

Study protocol

The association between workplace bullying and suicidal behaviour: A register-based prospective study of 98,330 participants in Denmark.

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ABSTRACT

Aim: To present a protocol for the analysis of the prospective association between workplace bullying and suicidal behaviour.

Method: The analyses will be carried out on a sample of 98,330 participants (64% women, n=62,582) taken from a pooled dataset of nine Danish questionnaire-based surveys (2004-2014) including self-reported measures of workplace bullying. The pooled dataset is linked to national register-based data on suicidal behaviour. We will fit multivariate Cox proportional hazard models to estimate Hazard Ratios (HR) and their 95% confidence intervals for the association between baseline workplace bullying and subsequent suicidal behaviour of any type (suicide attempt and death by suicide combined), adjusting for sex, age, living status, socio-economic status and previous history of psychiatric morbidity. We will have an 80% chance of detecting a hazard ratio of 1.67 for suicidal behaviour of any type, a hazard ratio of 1.74 for suicide attempt, and a hazard ratio of 2.54 for death by suicide.

Results: The study results will be reported in an English-language manuscript to be submitted to peer-reviewed research journals.

Conclusion: The data available for this study are adequate to examine the prospective associations between workplace bullying and suicidal behaviour of any type (suicide attempt and death by suicide combined). The purpose of this protocol is to reduce risk of data-driven findings.

INTRODUCTION

Globally, more than 817,000 deaths by suicide occur annually, while the number of persons with a non-fatal episode (i.e., self-harm (SH)) is likely to be 20 times higher (WHO, 2014). The suicide rate has declined over recent decades (Nagavi, 2016). In Denmark, the suicide rate underwent a historical decrease from 1980 (40 per 100,000) to 1999 (18 per 100,000), but has remained relatively stable in recent years (Nordentoft and Erlangsen, 2019; Dyvesether and Nordentoft, 2018).

Suicidal behaviour is a multi-factor phenomenon, with multiple contributing factors, including personality and individual differences, cognitive factors, social factors, and negative life events (O'Connor and Nock, 2014). A recent meta-analysis showed that social factors (e.g., isolation and life- and work-related stressful events) are key antecedents of suicide attempt and death by suicide (Franklin et al., 2016).

Among social factors related to the work life, workplace bullying, defined as harassing, offending, socially excluding someone or negatively affecting someone's work repeatedly and regularly over a long period (e.g., at least 6 months; Einarsen et al., 2011), is an established severe stressor that can strongly affect those exposed (Conway et al., 2018; Mikkelsen et al., 2020). From a theoretical standpoint, a link between workplace bullying and suicidal behaviour seems plausible based on the interpersonal theory of suicide (IPTs; Van Orden et al., 2010). IPTs posits that two factors, i.e., social alienation and burdensomeness, are crucial determinants of suicidal thoughts and behaviour. Targets of bullying are usually subjected to repeated negative acts that include acts aimed at socially excluding the target. The bullied become increasingly unable to defend themselves, which further compounds their negative experience leading to decreased self-esteem and performance. The latter, in turn, are associated with a sense of being a burden to others. Links between workplace bullying and suicidal behaviour are suggested by current evidence showing that workplace bullying is a risk factor for reduced mental health (Harvey et al., 2017), especially depression (Theorell et al., 2015), which plays a major role in the prediction of suicidal behaviour (Leach et al., 2016). Workplace bullying is also a risk factor for later suicidal ideation (Nielsen et al., 2015; Nielsen et al., 2016), which is suggested to be an antecedent of suicidal behaviour (Nielsen et al., 2016).

Despite these indications, there is to date no available empirical evidence linking workplace bullying to actual suicidal behaviour (Leach et al., 2016). To fill this research gap, the present study aims to examine the association between self-reported exposure to workplace bullying and subsequent risk of suicidal behaviour in a large Danish pooled dataset linked to national register data on death by suicide and suicide attempt.

In the main analysis, we will test the hypothesis that individuals exposed to workplace bullying have a higher risk of suicidal behaviour (suicide attempt and death by suicide combined) than those individuals not exposed to workplace bullying.

Participant inclusion criteria, actual participants, exposure and outcome measures, statistical models, and power analyses are described in the present study protocol, which we publish here before the analyses are performed. Any change causing the analytical models to diverge from what is presented in this protocol, will be reported in the published study.

METHODS

Study design and participants

We will adopt a cohort study design involving nine Danish questionnaire-based surveys performed from 2004 to 2014, each contributing 1 to 3 waves of measurement with a total of 15 waves. The surveys include persons employed in different occupational groups in both the private and public sectors. All surveys were occupational health and safety surveys that included questions regarding the work environment of the participants, in particular all surveys included a question about workplace bullying. All surveys were pooled in a single dataset at the National Research Centre for the Working Environment, Copenhagen.

The original pooled dataset consists of 105,455 unique participants providing 139,575 observations since several participants took part in multiple surveys. Participants who took part in multiple surveys will only be included the first time they provided information about self-reported bullying. Participants were included if they did not have any missing information on age, sex, living status or socio-economic status, or migrated from the country before completing the questionnaire. We do so to give equal weight to participants, as those who participated in multi-wave surveys had a higher

probability to report exposure to workplace bullying than those who participated in single-wave surveys. For the present study, we will exclude 5,945 participants with missing values on exposure to workplace bullying and 247 participants with missing values on sex, age, living status, or socioeconomic status, resulting in 99,263 participants available. We will additionally exclude three participants that already had migrated out of the country when we received the completed questionnaire. Finally, we will exclude further 930 participants with previous suicide attempts. This will result in a final pooled dataset of 98,330 participants (64% women, n=62,582, on which the analyses described in the present protocol will be performed. Table 1 shows the number of participants (total sample and by survey) for each step of participant exclusion.

The pooled dataset is linked to national register data covering: socio-demographic data (National Danish Civil Register; Pedersen, 2011), hospital contacts (National Patient Register; Lynge et al., 2011 and Psychiatric Central Research Register; Mors et al., 2011), causes of death (Danish Registry of Causes of Death; Helweg-Larsen, 2011). Individual-level linkage was performed using the unique personal ID numbers assigned upon birth or migration into the country (Erlangsen and Fedyszyn, 2015). Register data will be followed up until December 31st, 2016. The participants were followed for an average of 7.3 years, with a range of 1 day to 12.1 years.

Table 1. Number of participants (total sample and by survey) in each step of participant exclusion

Survey ^a	Total number of observations	Total unique participants	DWECS 05	DWECS 10	COPSOQ	PRIS07	SATH	WBH06	WBH08	SOSU I	SOSU II	SOSU III	SOSU U	DANES	WEHD 12	WEHD 14
Original dataset	139575	105455	9447	11291	3517	4533	4947	3598	3769	9928	10045	8430	5696	12559	24422	27393
After exclusion of participants with missing values on exposure to workplace bullying	130914	99510	9030	10952	3429	4455	4947	3282	2155	9805	9907	8315	2576	10700	24077	27284
After exclusion of participants with missing values on sex, age, living status, and socio-economic status	130616	99263	9008	10923	3421	4453	4934	3271	2135	9775	9882	8266	2572	10699	24073	27204
After exclusion of migrated participants	130555	99260	9008	10895	3421	4453	4934	3271	2130	9775	9881	8261	2572	10698	24070	27186
After exclusion of participants who already participated in an earlier survey	99260	99260	8958	6052	3420	4399	4567	3191	567	9751	3592	2468	2403	10483	23259	16149
After exclusion of participants with previous suicide attempts	98330	98330	8878	5997	3388	4364	4543	3172	564	9631	3537	2414	2362	10410	23053	16017

^aDWECS05 (The Danish Work Environment Cohort Study 2005): A national, representative sample of employed persons conducted in 2005; DWECS10 (The Danish Work Environment Cohort Study 2010): A national, representative sample of employed persons conducted in 2010; COPSOQ II (Copenhagen Psychosocial Questionnaire Study II): A national, representative sample of employed persons conducted in 2004; PRISME07: Workplace-based survey in public workplaces in the Regional sector in Denmark conducted in 2007; SATH (Nursing Work Environment, Well-being and Health): A national, representative sample of registered nurses in Denmark conducted in 2007; WBH06 (Workplace Bullying Cohort 2006): Workplace-based survey in private and public workplaces in Denmark conducted in 2006; WBH08 (Workplace Bullying Cohort 2008): Workplace-based survey in private and public workplaces in Denmark conducted in 2008; SOSU I (Social and Health Care Study I): Workplace-based survey among employees in the Danish Eldercare services conducted in 2004/2005; SOSU II (Social and Health Care Study II): Workplace-based survey among employees in the Danish Eldercare services conducted in 2006/2007; SOSU III (Social and Health Care Study III): Workplace-based survey among employees in the Danish Eldercare services conducted in 2008/2009; SOSU-U (The Danish Health Care Worker Cohort-Class of 2004): Survey conducted among all newly educated social and health care helpers and assistants in 2004; DANES (Danish National Working Environment Survey): A national, representative sample of employed persons conducted in 2007; WEHD12 (Work Environment and Health 2012): A national, representative sample of employed persons conducted in 2012; WEHD14 (Work Environment and Health 2014): A national, representative sample of employed persons conducted in 2014.

Exposure: Workplace bullying

For most surveys, self-reported exposure to workplace bullying was measured retrospectively with the following item: “Have you been subjected to bullying at work within the past 12 months?”, to be answered using five Likert-type response options, i.e. 1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily. The item, however, differed in the SATH II, DWECS05, DWECS10, WBH06, and WBH08 surveys. In the WBH study, participants were given the same response options, but a 6-month period for retrospective exposure to workplace bullying was used instead of a 12-month period. In SATH II, DWECS05 and DWECS10, exposure frequency was measured with a dichotomous item asking whether the respondent was bullied or not within the past 12 months. The items on workplace bullying were harmonised across surveys, resulting in the following dichotomous item: 1=0 “Not exposed to workplace bullying” (Reference); 2 to 5=1 “Exposed to workplace bullying”. Table 3 provides an overview of the retrospective exposure period and response options for each of the surveys included in the pooled dataset. Whenever possible, time of exposure will be considered as the date the survey questionnaire on workplace bullying was filled in. For the remainders, participants who confirmed being exposed to workplace bullying will be considered as exposed from the date that the survey questionnaire was sent out.

Table 3. Retrospective exposure period and response options of the workplace bullying item used in each survey included in the pooled dataset.

Survey ^a	Retrospective exposure period	Response options
DWECS05	12 months	1 = no, and 2 = yes
DWECS10	12 months	1 = no, and 2 = yes
COPSOQ	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
PRISME07	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
SATH	12 months	1 = no, and 2 = yes
WBH06	6 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
WBH08	6 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
SOSU I	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
SOSU II	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
SOSU III	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
SOSU U	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
DANES	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
WEHD12	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily
WEHD14	12 months	1 = never, 2 = now and then, 3 = monthly, 4 = weekly, and 5 = daily

^aDWECS05 (The Danish Work Environment Cohort Study 2005): A national, representative sample of employed persons conducted in 2005; DWECS10 (The Danish Work Environment Cohort Study 2010): A national, representative sample of employed persons conducted in 2010; COPSOQ II (Copenhagen Psychosocial Questionnaire Study II): A national, representative sample of employed persons conducted in 2004; PRISME07: Workplace-based survey in public workplaces in the Regional sector in Denmark conducted in 2007; SATH (Nursing Work Environment, Well-being and Health): A national, representative sample of registered nurses in Denmark conducted in 2007; WBH06 (Workplace Bullying Cohort 2006): Workplace-based survey in private and public workplaces in Denmark conducted in 2006; WBH08 (Workplace Bullying Cohort 2008): Workplace-based survey in private and public workplaces in Denmark conducted in 2008; SOSU I (Social and Health Care Study I): Workplace-based survey among employees in the Danish Eldercare services conducted in 2004/2005; SOSU II (Social and Health Care Study II): Workplace-based survey among employees in the Danish Eldercare services conducted in 2006/2007; SOSU III (Social and Health Care Study III): Workplace-based survey among employees in the Danish Eldercare services conducted in 2008/2009; SOSU-U (The Danish Health Care Worker Cohort-Class of 2004): Survey conducted among all newly educated social and health care helpers and assistants in 2004; DANES (Danish National Working Environment Survey): A national, representative sample of employed persons conducted in 2007; WEHD12 (Work Environment and Health 2012): A national, representative sample of employed persons conducted in 2012; WEHD14 (Work Environment and Health 2014): A national, representative sample of employed persons conducted in 2014.

Outcome: suicide attempt and death by suicide

Suicide attempt and death by suicide are in the main analysis assessed as a combined outcome, denoted as ‘any suicidal behaviour’. In sensitivity analyses, these outcomes are treated separately. The individual outcomes were identified as described here below.

Suicide attempt

Data on admissions and out-patient contacts to somatic and psychiatric hospital were obtained from the National Patient Registry and the Psychiatric Central Research Register, respectively.

Participants were considered as having had a suicide attempt when this had been recorded as the main or sub-diagnosis (ICD-10: X60-X84), or where the reason for contact was listed as being suicide attempt. All types of hospital contacts, i.e. emergency department, inpatient, and outpatients, were included. Participants would be considered as having had a suicide attempt at the first date of this event and then be censored, i.e. not being considered at risk of repeated events of suicide attempt.

Death by suicide

Information on persons who died by suicide was retrieved from the Danish Registry of Causes of Death, using the ICD-10 codes X60-X84 (Helweg-Larsen, 2011). The date of death would be considered as the date of the outcome.

Any suicidal behaviour

Events of suicide attempt or death by suicide were combined in the outcome ‘any suicidal behaviour.’ Any person who were recorded either with a suicide attempt or a death by suicide would be considered as having had a suicidal behaviour. Only first episode of either event would be considered as an outcome, hence, repeat events will not be included in the main analyses.

Follow-up and inclusion criteria

We will follow participants’ status with regard to suicide attempt and death by suicide up until the end of 2016, which is the latest year data on causes of death are available for the present study. For each participant included, status with regard to both suicide attempt and death by suicide will be assessed starting from the day after workplace bullying was assessed.

Co-variates

The following register-based co-variates will be entered in the multivariate models (Hawton and van Heeringen, 2009): sex (dichotomous: men/women), age (continuous), living status (categorical: unmarried; married or cohabiting or registered partnership; divorced or termination of registered partnership; widow(er) or surviving partner of a registered partnership), and socio-economic status (categorical: leaders or employed in a job requiring skills on the highest level; employed in a job requiring skills on the mid-level; employed in a job requiring skills on a basic level; student/other). Data on sex, age, living status will be obtained from the Danish Civil registration system. Information on socio-economic status derived from Statistic Denmark's IDA database.

Previous history of psychiatric morbidity is based on registry information about any psychiatric diagnosis in the time period from 1968 to 365 days prior to filling in the baseline questionnaire (ICD-8 codes 290-316 or ICD-10 codes F00-F99) and will be treated as a dichotomous variable (yes *vs.* no). Adjustment for previous psychiatry morbidity will enable us to address that a potential association between workplace bullying and suicide attempt or death by suicide may be attributable to individuals with previous psychiatric disorders having a higher risk of both being exposed to bullying and of engaging in suicidal behaviour. The reason for not including psychiatric diagnoses during the 12 months preceding baseline (i.e., when exposure status in relation to bullying was assessed) is that this would lead to over-adjustment, given the established evidence that exposure to workplace bullying is a risk factor for the onset of mental health problems and that mental health problems may be a part of the causal pathway from workplace bullying to suicide (Theorell et al., 2015; Conway et al., 2018).

Main statistical analyses

The analyses will be conducted on the pooled dataset of 98,330 participants, using the statistical package STATA 16.1. We will fit a series of multivariate Cox proportional hazard models to estimate Hazard Ratios (HR) and their 95% confidence intervals for the association between self-reported exposure to workplace bullying at baseline and register-based events of suicidal behaviours (suicide attempt and death by suicide combined) at follow-up. Robust clusters based on the survey waves will be used to account for intragroup correlations (Williams, 2000).

We will run three consecutively adjusted Cox proportional hazard models with the one outcome suicidal behaviour. The following adjustment sequence will be employed:

- 1) Crude associations: unadjusted associations between self-reported exposure to workplace bullying (dichotomous exposure: yes/no bullied), and subsequent suicidal behaviour (suicide attempt and death by suicide combined).
- 2) Model 1: crude associations additionally adjusted for sex, age, living status and socio-economic status.
- 3) Model 2: Model 1 additionally adjusted for previous history of psychiatric morbidity.

Table 3 provides a ghost table for the main results.

Table 3. Ghost table for main results, depicting the association between exposure to bullying and suicidal events

	Number of individuals	Person-years	Number of cases	Cases per 10,000 person-years	Crude HR (95% CI)	Model 1 HR (95% CI)	Model 2 HR (95% CI)
Exposure to bullying at baseline							
No					1.00	1.00	1.00
Yes							

HR: Hazard ratio; 95% CI: 95% Confidence interval

Model 1: Adjusted for gender, age, living status, and socio-economic status.

Model 2: Model 1 additionally adjusted for previous history of psychiatric morbidity.

Sensitivity analyses

We will also perform the following sensitivity analyses:

- 1) The prospective association between workplace bullying and suicidal events with suicide attempt and death by suicide will be considered separately in the three different models.
- 2) The prospective association between workplace bullying and any suicidal behaviour stratified by age (≤ 30 ; ≥ 31), sex and socioeconomic status (middle/high vs. low).
- 3) The prospective association between workplace bullying and suicidal behaviour of any type (suicide attempt and death by suicide combined) adjusted for previous history of psychotropic drug prescription within the last year prior to participating in the survey. Previous history of psychotropic drug prescription will be included as a dichotomous variable (any previous prescription of antipsychotics [N05A], anxiolytics [N05B], anxiolytics, hypnotics and sedatives [N05C], antidepressants [N06A] or psychostimulants, agents used for ADHD and nootropics [N06B] vs. no previous prescriptions of any of these drugs).

Before conducting the analyses, we will check if the Cox proportional hazard assumption holds. In case this assumption is violated, the analytical models will be adjusted accordingly.

Statistical power

We have followed the 98,336 participants for an average of 7.3 years. During follow-up, we identified 167 suicide attempts and 41 deaths by suicide. A total of 10,260 participants (10%) reported workplace bullying. The statistical power was calculated using the Logrank Test based on the available information regarding the prevalence of workplace bullying and suicidal behaviour. The statistical power to detect the main effect is presented in Figure 1 as a function of the Hazard Ratios. We will have an 80% chance of detecting a hazard ratio of 1.67 for any suicidal behaviour (suicide attempt and death by suicide combined), a hazard ratio of 1.74 for suicide attempt, and a hazard ratio of 2.54 for death by suicide. Table 4 shows the statistical power for the sensitivity analysis examining the association between workplace bullying and any suicidal behaviour stratified by sex, age, and socioeconomic status. To our knowledge, there is no previous studies linking workplace bullying to actual suicidal behaviour, but a study of the association between workplace bullying and suicidal ideation found an odds ratio of 2.05 (Nielsen et al., 2015),F which indicates that the data available for this study are adequate to examine the prospective associations between workplace bullying and suicidal behaviour.

Figure 1. Statistical power for detecting a prospective association between workplace bullying and suicide attempt, death by suicide, and any suicidal behaviour (suicide attempt and death by suicide combined) as a function of the Hazard Ratios.

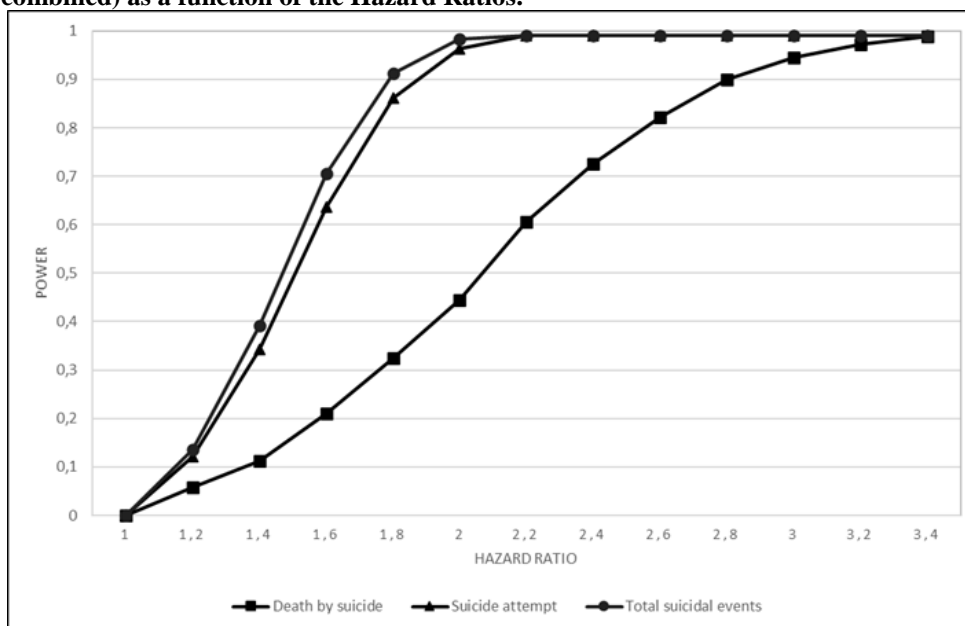


Table 4. Statistical power for detecting a prospective association between workplace bullying and any suicidal behaviour (suicide attempt and death by suicide combined) as a function of the Hazard Ratios in the sensitivity analyses stratified by sex, age, and socioeconomic status.

Sensitivity analysis	Group	Hazard Ratio required to obtain a power of 80%
Stratified by sex	Women	1.84
	Men	2.17
Stratified by age	30 or younger	2.70
	31 or older	1.74
Stratified by socioeconomic status	Middle/High	2.35
	Low	1.93

ETHICAL ISSUES

The study was approved by the Danish Data Protection Agency (RHP-2018-002 (I-Suite nr: 6134)). There is no actual personal contact and no intervention is carried out. The data is only be available in a pseudo-anonymized format for the researchers involved in the project and is kept at a secured researcher server at Statistics Denmark. All data analyses are conducted following the security regulations of Statistics Denmark.

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