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Relation between occupation, gender dominance in the occupation and workplace and suicide in Sweden: a longitudinal study

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ABSTRACT

Objectives To describe the association between occupations and suicide, and to explore the effect of gender dominance in the occupation and in the workplace on the risk of suicide.

Design Register-based cohort study.

Participants 3 318 050 workers in Sweden in 2005 and followed up until 2010. Exclusion criteria for the study were: missing information in the occupational codes, yearly income of <100 Swedish krona, missing information of the employer, death or migration, and registered occupational code reported from more than 5 years ago.

Outcome Suicides occurring during 2006–2010 identified in the cause of death register by the International Classification of Diagnoses-10 codes X60–84 and Y10–34.

Results Occupations with increased suicide were life science and health professionals (OR: 2.8, 95% CI: 1.50 to 5.26) among women. In men, these were metal, machinery and related workers (OR: 1.5, 95% CI: 1.09 to 2.05) and personal and protective service workers (OR: 1.59, 95% CI: 1.14 to 2.22). In terms of gender dominance in the occupation, borderline associations with increased suicide risk were found for men in both male-dominated (OR: 1.32, 95% CI: 0.98 to 1.79) and female-dominated (OR: 1.37, 95% CI: 0.99 to 1.91) occupations. For women, borderline increased risk of suicide was found in female-dominated occupations (OR: 1.51, 95% CI: 0.95 to 2.40). Finally, men showed a borderline increased risk of suicide in female-dominated workplaces (OR: 1.31, 95% CI: 0.94 to 1.81).

Conclusions This study found that women in the 'life science and health professionals' group and men in the 'metal, machinery and related workers' as well as 'personal and protective service workers' groups have increased incidence of suicide also when adjusting for sociodemographic characteristics, precariousness of the employment relationship, spells of unemployment, previous mental disorders and suicide attempts. Moreover, gender dominance at workplace and occupation seems to be associated with the risk of suicide among men. The results of our study are novel and are worth exploring in future qualitative studies.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study is based on population registers with high validity and low attrition rates.
⇒ The estimates are adjusted for several confounders, such as previous mental disorders and suicide attempts (which decreases the likelihood of reverse causation).
⇒ Compared with previous studies, this study uses an objective and single-point time measure of gender composition based on register data, instead of self-reported data, which decreases potential biases.
⇒ A sizeable share of self-employed individuals had missing information on their occupational codes. This may have excluded many self-employed individuals from the study population.

INTRODUCTION

In Sweden, approximately 1500 persons take their lives each year corresponding to a suicide rate of 12.4 per 100 000 persons in 2019,[1] which is slightly higher than the global suicide rate in the same year (9.0 per 100 000 persons).[1] Suicide is more common among men in Sweden (70% of suicides are committed by men)[2] as well as in all other high-income countries.[3] There are a number of well-known risk factors for suicide such as access to lethal means of suicide, mental disorders,[4] a wide range of somatic illnesses,[5–7] and a wider range of stressful life events[8] and chronic stressors (eg, [9–11]). A number of these and other, perhaps unknown, precipitators to suicide appear to be affected by occupation and workplace-related factors. For instance, the results from a meta-analytical review of suicide and occupation showed that elementary professions, machine operators, deck crew and agricultural workers were at elevated risk compared with the working-age population.[12] Mechanisms that may explain occupation-specific risk of suicide include access to lethal means through work, stressful working conditions, high job demands and low control, long working hours, work–family imbalance, individual factors associated

working in at-risk occupations and poor employment conditions (precarious employment).[12 13] Even though the meta-analysis showed increased risk of suicide for specific occupations, due to the heterogeneity of the studies included in it, the results should be interpreted with caution. For instance, while some studies found some occupations at increased risk of suicide such as doctors and farmers,[14 15] others found no evidence.[16] A possible explanation for this mixed evidence may be the variation in suicide-specific working conditions within occupations, and/or methodological issues in the included studies, such as low sample sizes that affect the statistical power, the use of comparison groups that include the general population and therefore are biased, as well as the use of multivariate models that do not consider potential confounders such as demographic characteristics (eg, level of education), employment characteristics (eg, temporary employment, low income) or previous mental disorders.

Moreover, it is also important to consider that the labour market is gender segregated when exploring the suicide risk associated with specific occupations. In 2018, only 19% of women and 16% of men in Sweden worked in gender-balanced occupations (defined as neither of the genders below 40% or above 60%).[17] Therefore, the occupation-related suicide risk is expected to differ between men and women. For instance, a study conducted in the USA (using data from 2012 and 2015) reported that for men, the occupational group with the largest percentage of suicides was construction and extraction, while the corresponding group for women were unpaid occupations (did not work, student status or homemaker) followed by the group arts, design, entertainment, sports and media.[18] Gender composition is usually studied based on the share of female or male workers in the occupation (eg, female-dominated or male-dominated occupations compared with gender-balanced occupations). Previous studies have found that the gender composition of an occupation has an impact on health.[19 20] However, many workplaces consist of several occupational groups that collaborate daily. Also, working in a gender-balanced occupation but being the minority sex in a workplace may be an unfavourable position. Therefore, gender composition can also be captured by composition at the workplace.

According to Kanter's theory of tokenism, individuals in a minority (gender) group are at increased risk of poorer health (eg, women working in male-dominated occupations/workplaces).[21–24] This may be explained by several reasons, such as being in a minority demographic group and subject to stereotyping and differential working conditions and pay.[25 26] Also, the minority group could be perceived as a threat to power and resources for the majority group. Another reason could be that individuals may experience gender-role conflict because they deviate from normative work arrangements for men and women.[27] It is also worth noting that the tokenism theory could predict differing gender effects depending on whether the minority groups are comprised of men or women. The gender order in western societies (the system practices through which power relations between women and men are made) shows that men and masculine behaviour may generate higher status at work. In general, maleness implies higher status versus femaleness, and thus a minority position could be of benefit to men but adverse to women.[28] But as of now, the empirical evidence seems to go against tokenism theory. For instance, a descriptive study in Greece found that men in male-dominant occupations have a higher suicide risk compared with women.[29] Similarly, a study conducted in Australia over the period 2001–2015 found that men in male-dominated occupations had a higher suicide rate compared with men in female-dominated occupations. Women in female-dominated occupations also showed a higher suicide rate compared with women in male-dominated occupations.[21] The study also found that gender-balanced occupations had a higher rate of suicides compared with female-dominated occupations. This raises interesting questions about how gender and distribution of gender in the occupation affect suicide.

To our knowledge, there are no previous studies on Swedish data examining the effects of gender dominance in occupations and workplaces on suicide. Moreover, the few previously published studies exploring associations between occupations and suicide have not accounted for employment characteristics of certain occupations. This may be especially relevant when exploring the associated suicide risk to certain occupations, as precarious employment is more common in certain occupations (eg, food preparation assistants, agriculture labourers and sales and service workers) and together with unemployment are also risk factors for mental disorders and suicide attempts.[13] Moreover, it is important to consider the effect of the employment characteristics when examining the risk associated with gender dominance in the occupation. Specifically, even though the share of female and male workers in precarious employment is similar in Sweden, the effects on mental health that come from being in precarious employment are worse among women.[13]

Therefore, against this background, the aims of this study are:

- To describe the association between occupations and suicide.
- To explore the effect of gender dominance in the occupation and in the workplace on the risk of suicide mortality.

MATERIALS AND METHODS

Study design and data collection

This is a longitudinal cohort study based on the Swedish Work, Illness, and Labour-market Participation cohort. The present study used a subpopulation of 3 318 050 individuals, residing and working in Sweden in 2005 and followed up until the end of 2010. This cohort used multiple data sources that were linked by Statistics Sweden: (1) Longitudinal Integration Database for Health

Insurance and Labour Market Studies Register, which contained sociodemographic and employment data,[30] (2) National Patient Register (NPR), which included dates of admission and diagnosis using the International Classification of Diagnoses (ICD codes) from inpatient and outpatient care[31] and (3) cause of death register, which contained dates and cause (ICD codes) of death.[32]

Exclusion criteria for the study were: (1) missing information in the occupational codes (2005), (2) yearly employer-based income of <100 Swedish krona during 2005, (3) missing information of the employer in 2005, (4) death, emigration or immigration during 2005, (5) registered occupational code reported from more than 5 years ago.

Study variables

Exposure variable: occupation (2005)

We used the Standard Swedish occupational classification of 1996 (SSYK-96) at the two-digit level for classifying individuals into 27 occupational groups. We then regrouped some occupational groups (based on similarities of the occupation) that presented few cases of suicides, resulting in 20 groups. The regrouped occupational groups were (SSYK-96 codes in brackets): (1) corporate managers (12) and managers of small enterprises (13); (2) precision, handicraft, craft printing and related trade workers (73) and other craft and related trade workers (74); (3) stationary plant and related operators (81) and machine operators and assemblers (82); (4) agricultural, fishery and related labourers (92) and skilled agricultural and fishery workers (61); (5) teaching professionals (23) and teaching associate professionals (33); (6) customer service clerks (42) and models, salespersons and demonstrators (52); (7) physical, mathematical and engineering science professionals (21) and other professionals (24).

Outcome variable: suicide (2006–2010)

Suicides occurring during 2006–2010 were identified in the cause of death register and NPR by the following ICD-10 codes: intentional self-harm (X60–X84) and events of undetermined intent (Y10–Y34). Undetermined intent is defined by ICD as 'events where available information is insufficient to enable a medical or legal authority to make a distinction between accident, self-harm and assault'. The reason for including undetermined intent was based on several studies that had concluded some deaths classified as undetermined intent were in fact suicides. Also, studies using register data usually include undetermined intent when studying suicide (this will allow us to compare our results with other Swedish studies).[33 34]

Effect modifier: sex and gender dominance in the occupation and workplace

Workplace was measured through the workplace identity number (Statistics Sweden's Business Database establishes an eight-digit, unique, serial number for each workplace). Everyone is linked to a workplace identity number. A workplace is any address, property or group of nearby properties where a company conducts business. Gender dominance in the occupation and workplace was measured based on the proportion of women in each occupation and workplace and classified as: (1) female dominated (more than 60% of women), (2) male dominated (less than 40% of women), (3) gender balanced (between 40% and 60% of women).

COVARIABLES

We obtained the minimal sufficient set of variables for adjustment by drawing the causal assumptions using a Directed Acyclic Graph (see online supplemental figure S1).[35] The analyses were adjusted for the following confounders:

- Sociodemographic characteristics: age in 2005, country of birth (Sweden, other than Sweden), educational level in 2005 (primary/secondary education, higher education), family composition in 2005 (cohabiting with children, cohabiting without children, single with children, single without children).
- Employment characteristics: unemployment spells in 2005 (categorised as none/any) and precarious employment in 2005 (measured using the V.3.0 of the Swedish Register-based Operationalization of Precarious Employment (SWE-ROPE)).[36] SWE-ROPE consisted of five components (contractual employment insecurity, temporariness, multiple job holding, income level, coverage under collective bargaining agreements) covering the three dimensions (employment insecurity, income inadequacy and lack of rights and protection) of precarious employment as identified by Kreshpaj *et al*.[37] Individuals were assigned a score according to the five components that ranged from –10 to +2 (being –10 very precarious), and then they were classified as precarious if their score was lower than –3.
- Mental health characteristics: previous suicide attempts (ICD-10 codes: X60–64 and Y10–Y34, ICD-9: E950–E959) and mental disorders (ICD-10 codes: F00–F99, ICD-9: 290–316).

Statistical analysis

We calculated the sex-specific and total cumulative incidences of suicide per 100 000 persons during 2006–2010 according to occupations, gender dominance in the occupation and gender dominance in the workplace of 2005. Cumulative incidence for the period of 2006–2010 was used for increasing the number of cases and therefore statistical power. Next, we estimated crude and adjusted ORs (aORs) with 95% CIs of suicide according to occupation (using the rest of the occupations as reference), according to gender dominance in the occupation (using the gender-balanced occupation group as reference) and according to gender dominance in the workplace (using the gender-balanced workplace group as reference) by means of logistic regression models. We adjusted the models for sociodemographic, employment and previous

mental health characteristics. The reason for adjusting for employment characteristics was that some of the occupations with higher incidence of suicide were also those with a sizeable share of workers in precarious employment and in spells of unemployment. Moreover, for the models of gender dominance in the workplace, we calculated a second set of adjusted models by occupation.

As additional analyses, we calculated the cumulative incidence of suicide among occupations identified at higher risk of suicide using the SSYK-96 at the four-digit level. We also compared the suicide rates among the included study population and the excluded due to missing values in their occupational codes.

All analyses were conducted for the total population and for women and men separately. Data management and statistical analysis were conducted with STATA V.16.

Patient and public involvement

No patients were involved in the design of this study.

RESULTS

This cohort study included a total of 3 318 727 workers, with a mean age of 43 years old. Out of these, 64.2% had higher education, 9.9% were foreign born (online supplemental table S1). Occupations with a higher share of workers in precarious employment or those who were unemployed at any point during 2005 were agricultural, fishery and related occupations (58.2% precariously employed and 18.8% unemployed), customer service, sales and service elementary occupations (approximately 48% precariously employed) and extraction and building trade workers (11% unemployed) (table 1).

The total number of suicides was 607 during 2006–2010, with a cumulative incidence of 18 suicide cases per 100 000 persons. Among male-dominated occupations, the occupations with the highest suicide incidence were metal, machinery and related trade workers, and agricultural fishery and related labourers (38 and 34 cases per 100 000 persons, respectively). Among female-dominated occupations, life science and health associate professionals had the highest incidence (26 cases per 100 000 persons). Gender-balanced occupations had lower incidence than the average (table 1).

Excluded individuals due to missing values in occupational codes were more frequently foreign born (15.8% vs 9.9%), younger (mean age 35.6 vs 43.6) and had spells of unemployment (24.6% vs 5.6%) compared with the included population. Also, the cumulative incidence of suicide per 100 000 persons was higher among the excluded individuals (26 vs 18) (online supplemental table S2).

Occupations that showed an increased risk of suicide after adjusting for sociodemographic characteristics, employment characteristics and previous mental disorders and suicide attempts among women were life science and health professionals (aOR: 2.80, 95% CI: 1.50 to 5.26) (table 2). The occupational subgroups among life science and health professionals that had a higher incidence of suicide were veterinarians, emergency room nurses, district nurses and paediatric nurses (online supplemental table S3A). Among men, those in metal, machinery and related occupations had increased risk of suicide (aOR:1.50, 95% CI: 1.09 to 2.05), and the occupational subgroups with increased suicide incidence were structural-metal preparers and erectors as well as bookbinders and related workers (online supplemental table S3B). Also, male personal and protective service workers had increased risk of suicide (aOR: 1.59, 95% CI: 1.14 to 2.22) (table 2). In this case, the occupational subgroups that had a higher incidence of suicide were assistant nurses and hospital ward assistants as well as attendants in psychiatric care (online supplemental table S3B).

Moreover, occupations that had lower risk of suicide compared with the rest were teaching (aOR: 0.47, 95% CI: 0.24 to 0.92) for women, and managers (aOR: 0.49, 95% CI: 0.28 to 0.85) and other associate professionals (aOR: 0.60, 95% CI: 0.39 to 0.94) for men (table 2).

Among men, the suicide incidence in male-dominated and female-dominated occupations was higher than in gender-balanced occupations (30 vs 20 cases per 100 000 persons). After adjustment, the associations were borderline, showing increased risk of suicide among men in male-dominated (OR: 1.32, 95% CI: 0.98 to 1.79) and female-dominated occupations (OR: 1.37, 95% CI: 0.99 to 1.91) compared with gender-balanced occupations. For women, suicide incidence was similar in gender balanced as well as in male-dominated and female-dominated occupations. The adjusted associations showed an increased borderline risk of suicide in female-dominated occupations (OR: 1.51, 95% CI: 0.95 to 2.40) (table 3).

Men in male-dominated and female-dominated workplaces had a higher suicide incidence compared with gender-balanced workplaces (30 vs 20 cases per 100 000 persons). After adjusting for potential confounders except for occupation, only men in female-dominated workplaces had an increased risk of suicide (OR: 1.43, 95% CI: 1.02 to 2.01), but after adjustment for occupations, the association became borderline (OR: 1.31, 95% CI: 0.94 to 1.81) (table 4). The suicide risk among women is not associated with gender dominance in the workplace (table 4).

DISCUSSION

Main findings

This study found that women in the ‘life science and health professionals’ group and men in the ‘metal, machinery and related workers’ as well as ‘personal and protective service workers’ groups have increased incidence of suicide after controlling for sociodemographic characteristics, precariousness of the employment relationship, spells of unemployment, previous mental disorders and previous suicide attempts. Moreover, men in female-dominated and male-dominated occupations and women in female-dominated occupations

Table 1 Characteristics of the included individuals according to occupation and gender dominance in the occupation

	Occupation (2005)	All n	All %	% Women	Precarious employment (2005) (%)	Unemployment (2005) (%)	Suicide cumulative incidence per 100 000 persons (2006–2010)
	Total	3 318 050		48.5	28.3	5.6	18
Male-dominated occupations	Armed forces	11 029	0.3	4.1	7.8	0.9	0
	Managers	206 739	6.2	27.8	16.2	2.4	11
	Physical, mathematical, engineering science and other professionals	176 543	5.3	18	16.4	3.3	16
	Extraction and building trade workers	173 433	5.2	3	32.4	11.4	32
	Metal, machinery and related trade workers	119 789	3.6	2.6	26.1	5.6	38
	Craft and related workers	25 277	0.7	29.7	37.1	6.7	32
	Operators and assemblers	241 346	7.3	20.8	21.2	6	25
	Drivers and mobile plant operators	120 088	3.6	5.3	39.6	8.6	31
	Agricultural, fishery and related labourers	26 831	0.8	24.4	58.2	18.8	34
	Labourers in mining, construction, manufacturing and transport	40 418	1.2	28.2	29.8	8.6	30
	Legislators and senior officials	2078	0.1	36.8	21.7	2.5	0
Female-dominated occupations	Life science and health professionals	77 367	2.3	68.7	13.8	1	18
	Teaching	257 923	7.8	71.4	20.1	4.5	10
	Life science and health associate professionals	98 178	2.9	87.1	22	1.9	26
	Office clerks	250 240	7.5	67.8	33.3	4.9	13
	Customer service-related occupations	199 335	6.1	67.6	48.9	8.4	15
	Personal and protective service workers	487 180	14.7	82.8	33.7	6.7	19
	Elementary sales and service occupations	138 513	4.2	63.4	47.9	8.2	20
Gender-balanced occupations	Professionals	365 402	11.1	44	19.1	3.3	13
	Other associate professionals	301 018	9.1	50.3	28.2	4.2	11

Table 2 Sex-specific crude and adjusted associations of occupation (2005) and suicide (2006–2010)

	Occupations (2005)	Women						Men					
		OR	95% CI		aOR	95% CI		OR	95% CI		aOR	95% CI	
Male-dominated occupations	Armed forces	na	na	na	na	na	na	na	na	na	na	na	na
	Managers	0.48	0.15	1.52	0.59	0.19	1.87	0.47	0.30	0.75	0.49	0.28	0.85
	Physical, mathematical, engineering science and other professionals	0.89	0.29	2.81	0.94	0.30	2.96	0.68	0.46	1.01	0.73	0.49	1.09
	Extraction and building trade workers	1.81	0.25	12.9	1.59	0.22	11.4	1.31	1.01	1.74	1.15	0.86	1.54
	Metal, machinery and related trade workers	na	na	na	na	na	na	1.6	1.18	2.17	1.50	1.09	2.05
	Craft workers	na	na	na	na	na	na	1.77	0.88	3.56	1.69	0.84	3.4
	Operators	1.14	0.50	2.59	1.10	0.48	2.52	1.11	0.84	1.48	1.01	0.75	1.34
	Drivers and mobile plant operators	na	na	na	na	na	na	1.29	0.92	1.81	1.06	0.75	1.49
	Agricultural, fishery & related	2.93	0.72	11.8	2.78	0.68	11.3	1.35	0.64	2.85	1.05	0.49	2.23
	Labourers in mining, construction, manufacturing and transport	1.68	0.41	6.78	1.41	0.35	5.72	1.35	0.72	2.53	1.08	0.57	2.02
	Legislators and senior officials	na	na	na	na	na	na	na	na	na	na	na	na
Female-dominated occupations	Life science and health professionals	2.64	1.53	4.57	2.80	1.50	5.26	0.97	0.43	2.16	1.54	0.66	3.59
	Teaching	0.48	0.26	0.92	0.47	0.24	0.92	0.79	0.47	1.32	0.99	0.58	1.72
	Life science and health associate professionals	1.61	0.93	2.78	1.77	0.98	3.20	1.23	0.46	3.29	1.07	0.34	3.37
	Office clerks	0.71	0.40	1.25	0.74	0.42	1.31	0.96	0.62	1.51	0.79	0.50	1.26
	Customer service	0.91	0.52	1.61	1.04	0.58	1.87	1.03	0.63	1.67	1.12	0.69	1.82
	Personal and protective service workers	1.44	1.05	1.99	1.33	0.94	1.90	1.95	1.41	2.70	1.59	1.14	2.22
	Sales and service elementary occupations	1.21	0.65	2.22	0.98	0.52	1.83	1.32	0.81	2.15	0.76	0.46	1.34
Gender-balanced occupations	Professionals	0.57	0.30	1.07	0.56	0.29	1.09	0.66	0.47	0.92	0.93	0.65	1.34
	Other associate professionals	0.74	0.41	1.33	0.84	0.46	1.51	0.52	0.34	0.82	0.60	0.39	0.94

Adjusted OR by age (continuous), level of education, country of birth, family composition, previous mental disorders and previous suicide attempts, precarious employment and spells of unemployment at baseline.
aOR, adjusted OR; na, not available.

have higher incidence of suicide, compared with those working in gender-balanced occupations; but after adjustment for potential confounders, the associations become borderline. Finally, men in female-dominated workplaces have increased incidence of suicide compared with men in gender-balanced workplaces;

Table 3 Sex-specific suicide incidence and crude and adjusted associations of gender balance in the occupation (2005) and suicide (2006–2010)

		Suicide							
	Gender dominance in the occupation (2005)	Cases	Cumulative incidence per 100 000 persons (2006–2010)	OR	95% CI		aOR	95% CI	
Men	Gender balanced	57	20	Ref			Ref		
	Male dominated	262	30	1.69	1.27	2.25	1.32	0.98	1.79
	Female dominated	119	30	1.89	1.38	2.60	1.37	0.99	1.91
Women	Gender balanced	22	10	Ref			Ref		
	Male dominated	17	10	1.33	0.71	2.51	1.31	0.69	2.49
	Female dominated	130	10	1.65	1.05	2.59	1.51	0.95	2.40

*aOR by age (continuous), level of education, country of birth, family composition, previous mental disorders and previous suicide attempts, precarious employment and spells of unemployment at baseline.
aOR, adjusted OR; Ref, Reference category.

but after adjustment for occupation, this association becomes borderline.

Interpretation

This study found that there are some occupations in Sweden which are associated with a higher risk of suicide even after adjusting for potential confounders, including employment conditions (which few previous studies have adjusted for).

Women employed as life science health professionals were found to have an increased risk of suicide. Among this occupational group, the specific occupations that displayed the highest incidence were veterinarians, emergency room nurses, district nurses and paediatric nurses. This finding is in line with previous research from other countries that also reported an increased risk of suicide in veterinarians[15 38] and nurses.[16 39] The potential reasons for the increased risk among these healthcare professionals may include unique aspects related to medical science. For example, access to and knowledge about lethal dosage of medications.[15 40] Several studies have reported that physicians,[41] nurses[39] and veterinarians[38 42] are more likely to use poisoning as their suicide method than other occupational groups, and that the drugs used were obtained from the workplace in most cases.[40] The results from one study have suggested that access to lethal means (especially medications and drugs) in an occupation might be more relevant to women.[43] This could be, in part, due to the different preferences for suicide method among men and women, where men more often use more lethal and violent suicide methods (ie, hanging, guns) compared with women (ie, drugs and carbon monoxide poisoning).[44] This may explain why a heightened risk was found only for female healthcare professionals. It has also been theorised that repeated engagement with provocative events such as death and illness, and euthanasia (specifically for veterinarians) may increase suicide risk.[45] It is possible that this practice affects veterinarians' attitudes towards suffering, or towards alleviating suffering through death.[45] Another aspect regards the managing of client relations (such as handling clients' expectations) which has been found to contribute to feelings of stress among veterinarians.[42] Previous studies have found an increased risk of suicide among physicians in Sweden and several other countries.[46–48] However, a recent review and meta-analysis found that physician suicide has decreased over time in Europe.[39] We did not find this group to be at increased risk, which could mean that suicide among physicians in Sweden has followed the decreasing trend apparent in other European countries.

In our study, we also found that men employed as personal and protective service workers also had an increased risk of suicide. Specific occupations with a higher suicide incidence in this group were assistant nurses and hospital ward assistants, and attendants in psychiatric care. A study conducted in Sweden in the 1970s–mid-1980s found that men working as attendants in psychiatric care and as auxiliary nurses had a higher suicide risk. Proposed explanations from the authors included the importance of professional status and employment for men and feelings of personal failure due to staying in a lower social status despite changing occupation, and hence status, has become easier throughout the years.[46]

Further, men employed as metal, machinery and related trade workers also showed an increased risk of suicide in the current study. Interestingly, in this occupational group, the subgroups which had higher incidence of suicide were structural-metal preparers and erectors, as well as bookbinders and related workers. An elevated suicide risk among construction workers has been reported by studies conducted in other countries.[12 18] Physical injuries are a well-known risk factor for suicide[49] and are perhaps more likely to occur from accidents during steel erection at construction sites and could thus be a possible explanation for an increased incidence in this group. However, the higher incidence of suicide

Table 4 Sex-specific suicide incidence and crude and adjusted associations of gender balance in the workplace (2005) and suicide (2006–2010)

		Suicide									
	Gender dominance in the workplace	Cases	Cumulative incidence per 100 000 persons (2006–2010)	OR	95% CI		aOR (model 1)	95% CI		aOR (model 2)	95% CI	
Men	Gender balanced	54	20	Ref			Ref			Ref		
	Male dominated	286	30	1.17	0.87	1.56	1.18	0.87	1.59	0.92	0.69	1.24
	Female dominated	98	30	1.50	1.08	2.09	1.43	1.02	2.01	1.31	0.94	1.81
Women	Gender balanced	27	10	Ref			Ref			Ref		
	Male dominated	21	10	0.84	0.47	1.48	0.88	0.50	1.57	0.87	0.50	1.52
	Female dominated	121	10	0.98	0.65	1.50	0.95	0.62	1.44	0.81	0.52	1.27

Model 1 (aOR by age (continuous), level of education, country of birth, family composition, previous mental disorders and previous suicide attempts, precarious employment and spells of unemployment at baseline.); model 2 (aOR by age (continuous), level of education, country of birth, family composition, previous mental disorders and previous suicide attempts, precarious employment, spells of unemployment at baseline and occupation at baseline).
aOR, adjusted OR; Ref, Reference category.

among male bookbinders is a surprising finding. It could be interesting to see if this finding can be replicated in other populations (countries), and if so, future research could explore potential occupation-specific risk factors, perhaps through qualitative studies.

Moreover, in this study, three occupations appeared to have a lower risk of suicide. Among women, the group of teaching professionals, and among men, the group of managers and other associate professionals had a lower risk compared with other occupations. These results are in line with previous studies,[50] which suggest that the decrease could be due to better working conditions (ie, good work environment), a favourable societal perception of their occupation (status), and not being exposed to death or illness like in some of the high-risk occupations.

Our results add to the literature of the effect of occupation and gender composition on mental health. In this study, we found that the suicide risk is increased both when men are in female-dominated occupations and when they are in male-dominated occupations. Women, on the other hand, appear to be affected only by occupations that are female dominated. These results should be interpreted with caution considering that all gender effects were borderline, especially after controlling for potential confounders.

Also, considering that the workplace is the context where most professional social interactions occur and where the adversities associated to minority status could be most expressed, dominance at the workplace level may be a more precise measurement. Our results suggest that the risk of suicide is increased among men working in female-dominated workplaces. This finding could be explained by several reasons. First, the occupation with a higher incidence of suicides among men in female-dominated workplaces was personal and protective service workers. Therefore, the increased suicide risk among men working in female-dominated workplaces may be explained by the occupation they have and not because of the gender dominance in the workplace. An alternative explanation may be the help-seeking behaviour among men (it is less common among men to seek help from mental health professionals than women).[51] Our results are not in line with previous literature in the Swedish context exploring the effect of gender dominance in the workplace on mental health. For instance, a study found that working in a workplace with a mixed gender composition was related to a higher likelihood of psychological distress at age 42 years compared with working in a male-dominated workplace,[22] although no separate models for men and women were reported. We believe that the results of our study are novel and are worth exploring in future qualitative studies.

Limitations and strengths

This study is based on population registers with high validity and low attrition rates.[30–32] This also makes it possible to generalise our results to the whole working population of Sweden, especially those who are directly

employed. Moreover, by adjusting our estimates for previous mental disorders and clinically treated suicide attempts, we reduced the likelihood of reverse causation (ie, being diagnosed with a mental disorder and then working in a specific occupation). Additionally, compared with previous studies that have measured gender composition of the workplace through self-reported data, this study uses an objective and single-point time measure of gender composition based on register data which decreases potential biases. In this study, a sizeable share of self-employed individuals had missing information on their occupational codes. This may have excluded many self-employed individuals. In the Swedish context, a study conducted with register data reported that the risk of suicide was lower among the self-employed compared with employees.[52] Therefore, the involuntary exclusion of some self-employed individuals in our study may not have underestimated our results. In this regard, the comparison of the characteristics of excluded and included individuals in our study showed that individuals working without information in their occupational codes were more likely to be young, foreign born and had any spells of unemployment, which may also explain why they also had a higher incidence of suicide. Moreover, we measure occupation at a single point (baseline), therefore our estimates do not consider the possible effect of changes in occupation during the follow-up. However, the share of workers changing their occupation status at a second digit level is really low.

Finally, this study is exploring the effects of occupation and workplace in the individual incidence of suicide. This may have been approached using mixed-methods models, where workplace and/or occupation are included as random effects in the model. Due to the low incidence of our outcome and the small number of levels in the variable gender dominance in the occupation and workplace, this study is not considering the clustering of individuals at the occupation or workplace level.[53 54]

CONCLUSIONS

This study found that women in the 'life science and health professionals' group and men in the 'metal, machinery and related workers' as well as 'personal and protective service workers' groups have increased incidence of suicide also when adjusting for sociodemographic characteristics, precariousness of the employment relationship, spells of unemployment, previous mental disorders and suicide attempts. Moreover, gender dominance at workplace and occupation seems to be associated with the risk of suicide among men. The results of our study are novel and are worth exploring in future qualitative studies.

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