9225	Bar staff	37	157 (111-216)	97 (68-133)
9	5113	Gardeners and groundswoman	9	240 (110-455)	260 (119-494)
10	6115	Care assistants and home carers	210	120 (104-138)	107 (93-122)
11	2451	Librarians	14	190 (104-319)	206 (113-345)
12	4215	Personal assistants and other secretaies	136	122 (102-145)	86 (72-102)

Table 2b. Occupations with the highest suicide proportional mortality ratios, with corresponding standardised mortality ratios, for women in England and Wales, 2001-2005 from Meltzer H, Griffiths C, Brock A, Rooney C, Jenkins R. Patterns of suicide by occupation in England and Wales: 2001-2005. Br J Psychiatry. 2008;193(1):73-6 (4) reproduced with permission.

These occupations, broadly, mirror those reported in unpublished form by the ONS in an analysis of suicides among working aged adults in England between 2011 and 2015[5] .

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[5] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/suicidebyoccupationenglandsupplementarydatatables

3. Models that aim to explain suicide risk; the Integrated Motivational-Volitional Model

The pre-disposing factors and mechanisms that lead to suicidal behaviour are highly complex and multi-faceted, encompassing societal, cultural and individual factors which probably change with time. Many different models have been developed in an attempt to explain suicide risk, including biological models, psychological models, sociological, psychosocial and biopsychosocial models (6). Even within the category of psychological models there is a diversity of theoretical stances ranging from classical psychodynamic approaches, to psychological pain theories, cognitive theories and diathesis stress theories (7) – see table 3 for a sample of these models. Other approaches have included a population health perspective (8) and an 'ideation-to-action framework' (9). The number and complexity of models of suicide has increased over recent decades, leading to calls for a more comprehensive and unified approach (7).

Author	Main assumtions
Beumeister (1990)	Unbearable state of distorted self-awareness causes cognitive deconstruction and a search for a means to escape.
Beck, Brown, Berchick et al. (1990)	Suicide schema of biases in attention, information processing, and memory impairs the individual's ability to recall reasons for living or being hopeful about life.
Brent & Mann (2006)	Familial transmission of the impulsive-aggressive trait places individuals at higher risk of suicidal behaviour.
Joiner (2005)	Feelings of non-belongingness and burdensomeness lead to a desire for death. The realization of this desire is determined by one's acquired capability for self-harm.
O'Connor (2011)	Suicidal behaviour results from the interplay among background factors, motivational factors, and volitional factors (i.e., behavioural enactment)
Plutchik, van Praag &Conte (1989)	Certain risk factors determine the level of impulsive aggression that leads to violent acts, while the presence of other factors determines if aggression is directed inward or outward.
Rudd (2006)	Cognitive, behavioural, physiological, and affective characteristics of the suicide mode predict vulner-ability to triggers and severity and duration of suicidal crises.
Schotte & Clum (1987)	A deficit in interpersonal problem-solving increases the risk of suicidal behaviour as a reaction to stress.
Shneidman (1993)	Unmet psychological needs cause torturing mental pain that leads to suicide as the only option.
Williams (1997)	Suicidal ideation develops from feeling of entrapment due to defeat in stressful situations.

Table 3. Empirical psychological models of suicide behaviour (from (7))

In response to the call to provide a comprehensive, theoretical model to predict the emergence of suicidal ideation and the transition between suicidal ideation and suicide attempt/suicide, O'Connor and colleagues (10) proposed an 'Integrated Motivational-Volitional' (IMV) model of suicidal behaviour. This model built upon and extended the empirical evidence base, aiming to synthesise and distill existing knowledge of why people die by suicide, and recognising that suicide is characterised by a complex interplay of biology, psychology, environment and culture.

As shown in Figure 3a, the IMV model is a three-phase framework, describing: the background and contextual factors that can give rise to suicidal ideation and behaviour; the factors that lead to the emergence of suicidal ideation; and the factors that determine the transition from suicidal ideation to suicide attempts/death by suicide.
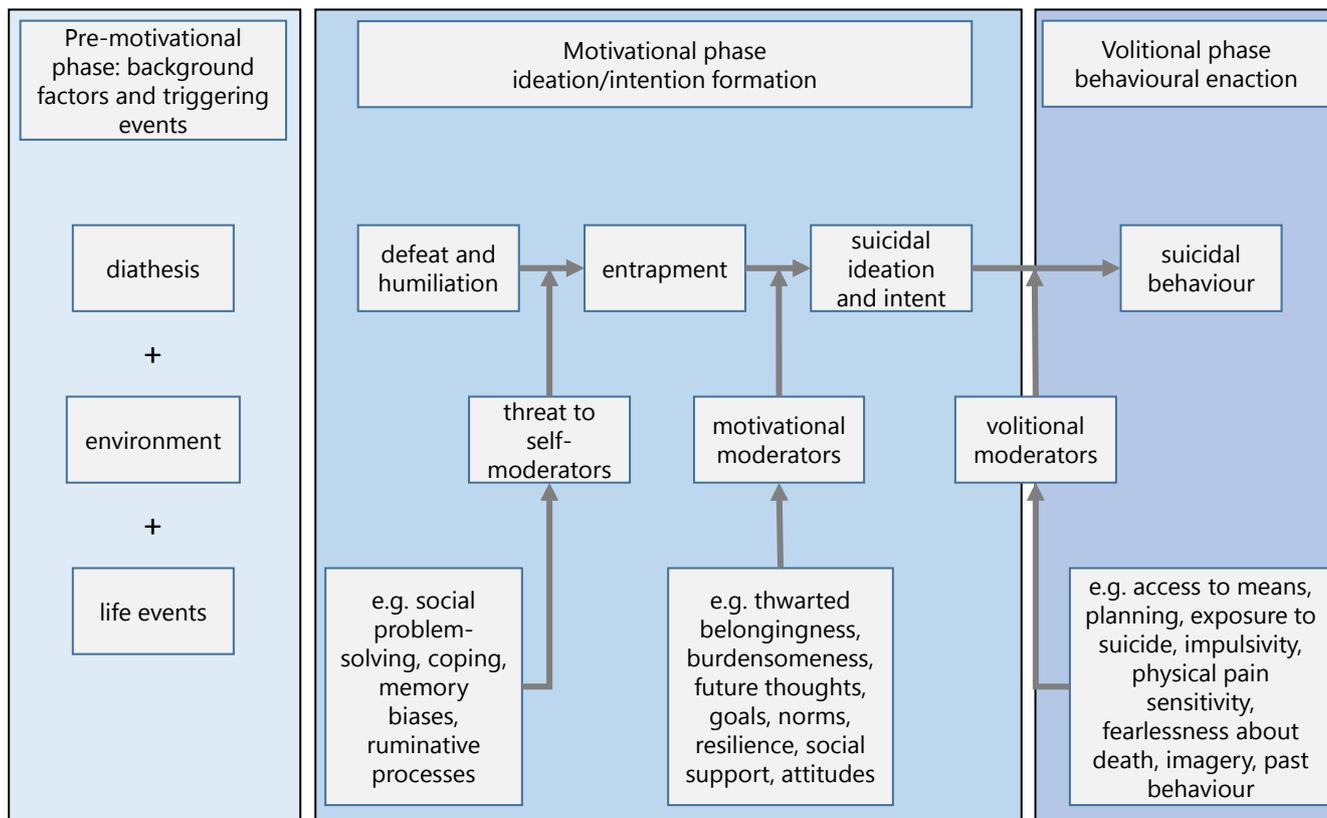
Pre-motivational phase: background factors and triggering events	Motivational phase ideation/intention formation	Volitional phase behavioural enaction

diathesis

+

environment

+

life events

defeat and humiliation → entrapment → suicidal ideation and intent → suicidal behaviour

threat to self-moderators

motivational moderators

volitional moderators

e.g. social problem-solving, coping, memory biases, ruminative processes

e.g. thwarted belongingness, burdensomeness, future thoughts, goals, norms, resilience, social support, attitudes

e.g. access to means, planning, exposure to suicide, impulsivity, physical pain sensitivity, fearlessness about death, imagery, past behaviour

Figure 3a. The Integrated Motivational-Volitional Model (from (10))

When considering the implications of the IMV model for work-related suicide risk, there are a number of ways in which work or job factors might appear, including:

- Pre-motivational phase: work-related stressors such as job insecurity, low pay, bullying, and negative levels of any of the HSE management standards areas (high demands, low control, lack of support, negative relationships, poorly defined roles, or uncertainty due to change) might be part of the 'environment' factor.
- Motivational phase: work or job circumstances might generate feelings of defeat, humiliation and entrapment – for example, being humiliated due to being bullied or rejected at work, and feeling trapped in that job because of (perceived) lack of possibilities to find a job in another organisation, particularly in situations where the income is essential to support dependents, pay bills etc.
- Volitional phase: some of the volitional moderators outlined in the model could be work-related. Figure 3b shows an expanded representation of these factors. The factors 'access to means' and 'exposure to suicide or suicidal behaviour', in particular, might be provided through a work context.
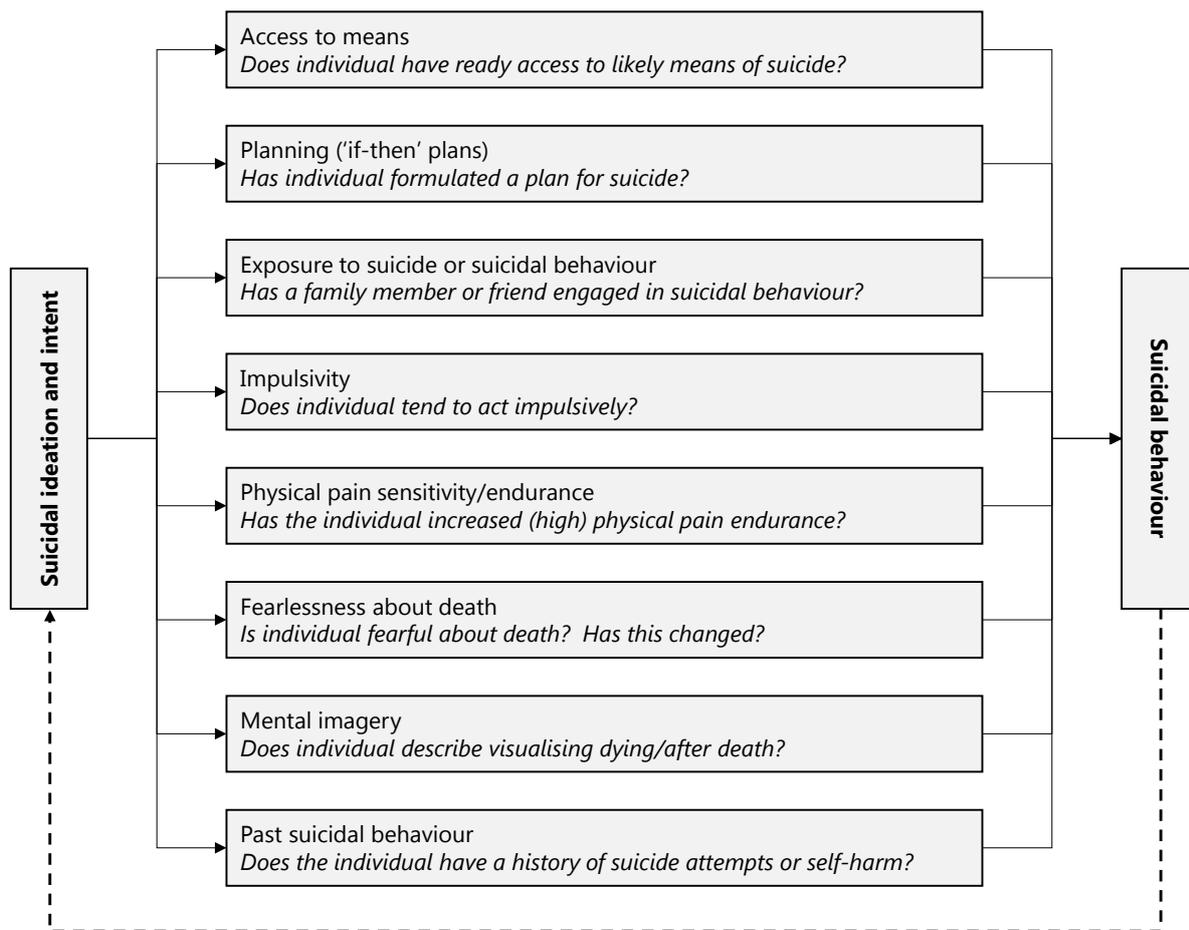
Figure 3b. The volitional moderators that determine whether suicidal ideation and intent transition to suicidal behaviour (from (10))

Although it is relatively new, there appears to be growing evidence supporting the different elements of the IMV model; see, for example: (11-14).

4. Evidence for occupational factors that might contribute to risk of suicide

In the context of the above, three major groups of factors have been considered as explanations for the variation in risk across occupations: 'job-related' factors, access to means, and selection into particular jobs by the potentially more vulnerable. The evidence to support each of these will be considered in turn, together with consideration of how they fit with the IMV model outlined above.

4.1 'Job-related' factors:

'Job-related' factors might contribute either to the pre-motivational or to the motivational phases of the IMV model. For example, job-insecurity, unemployment, psychosocial work stressors and bullying could be background factors and triggering events in the pre-motivational phase; they might also contribute to feelings of defeat, humiliation and entrapment in the motivational phase.

Unemployment and low pay

A relationship between suicide risk and unemployment is well described. Lewis and Sloggett (15) investigated the risk of suicide and undetermined deaths between 1983 and 1992 (383 men and 197 women) in the ONS longitudinal study of a 1% representative sample of the population of England and Wales, using data on employment from both 1971 and 1981. They reported a 2.5 fold increased risk of suicide in the unemployed and those permanently unable to work because of ill health; the risk was only a little higher (RR 2.8) among those aged 15-54 years. Risk estimates were highest for those unemployed in both 1971 and 1981 (RR 3.3) and in those employed in 1971 but not in 1981 (RR 2.4); there was no significant increase in those unemployed in 1971 but employed in 1981. After adjustment for unemployment, there was no association with social class.

In an analysis of deaths in 26 European countries between 2000 and 2007, short-term fluctuations in unemployment were generally associated with rising suicide rates, with a 1% rise in unemployment rates being associated with a 0.79% rise in suicides at ages younger than 65 years (16). The association was strongest in Spain and absent in Sweden and Finland, the authors arguing that it was attenuated by higher spending on 'active' labour market programmes[6].

There is substantial evidence, ecologically, that suicide rates vary by area socio-economic characteristics. Following a systematic review of 86 studies Rehkopf and Buka (17) suggested that the apparent discrepancies in the evidence base are largely the result of methodological issues relating to the area of aggregation; once these are taken into account, there are clear relationships between suicide rates and community levels of poverty and deprivation. At an individual scale, Agerbo and colleagues (18) undertook a case-control study of 3195 men and women (n=898) who died from suicide in Denmark between 1991 and 1997. Using individual level information on employment (fully employed, self-employed, unemployed, otherwise), marital status and gross income they demonstrated that these factors explained much of the disparity in risks between occupational groups but, importantly, only in those who had a history of hospital admission for mental illness (including alcohol dependence). In those with no previous psychiatric admission the variation remained evident.

Similarly, but using only group levels of unemployment, Windsor-Shellard and Gunnell (2) reported that adjustment in that way reduced the risk estimates associated with each occupation but did not eliminate the variation between them.

Economic 'downturns'

In an ecological analysis of suicides in 54 countries before and after the global economic downturn in 2008, Chang and colleagues reported an estimated excess of 4884 deaths above figures derived from trends between 2000 and 2007 (19). In the 27 European countries, the additional deaths mainly occurred in men aged 15-21 years. There was a weak correlation with increases in unemployment, especially in countries with high levels of employment prior to 2008.

Psychosocial work stressors; low job control, low support, high demands

Psychosocial job stressors such as high job demands with low decision latitude ('job strain'), and high efforts but low rewards, ('imbalance') have been widely associated with intermediaries of suicide such as depression (see, for example (20-22). Milner and colleagues published a systematic review of psychosocial job stressors and 'suicidality', a term encompassing not only suicide but also attempted suicide, self-harm and suicidal ideation (23). In a meta-analysis they reported positive – but highly heterogeneous – associations with low job control and high job demand, with effort-reward imbalance, with job insecurity and strain, with role conflict and with long working hours; these were not necessarily independent effects.

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[6] "Active labour market programmes contain all social expenditure (other than education) aimed at improving beneficiaries' prospects of finding gainful employment or to otherwise increase their earnings capacity. This expenditure includes spending on public employment services and administration, labour market training, special programmes for youth when in transition from school to work, labour market programmes to provide or promote employment for unemployed and other people (excluding young and disabled people), and special programmes for disabled people".

The evidence for an association with suicide itself appears to be more limited. In a population-based, case-control study of 9,000 (84% male) deaths by suicide in Australia between 2001 and 2012 (24), low job control and high job demands, estimated through a job exposure matrix, were associated with suicide after adjustment for age and socio-economic status; this, however, was true only for men, high job demands actually appearing to be 'protective' for women.

In a cohort of 29,000 male Canadian sawmill workers (25) followed from 1952 to 2001 the risk of suicide (162 cases) was independently associated with low psychological demand at work; as was low social support for attempted suicide (127 cases). None of job control, job mobility, lay-offs, physical demand (or noise) was independently associated with either outcome. Analyses of risk in different periods of the 50 year follow up were not reported, but the authors surmise that short but repeated periods of unemployment (lay-offs) may contribute significantly to an accumulated 'burden' among vulnerable individuals, which, in conjunction with low psychological demand, could lead them to extreme behaviours such as completed suicide.

The relatives of 163 men (67%) and women who died from suicide in western Germany in 1999/2000 were interviewed using a 'psychological autopsy' approach (26); the results were compared with those derived from interviewing a relative of a 'control' of the same age. Monotonous or dull work, dissatisfaction with colleagues or superiors and heavy responsibility – but not 'time pressure' – were each associated with risk of suicide although it is unclear whether these were independent of one another.

Among 94,000 female nurses aged 36-61 years recruited to the Nurses' Health Study in the US and who completed a questionnaire into work stress in 1982 and were followed for 14 years, there were 73 reported deaths from suicide (27). The median age at death was 56 years but ranged from 39-75 years, it being unclear how many deaths occurred before retirement. After adjustment for age, smoking, alcohol and coffee consumption, and marital status and stress at home, self-reported work stress was associated with subsequent suicide but in a U-shaped pattern; in comparison to those reporting 'light' work stress, the risks of suicide were doubled in both those reporting 'minimal' and 'severe' work stress.

In a cohort of around 3,000 Japanese men recruited to a prospective study of cardiovascular disease, 14 suicides were reported over nine years of follow-up (28). There, low job control was associated with a four-fold increase in risk of suicide, after adjustment for age, occupation, study area, marital status, education, smoking, alcohol consumption, and total cholesterol. High job demand was associated with a decrease in risk, although this was not statistically significant after adjustment.

Mood disorders and work-environment
While there is strong evidence for mental illness being a risk factor for suicide (29), the literature on comparative rates of mental ill-health between occupational groups is broad and somewhat inconsistent. A systematic review of 20 studies (30) suggested that the prevalence of depression was higher in those working in manual occupations (three studies) and in 'male-dominated' occupations[7], specifically farmers, machine operators, labourers and those in (other) unskilled manual occupations. Note that these studies, of cross-sectional design, cannot distinguish depression arising as a consequence of employment from selection into employment by those with (a tendency to) depression.

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[7] ≥70% male

Social isolation

'Social isolation', measured variously, is a well-established risk factor for suicide (summarised well in (31). While it does not appear to have been examined in direct relation to occupation, we note that several of the occupations associated with a high risk – such as jobs in construction, farming or gardening – are characterised by relatively high measures of isolation. Combined with low income and financial/job insecurity, this may have an additive effect.

Bullying

There is a limited literature on the association between workplace bullying and suicidal ideation, although not actual suicidal behaviour. For example, a longitudinal study, using three surveys between 2005 and 2010 of a random sample of Norwegian workers, gathered data from 1846 people (who completed the survey at least twice) about bullying and suicidal ideation (32). It reported that being a victim of bullying was associated with subsequent suicidal ideation (odds ratio=2.05; 95% CI=1.08, 3.89). Suicidal ideation at baseline was not related to subsequently being a victim of workplace bullying, which suggests, but does not confirm, that bullying led to suicidal ideation rather than vice versa.

Alcohol misuse

The evidence for substance abuse being a risk factor for suicide is compelling (29). Triangulating this with occupation and with suicide risk is not, however, straightforward. For example, in an analysis of occupational PMRs from deaths between the ages of 16 and 74 years between 1991 and 2000 (33), Coggon and colleagues identified three job groups with significantly elevated rates for at least four of eight categories of alcohol-related disease - male seafarers, publicans and bar staff, and cooks and kitchen porters. Occupations with high mortality from diseases related to alcohol also had high PMRs from injury by falls and by fire but, in contrast, their proportional mortality from suicide was lower than expected.

Toxic exposures and workplace injuries

There has been some concern that chemical exposures encountered at work may engender depression and consequently increase the rate of suicide. Exposures to pesticides, for example, have been associated with depression in farmers although there is little evidence for an association with completed suicide (34). The observation that the risk of suicide is doubled in those with workplace solvent exposures (35) does not seem to have been replicated.

Injuries incurred at work are associated with incidence of depression and may increase the risk of suicide. Appelbaum and her colleagues (36) linked compensation data for 100,806 workers injured in New Mexico between 1994 and 2000 with mortality data through to 2013. Among injured women and after adjustment for age and income, there was a doubling in risk of suicide; in men the increase was by 72%. The mechanisms for this association are speculative - deaths from drug overdoses were similarly increased – and in the absence of data from elsewhere it is not clear that the findings are generalizable.

4.2   Access to means of suicide

One way in which occupation might confer an increased risk of suicide could be by providing access to and familiarity with a particular method; this would be identified as a volitional moderator in the IMV model in the form of 'access to means'. In an analysis of working-age suicides in England and Wales between 1982 and 1996, Kelly and Bunting (37) noted that the proportions of suicides resulting from 'poisoning by solid or liquid substances' were far higher in vets, pharmacists and medical practitioners than in other occupational groups. The pattern was less evident among women, probably because poisoning accounted for half of all female suicides. In 392 deaths by suicide or unexplained means among medical

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[8] https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/datasets/suicidebyoccupationenglandmaindatatables

practitioners in England and Wales between 1979 and 1985, 50% of those in anaesthetists were from poisoning by anaesthetic agents, a rate 21 times higher than in other specialties (38).

Hawton and colleagues noted that 40% of suicides by male farmers in England and Wales between 1981 and 1993 were effected by a firearm, a rate 10 times higher than in non-farmer, male suicides over the same period (39). In a more recent, unpublished, analysis of deaths by suicide among working age men in England between 2011 and 2015, 12.6% of those in farmers were caused by a firearm, a figure higher than in the general population (1.7%)[8] Similar observations have been made in other countries and for other occupations, such as police officers, although it is worth noting that the evidence is not wholly consistent (40). Milner and colleagues, in a study of suicides in Australia between 2001 and 2012 (41) reported that the effect of occupational 'access to means' was stronger for women than men.

Yip and colleagues (42) provide a useful summary of suicide prevention by restriction of access to means; there appears to be no evidence that this approach has been taken, or proven successful, within an occupational setting.

4.3 Selection into particular jobs of the potentially more vulnerable

Occupational groups may attract and recruit individuals with varying levels of psychiatric morbidity; if an occupation is characterised by persons with preferences and past experiences that put them at risk of suicide, such occupations may be marked by high suicide rates. In terms of the IMV model, this would suggest that such occupations include a higher than average proportion of people with pre-motivational, diathesis factors that increase their risk. This may explain part of the occupational differential in risk although there seems to be only limited empirical supporting evidence.

In an analysis of suicide among working-age male artists in the US, in whom the rate of death from suicide was three times higher than in a referent group, Stack suggests that the profession attracts a population of individuals whose characteristics make them 'already at risk of suicide' and may give them 'a greater chance at success in art' (43). Bartram and Baldwin undertook a similar analysis of suicide in vets among whom the PMR for suicide tends to be very high (44). They proposed a complex interaction of potential mechanisms for this pattern including the characteristics of those entering the profession but also work-related stressors, access to means, stigma in relation to mental illness, social isolation, drug misuse, 'contagion' and the contextual effect of routine euthanasia of animals:
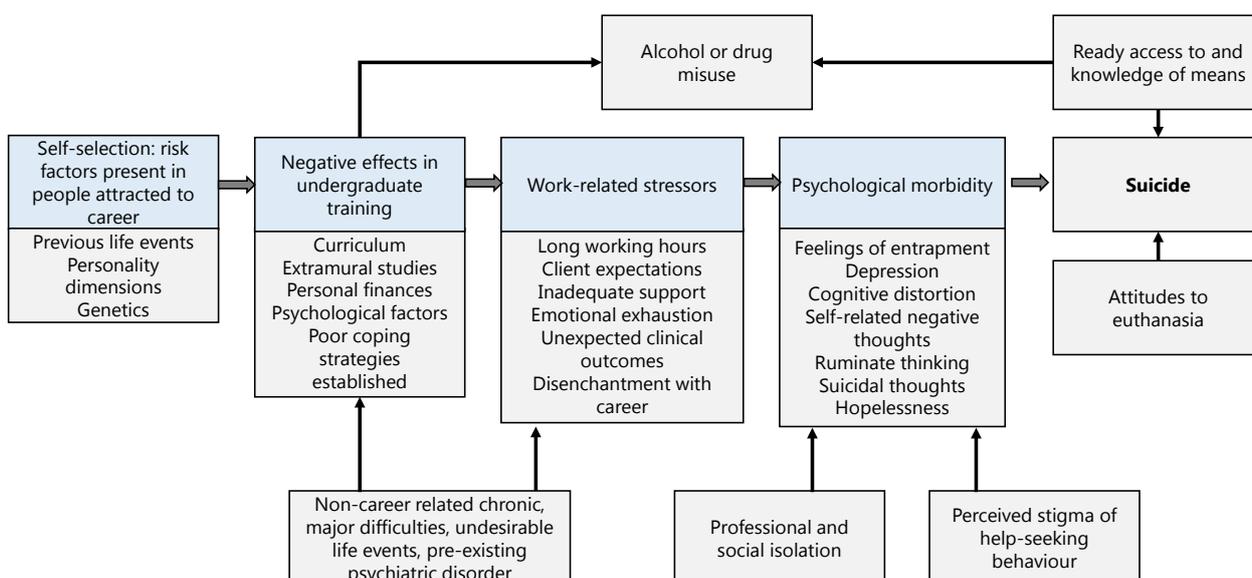

Figure 4. Schematic representation of a hypothetical model to explain the risk of suicide in veterinary surgeons (from (44))

However, without data to compare this proposed model with the situation in other occupational groups, it is not possible to determine whether self-selection is a causal factor particularly in veterinary surgeons.

This scheme can be related to the IMV model as follows: self-selection, negative effects in undergraduate training and work-related stressors create risk factors in the pre-motivational phase; psychological morbidity generates risk factors in the motivational phase; and ready access to and knowledge of means, and attitudes to euthanasia provide volitional moderators that could move an individual into the volitional phase.

5. Can an individual's death by suicide be attributed to their occupation?

The Japanese have terms for both death from overwork ('karoshi') and work-related suicide ('karojisatsu'), each of which is defined in law, largely in relation to excessive hours of overtime work (45).

In the United States, suicide is considered a fatal occupational injury where any of the following is true:
- it occurred at the workplace while the deceased was there for work activity
- it occurred away from the workplace, while the deceased was engaged in work activity
- death was related to the deceased's work status (e.g. a suicide at home that can be definitively linked back to work).

In France, since 2000, a suicide has been presumed to be work-related and subject to further investigation where any of the following is true:
- it occurred in the place of work or on the journey to and from work
- it was officially recognised as a workplace accident
- there was circumstantial evidence of a link to work (a suicide letter or witness statement)
- a work implement or tool was used (including firearm or medication)
- work clothes were worn.

Any suicide that occurs in the workplace in France is investigated as a workplace accident; the burden of proof is on the employer to prove that the suicide is not work-related. Even in cases where a suicide takes place outside of work, it is still investigated as work-related where the employee (in an attempted suicide) or the family can prove a causal link to work. Hence, around one in five employee suicides reported to the authorities in France is officially recognised as being work-related. Attempted suicide may also be recognised as a workplace accident; since 2007 this includes an attempted suicide by an employee who was on sick leave following depression that was linked to deteriorating working conditions or the behaviour of his/her employer.

In 2019, following investigation of 19 suicides (and 12 attempted suicides) among employees of the French telecommunications company 'Orange' (previously France Télécom) a number of executives were given jail sentences, and the company was fined €75,000. At the time the company had been undergoing a major 'restructuring' with the loss of many posts; in its ruling, the French court used, for the first time, the term 'institutional harassment'.

In the UK there is no official recognition of a 'workplace suicide'. Further, RIDDOR guidance states that suicides are not reportable although the Regulations require the reporting of any death arising as a 'result of a work-related accident'.   In 2008, the House of Lords ruled that an employer was in breach after it failed to take action to safeguard an employee who died by suicide following a workplace accident (Corr v IBC Vehicles Ltd). In doing so, the House agreed that the employee's depressive illness was caused by the accident, and that it was his depressive illness which drove him to take his own life.

THOR, the voluntary reporting scheme for occupational diseases, based at the University of Manchester, has since 2004 received reports from occupational physicians (or GPs with a special interest) of seven work-related suicides or attempted suicides (S Daniels, personal communication).   These are summarised below; there is no evident spatial or temporal pattern:

Year	Sex	Age group	Industry	Suspected agent
2004	F	35-44	healthcare	nature of patients and pressure of work
2005	M	45-54	broadcast media	job dissonance, experience over-ruled by young managers
2005	M	25-34	finance	intimidation
2006	M	35-44	waste management	relationship with manager; relocation
2007	M	25-44	civil service	stress at work; feeling overwhelmed
2008	M	35-44	retail	unable to cope with perceived overwhelming IT problem; long term low mood
2018	M	16-24	other manufacturing	complained about bullying by his supervisor; two suicide attempts

The Industrial Injuries Advisory Council has not published on the issue of suicide and work and has no immediate plans to do so (L Rushton, personal communication).

Suicide in pandemics
At the time of writing, it is, evidently, too early to know whether national suicide rates will be affected by the Covid-19 pandemic although there is no evidence yet of a substantial increase in either suicide or suicidal ideation in the UK (46, 47), Previous experience is limited but may be instructive. Using a time-series approach, Wasserman (48) suggested that the rate of suicide in the US increased during the influenza pandemic of 1919/1920 (but not during the First World War). There is tenuous evidence of an association between suicide in adults aged over 65 years in Hong Kong and the 2003 SARS pandemic (49).

6. Suicide clusters

It is unclear whether the deaths at Orange constituted a 'cluster'. Elsewhere, there is a substantial literature on clustering in suicides, most of it focussed on temporal ('mass' clusters) and spatio-temporal ('point' clusters) clusters, reflecting the dominant analogy of 'contagion' or, perhaps more accurately, of common behaviour arising as a social identity phenomenon. Clusters of these types are more common in individuals aged less than 24 years (52) but point clusters occur also in older adults. In an analysis of suicides in Kentucky, for example, the average age of death in the two identified clusters was 49 years (53); the sex distribution of cases was not reported. Explanations for point clustering are many and complex (54) but individual workplace or employer factors do not appear to have been considered. Equally there are no established surveillance schemes for 'occupational' suicides although Bossard and colleagues piloted a regional scheme in France which detected an estimated 28 cases of 'work-related' suicide over a two year period (55).

Much of the research covered in section 4 describes occupationally-specific risk factors. It is likely that many such factors coalesce, and are more concentrated, in certain organisations and/or workplaces. It is also possible that risk factors relate to organisational and/or workplace issues relevant in a particular employer or location and affect people across occupational groups in that organisation or workplace. If this is the case then preventive efforts should include a focus on identifying the organisations or workplaces that are at high risk; this can be problematic since cases of suicide within an organisation – and especially within an individual workplace – are thankfully rare and it is difficult to know at which point their numbers constitute a true cluster or 'outbreak', a difficulty compounded further by registration delay. In their guidance for investigating clusters of suicide, Public Health England make only passing reference to workplaces (56). An example, perhaps, of the problem is provided by the recent reports of the deaths by suicide of four (possibly five) police officers in Scotland between October 2019 and January 2020. While all were employed by Police Scotland, each worked in a different location. Importantly, the organisation has been reported as admitting they do not collate records of suicide among their staff; further, it appears, that the collective deaths came to light only through the media[9].

7. Postvention

While this paper is focussed on the occupational factors that may contribute to the risk of suicide - and the hope of preventing death by suicide - it is important also to recognise the impact that the suicide of a worker can have on their colleagues. This is perhaps particularly true if the suicide is perceived to be work-related or occurs in the workplace. In terms of the IMV model, the death by suicide of a colleague could be a volitional moderator, whereby exposure to suicide or suicidal behaviour increases the risk of an individual moving from suicidal ideation/intent to suicidal behaviour. In recognition of the potential negative impact of suicide on colleagues, some organisations (e.g. Society of Occupational Medicine, Business in the Community) are suggesting 'postvention' frameworks and guidance aimed at helping employers take appropriate action when a suicide happens. This covers issues such as communications with family, colleagues and others in the workplace, supporting those who are grieving or experience trauma, and memorials/ remembrance/ anniversaries.

Under Health and Safety regulations, employers have a duty to assess and manage risks to their employees' health and safety. This includes psychosocial risks and the HSE's Management Standards provide a framework of categories of psychosocial hazard to be considered (demands, control, support, relationships, role and change). The intention is that ongoing assessment and management of such factors reduces the risk of – and ideally prevents – harm due to work-related stress, where harms could include mental ill-health and, potentially, suicidal ideation, intent and behaviour. The occurrence of a suicide within their workforce seems an appropriate prompt for the employer to undertake additional assessment and exploration of the psychosocial environment. If occupational/workplace psychosocial factors appear to have contributed to the suicide, it is possible that there are others exposed to the same factors who might also be at risk of harm, even if the distress experienced is not prompting suicidal behaviour in other cases. In these instances, identifying and removing or mitigating the risk posed by such factors (in other words, improving the psychosocial environment) could be a valuable way to prevent further harm. Removing any access to means of suicide could also be an important intervention to prevent further risk of suicide.

8. Conclusions

While there is strong evidence of variation in suicide risk between occupations, the determinants of this appear complex, encompassing societal, cultural and individual factors which probably change with time. Currently, the occupations in the

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[9] https://www.dailyrecord.co.uk/news/scottish-news/shock-police-scotland-reveal-no-21366795

UK with the highest absolute, and relative, risks of suicide are chiefly those employing workers in low-skilled, and some skilled manual, positions; 'low-skilled' may be a proxy for low pay, job insecurity and/or precarious income. The likely correlates are precarious employment with episodic unemployment, a predominantly male workforce, relatively high rates of workplace accidents, lack of consistent social support and high rates of alcohol and drug misuse. In some contrast, proportional mortality rates are high in other occupations – veterinary practice, farming, dentistry, hospitality and cultural work - where the factors above may be less relevant than access to means of suicide and self-selection of vulnerable individuals. The evidence for a direct role of psychosocial work stressors, including social isolation, bullying, job strain and imbalance, on the risk of suicide is limited and somewhat inconsistent, with low job control showing the best evidence thus far.

Suicide not infrequently occurs in spatio-temporal clusters, but it appears that this has not been formally studied in the context of individual workplaces or employers. This is perhaps unsurprising since the identification of a true organisational cluster, even in the context of a large employer, is very difficult. Further research into workplace (rather than 'occupational') suicide and suicidal ideation and their workplace correlates would be useful but would probably have to be undertaken across multiple organisations.

Unlike some jurisdictions – notably those in Japan, the US and France – there is no formal recognition of 'work-related suicide' in the UK. In France, it appears that 20% of suicides in working age adults are deemed to be work-related. There are, in the UK, no systematic methods of collating employee suicides within an organisation or workplace. Suicides are not reportable under RIDDOR although there is a legal precedent for an employer to be held responsible for suicide arising as a result of the consequences of a (reportable) workplace accident. Statutory reporting of work-related suicide is problematic in the UK because of the registration delay consequential upon the requirement for a coroner's inquest. It could therefore be beneficial to establish a way of recording more data about employee suicides through a voluntary reporting scheme, such as THOR. It might also be useful to consult with coroners on data-recording options.

Given that employers have a responsibility to assess and manage psychosocial risks and prevent psychological as well as physical harm, it would seem appropriate to suggest that any worker's suicide should be a prompt for their employer to conduct an additional investigation of psychosocial workplace risks and control mechanisms. Alongside 'postvention' activities and minimising access to means of suicide, this could be a way to reduce risk of suicide and other psychosocial harm to the late worker's colleagues.

**Appendix; distributions of suicide by age, sex and region, UK 2018 (ONS[10])**

Figure A1. Age-specific suicide rates (per 100,000) by sex and five-year age groups, UK, registered in 2018
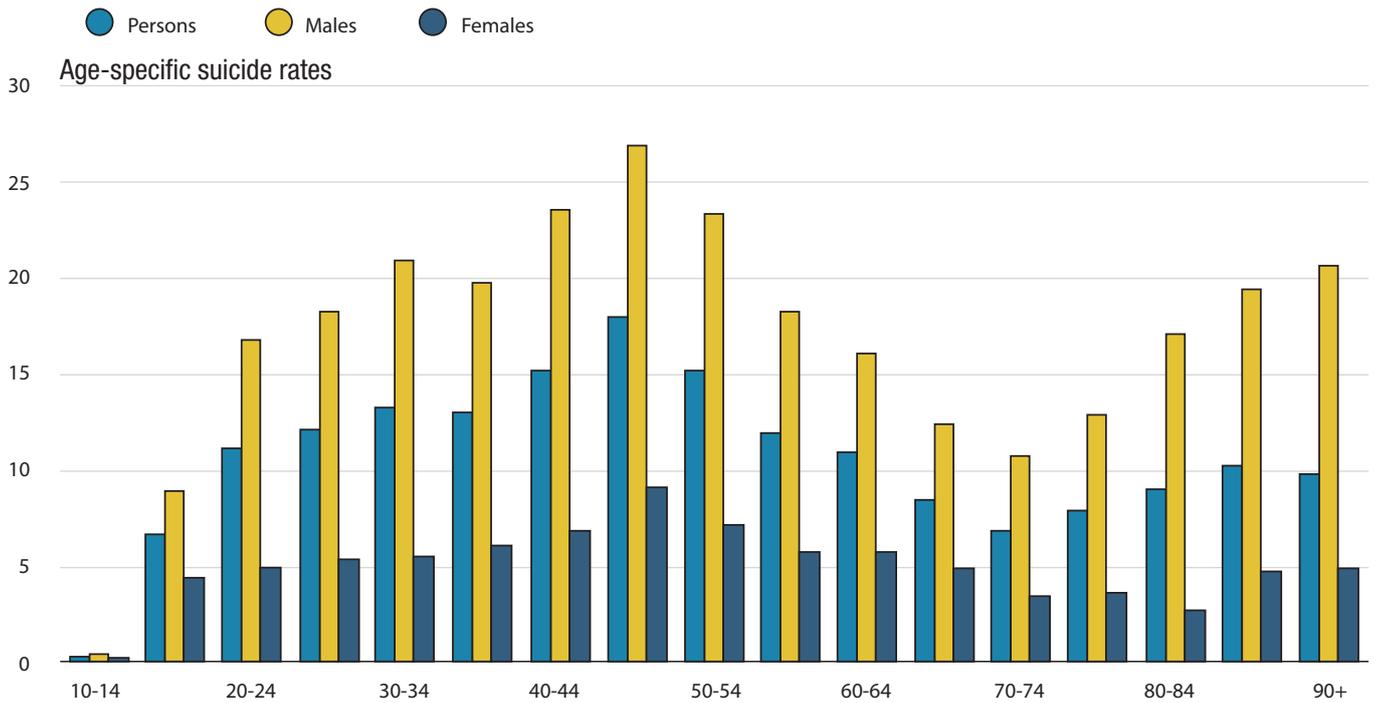
Source: Office for National Statistics, National Records of Scotland, and Northern Ireland Statistics and Research Agency

[10]https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/suicidesintheunitedkingdom/2018registrations

Figure A2a. Age-specific suicide rates (per 100,000) by broad age groups, females, UK, registered between 1981 and 2018
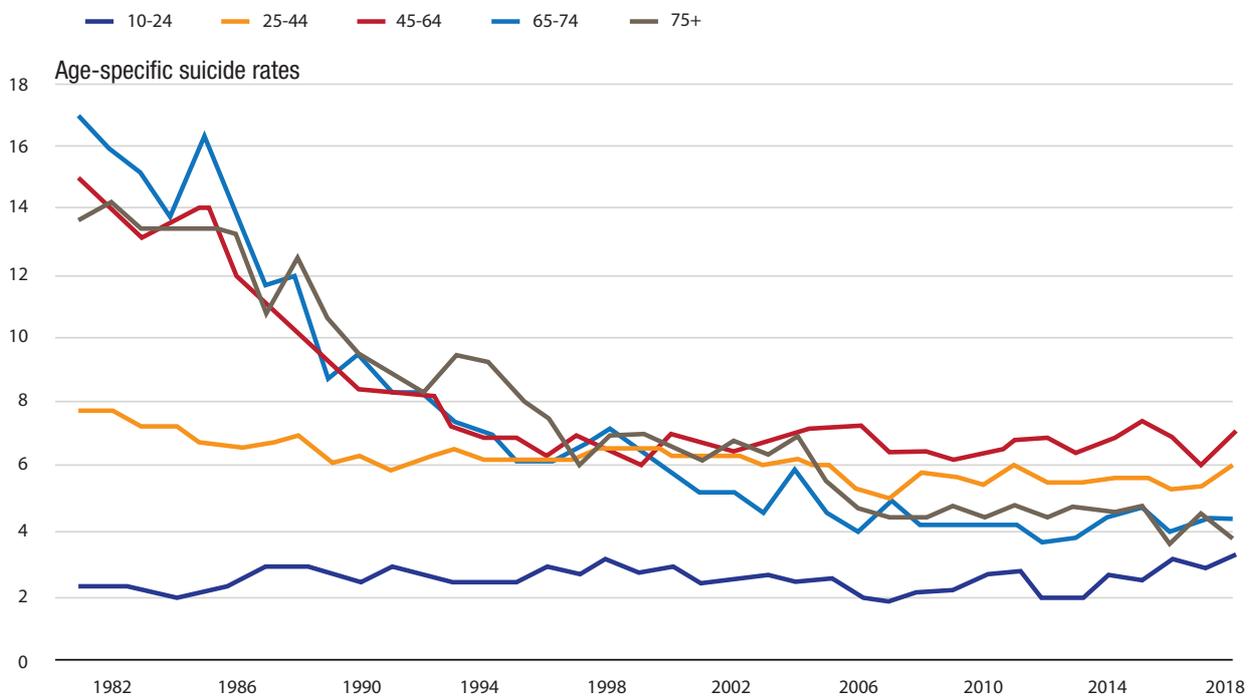
Source: Office for National Statistics, National Records of Scotland, and Northern Ireland Statistics and Research Agency

Figure A2b. Age-specific suicide rates (per 100,000) by broad age groups, males, UK, registered between 1981 and 2018
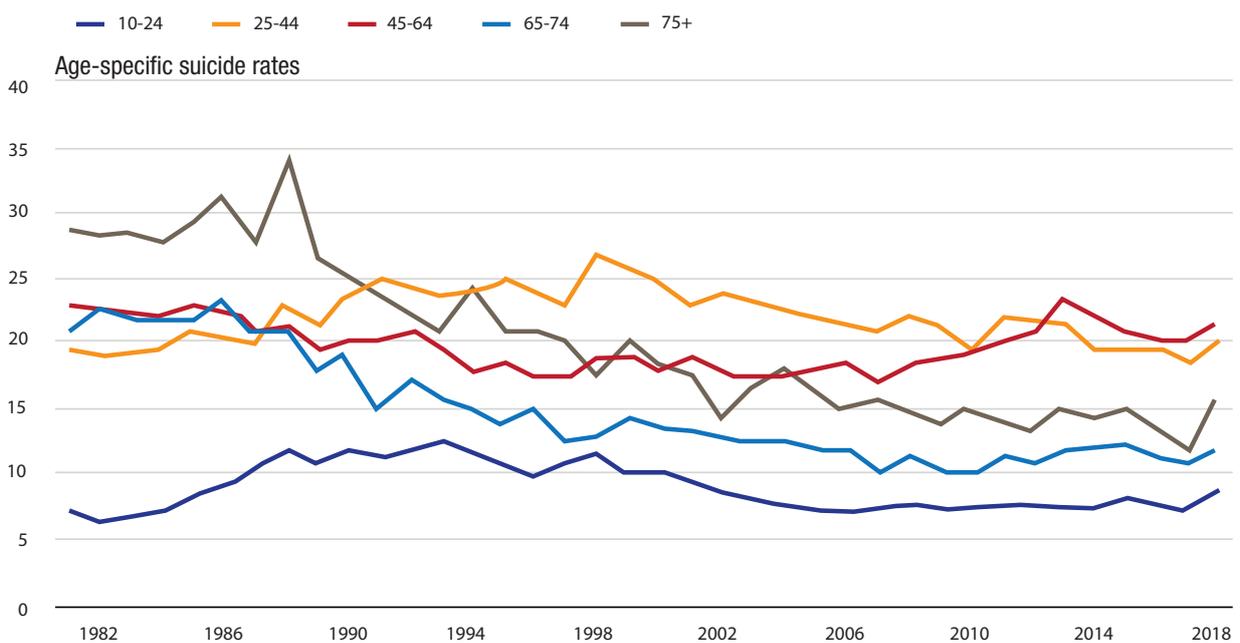
Source: Office for National Statistics, National Records of Scotland, and Northern Ireland Statistics and Research Agency

Figure A3a. Age-specific suicide rates (per 100,000) by region of England, males, 2018
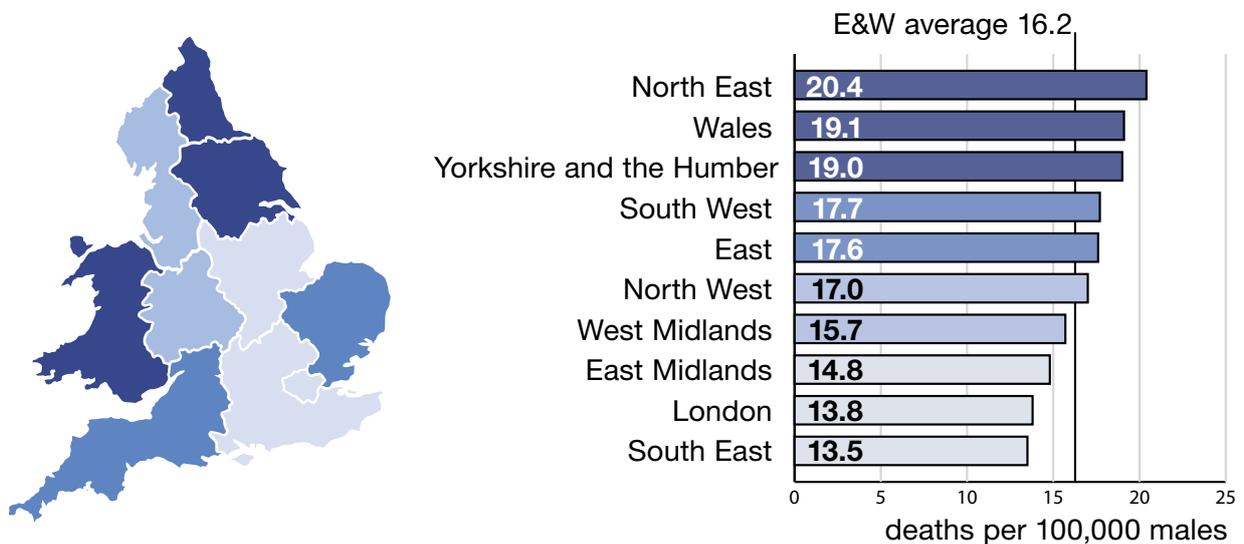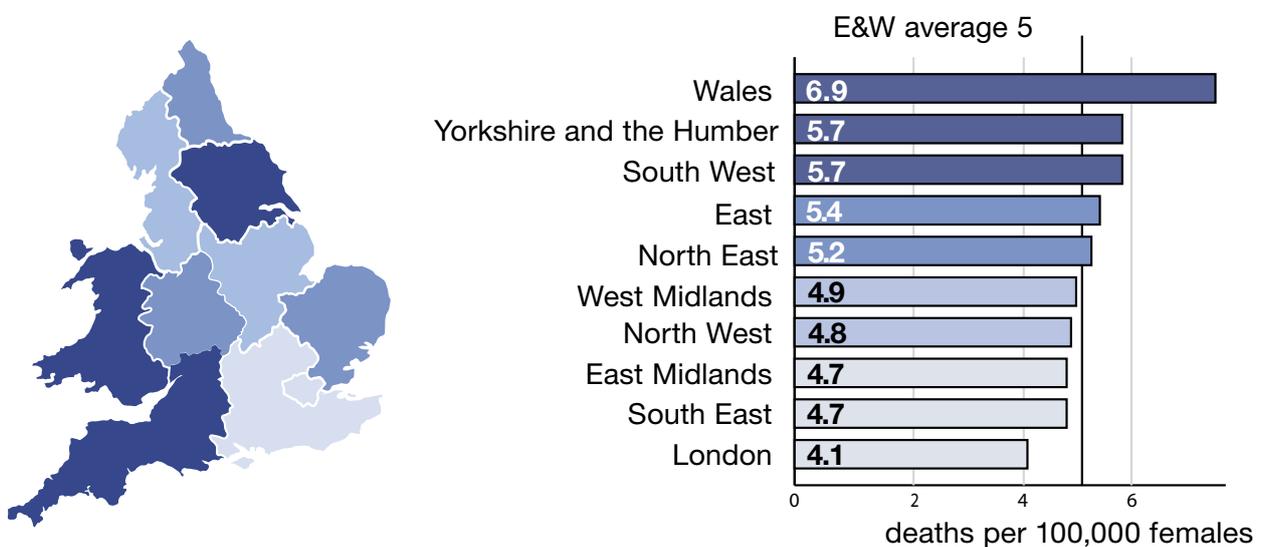

E&W average 16.2

Region	Rate
North East	20.4
Wales	19.1
Yorkshire and the Humber	19.0
South West	17.7
East	17.6
North West	17.0
West Midlands	15.7
East Midlands	14.8
London	13.8
South East	13.5

deaths per 100,000 males

Figure A3b. Age-specific suicide rates (per 100,000) by region of England, females, 2018

E&W average 5

Region	Rate
Wales	6.9
Yorkshire and the Humber	5.7
South West	5.7
East	5.4
North East	5.2
West Midlands	4.9
North West	4.8
East Midlands	4.7
South East	4.7
London	4.1

deaths per 100,000 females

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What is WHEC?

The Workplace Health Expert Committee (WHEC) provides independent expert opinion to HSE by identifying and assessing new and emerging issues in workplace health. Working under an independent Chair, WHEC gives HSE access to independent, authoritative, impartial and timely expertise on workplace health.

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