

## Research paper

# Onset of workplace sexual harassment and subsequent depressive symptoms and incident depressive disorder in the Danish workforce



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## ABSTRACT

**Background:** We studied onset of workplace sexual harassment and subsequent risk of depressive symptoms and depressive disorder.

**Methods:** We examined 9,981 individuals who participated in the Work Environment and Health in Denmark survey in 2012 and 2014 and 6,647 individuals who also participated in 2016, all unexposed to sexual harassment in 2012. Depressive symptoms and disorder were assessed with the Major Depression Inventory. Using linear regression, we estimated the associations between onset of sexual harassment in the 12 months preceding the 2014 survey and depressive symptoms in 2014 and 2016, respectively. Using logistic regression, we estimated risk of incident depressive disorder in 2014.

**Results:** Onset of sexual harassment was associated with elevated depressive symptoms in 2014, both for harassment by non-workplace personnel (e.g., patients, estimate (B): 1.61, 95% CI: 0.51–2.72,  $p = 0.004$ ) and workplace personnel (e.g., supervisors, B: 3.85, 95% CI: 2.51–5.20,  $p < 0.001$ ), after adjustment for depressive symptoms in 2012. Harassment by workplace personnel was further associated with elevated depressive symptoms in 2016 after adjustment for symptoms in 2012, but not after adjustment for symptoms in 2014. Harassment by workplace personnel was associated with incident depressive disorder in 2014 (odds ratio: 5.26, 95% CI: 2.68–10.31,  $p < 0.001$ ).

**Limitations:** Depressive symptoms and disorder were assessed with a validated self-administered rating scale but not a clinical diagnostic interview. Participants reporting harassment in 2014 had elevated depressive symptoms already in 2012 requiring future investigation.

**Conclusions:** Exposure to sexual harassments at the workplace may be a contributing factor in the aetiology of depressive symptoms and disorder.

## 1. Introduction

Sexual harassment at work has become a topic of rapidly increasing interest, not least because of the #MeToo debate, where well-known individuals from the entertainment and professional sports industry and from politics were accused of sexual harassment (Choo et al., 2019; Freischlag and Faria, 2018; Mendes et al., 2018). While the debate showed a broad societal consensus that workplace sexual harassment is unacceptable and is thought to be psychological harmful for those exposed to sexual harassment (O'Neil et al., 2018), epidemiological

studies of high quality quantifying the impact of workplace sexual harassment on mental health outcomes are scarce (McDonald, 2012; O'Neil et al., 2018; Quick and McFadyen, 2017; Sojo et al., 2016; Spector et al., 2014; Willness et al., 2007).

Reviews of the literature have shown that the vast majority of studies examining the association of workplace sexual harassment and risk of mental ill-health have been cross-sectional in design, severely limiting any conclusion about the causal direction of the association (McDonald, 2012; Sojo et al., 2016; Spector et al., 2014; Willness et al., 2007). One of the few exceptions is a longitudinal study with 1775

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Norwegian employees, reporting a two-fold higher risk of psychological distress symptoms among women, but not among men, following exposure to sexual harassment in a two-year follow-up study (Nielsen and Einarsen, 2012). To the best of our knowledge, no longitudinal study has examined yet, whether workplace sexual harassment predicts elevated depressive symptoms or the incidence of a depressive disorder.

Although longitudinal studies have the obvious advantage over cross-sectional studies that they allow examining the temporal order in the association between the exposure to sexual harassment and subsequent mental health, they also face important challenges. In a longitudinal study, researchers usually would examine if sexual harassment at baseline predicts depressive symptom level at follow-up, after adjustment for baseline depressive symptom level. On the one hand, adjusting for baseline depressive symptom level is an appropriate approach, because baseline depressive symptom level may influence both the reporting of baseline sexual harassment and depressive symptom level at follow-up, causing spurious associations between baseline sexual harassment and depressive symptom level at follow-up. On the other hand, adjusting for baseline depressive symptom level would be inappropriate if the effect of sexual harassment on depressive symptoms is instantaneous, i.e. without any considerable latency period. In this case, baseline sexual harassment would influence baseline depressive symptom level and adjusting for baseline depressive symptom levels would be an adjustment for an earlier manifestation of the effect, leading to an underestimation of the association between baseline sexual harassment and depressive symptom level at follow-up.

To address the challenge that baseline depressive symptoms might be influenced by baseline sexual harassment, we constructed a cohort of workers where no one was exposed to sexual harassment at baseline. We then followed this cohort for two years and during this time some of the participants reported being exposed to sexual harassment. We then analysed both the association between the onset of exposure to sexual harassment and subsequent depressive symptoms and incident depressive disorder, while adjusting for participants' depressive symptoms at baseline, when they were unexposed.

We had previously reported cross-sectional results on sexual harassment and depressive symptoms in a subsample of our study population (Friborg et al., 2017). These results indicated that the strengths of the association between sexual harassment and mental health might depend on the type of the perpetrator (Friborg et al., 2017). Consequently, we distinguished in the present study between harassment by non-workplace personnel (customers, clients, students) and by workplace personnel (colleagues, supervisors, subordinates).

## 2. Methods

### 2.1. Study design and population

We used data from the Work Environment and Health in Denmark (WEHD) study, a bi-annual survey on working conditions and health established in 2012. We examined the association between onset of workplace sexual harassment and subsequent level of depressive symptoms and incident depressive disorder in the Danish workforce with measurements in 2012 (t1), 2014 (t2) and 2016 (t3). All participants were free of sexual harassment at t1 and the 12 months preceding t1. At t2, some participants reported the onset of at least one episode of sexual harassment during the last 12 months. Based on this information we constructed two cohorts. In **cohort I** (participants with measurements in 2012 and 2014) we analysed the association between onset of sexual harassment in the 12 months before t2 and depressive symptoms and disorder at t2 (short-term association). In **cohort II** (participants with measurements in 2012, 2014, and 2016) we analysed the association between onset of sexual harassment in the 12 months before t2 and depressive symptoms at t3 (long-term association). In both cohorts we adjusted the analyses for depressive symptom level at t1 when all participants were unexposed to sexual harassment. Fig. 1 illustrates the

two study designs.

Fig. 2 shows the flow-chart for inclusion into the study and constructing the two cohorts. A detailed description of the WEHD study design and recruitment process is published elsewhere (Johnsen et al., 2019). Briefly, in 2012, Statistics Denmark drew a nationwide sample of 35,039 employees, aged 18 to 64 years, of which 17,622 (50.3%) responded to the WEHD 2012 questionnaire (t1). We excluded respondents who were not in the workforce when they filled in the questionnaire ( $n = 950$ ), had missing values on key variables ( $n = 865$ ) or were exposed to sexual harassment at t1 ( $n = 412$ ), yielding a sample of 15,435 individuals. Of those, 9981 responded to the follow-up questionnaire in 2014 (t2), were at work at t2 and had no missing values on key variables. These individuals constituted cohort I for analysing the short-term association between onset of sexual harassment in the 12 months before t2 and level of depressive symptoms at t2. For analysing risk of incident depressive disorder at t2, we built a subsample of cohort I by excluding 972 individuals who at t1 had signs of a depressive disorder ( $n = 485$ ), reported treatment for a depressive disorder during the last year ( $n = 359$ ), or both ( $n = 128$ ), yielding a subsample of 9009 individuals who were free of a depressive disorder at baseline.

Of the 9981 participants of cohort I, 6647 filled in the WEHD 2016 survey (t3) with no missing values on key variables. These individuals constituted cohort II for analysing the long-term association between onset of sexual harassment in the 12 months before t2 and level of depressive symptoms at t3.

### 2.2. Assessment of workplace sexual harassment

Workplace sexual harassment was assessed with one question: "Have you been exposed to sexual harassment at your workplace during the last 12 months?", with the response options "yes, daily", "yes, weekly", "yes, monthly", "yes, rarely", "no, never". For the purpose of analysis, we collapsed all "yes" options together, generating a binary variable indicating presence or absence of sexual harassment.

Participants who selected one of the "yes" options were then asked "Who exposed you to sexual harassment?", with the response options "customer/client/patient/student/others" (non-workplace personnel), "colleague", "supervisor", or "subordinate" (workplace personnel).

We constructed three exposure groups according to exposure in 2014 (t2): Group 1 was not exposed to sexual harassment, Group 2 was exposed to sexual harassment by non-workplace personnel and Group 3 was exposed to sexual harassment by workplace personnel. If an individual was exposed to sexual harassment by both non-workplace personnel and workplace personnel then this individual was assigned to Group 3.

### 2.3. Measurement of depressive symptoms and disorder

We measured depressive symptoms and disorder by the Major Depression Inventory (MDI), a clinically validated self-administered rating scale (Bech et al., 2001, 2015; Olsen et al., 2003). The MDI consists of 12 items assessing the presence of depressive symptoms during the last two weeks in accordance with the ICD-10 symptom list of depression (Bech et al., 2001). Each item is responded on a scale ranging from 0 (the symptom has not been present at all) to 5 (the symptom has been present all of the time). Two pairs of items are combined (i.e. only the item with the higher score is included), yielding an MDI-score with a possible range of 0 to 50 points. We used this score for assessing the level of depressive symptoms in our study. As an indicator for the presence of a depressive disorder we used a MDI-score of  $\geq 21$  points as recommended in a recent validation study of the MDI (Bech et al., 2015).

In addition to the MDI, the survey included also a question whether the respondent was currently or in the last year in treatment for a depressive disorder, with the response options "yes" or "no". We used this

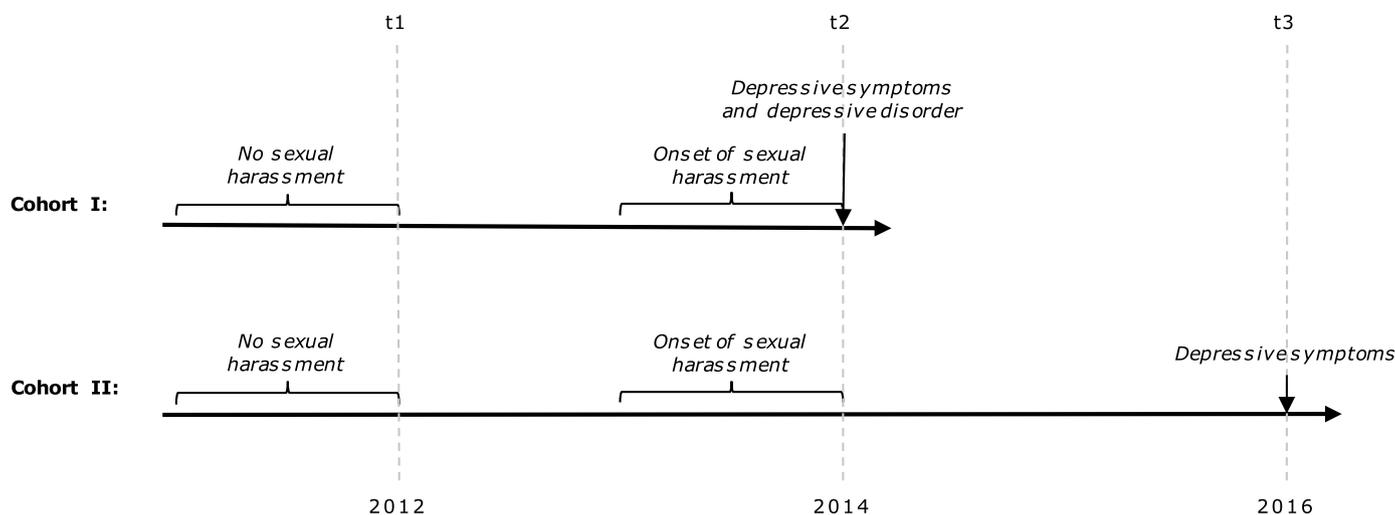


Fig. 1. Illustration of the design and measurement points of the two cohort studies.

response as further information for identifying a prevalent depressive disorder at baseline.

#### 2.4. Measurement of covariates

As covariates we included age (continuous, in years), sex, cohabitation (yes/no), education (“low” ( $\leq 10$  years of education), “medium-low” (10–12 years), “medium high” (13–15 years) and “high” ( $\geq 15$  years)), and occupational status (“senior manager”, “working in a job requiring high skill level”, “working in a job requiring intermediate skill level”, “working in occupation requiring basic skill level”, “other jobs/not classified”). All these covariates were derived from national registers maintained by Statistics Denmark, using the participants’ unique civil registration number (Pedersen, 2011). We further included a variable indicating the occupational sector, by using the codes of the Danish version of the EU’s nomenclature (NACE, Statistical classification of economic activities in the European Community) from Statistics Denmark (Torma et al., 2007). We used “the standard industrial grouping for publishing purposes” that aggregates the 726 possible industries into 10 groups (Torma et al., 2007).

#### 2.5. Statistical analysis

Using linear regression and logistic regression, respectively, we compared the level of depressive symptoms and the proportion of individuals with incident depressive disorder at follow-up in the two exposed groups (onset of sexual harassment by non-workplace personnel; onset of sexual harassment by workplace personnel) to the level and proportion in the reference group (no onset of sexual harassment).

In cohort I, we compared levels of depressive symptom scores at t2 in the three groups, yielding estimates for the mean differences with 95% confidence intervals (CI) for the short-term association between onset of exposure to sexual harassment during the last 12 months before t2 and level of depressive symptoms at t2.

In the subsample of cohort I that was free of a depressive disorder at t1, we compared the proportion of individuals with incident depressive disorder at t2 in the three groups, yielding odds ratios (OR) with 95% CI for the short-term association between onset of sexual harassment during the last 12 months before t2 and risk of incident depressive disorder at t2.

All estimates from cohort I were adjusted for age, sex, cohabitation, education, occupational status, occupational sector and depressive symptom level at t1.

In cohort II, we compared levels of depressive symptom scores at t3 in the three groups, yielding estimates for the mean differences with

95% CI for the long-term association between onset of sexual harassment during the last 12 months before t2 and level of depressive symptoms at t3. In model 1, estimates were adjusted for age, sex, cohabitation, education, occupational status, occupational sector, depressive symptom level at t1 and treatment for a depressive disorder at t1. In model 2, estimates were further adjusted for depressive symptom level at t2 and treatment for a depressive disorder at t2. Because some individuals who were free of sexual harassment at t2 became exposed to harassment in the 12 months before t3, we conducted an additional analyses of cohort II, in which we excluded those newly exposed participants.

### 3. Results

Table 1 shows the characteristics of the participants of the two cohorts. Mean age was 46 years in cohort I and 47 years in cohort II. Women and men were almost equally represented in the study (53% women in both cohorts). Most participants worked in public administration, education and health (41 and 42% in cohort I and II, respectively), followed by trade and transport (17% in both cohorts).

Onset of sexual harassment in the 12 months before t2 was reported by 175 participants in cohort I (1.75%) and 103 individuals in cohort II (1.55%). The majority of the participants reported that the exposure was “rarely” (146 out of 175 (83.43%) and 87 out of 103 (84.47%) in cohorts I and II, respectively). The perpetrator came more often from non-workplace personnel than from workplace personnel (105 out of 175 (60.00%) and 67 out of 103 cases (65.05%) in cohorts I and II respectively).

Women reported more sexual harassment than men. In cohort I, harassment from non-workplace personnel was reported by 1.80% of women (95 out of 5281) and 0.21% of men (10 out of 4700). Harassment from workplace personnel was reported by 0.78% of women (41 out of 5281) and 0.62% of men (29 out of 4700). In cohort II, harassment from non-workplace personnel was reported by 1.69% of women (60 out of 3543) and 0.23% of men (7 out of 3104). Harassment from workplace personnel was reported by 0.73% of women (26 out of 3543) and 0.32% of men (10 out of 3104).

#### 3.1. Onset of sexual harassment in the 12 months before t2 and depressive symptoms at t2 (short-term association)

Fig. 3 shows changes in depressive symptom levels from t1 to t2 in the three groups from cohort I. Groups 2 and 3 consisting of participants who later became exposed to sexual harassment had already at t1 higher depressive symptom levels than the reference group that not

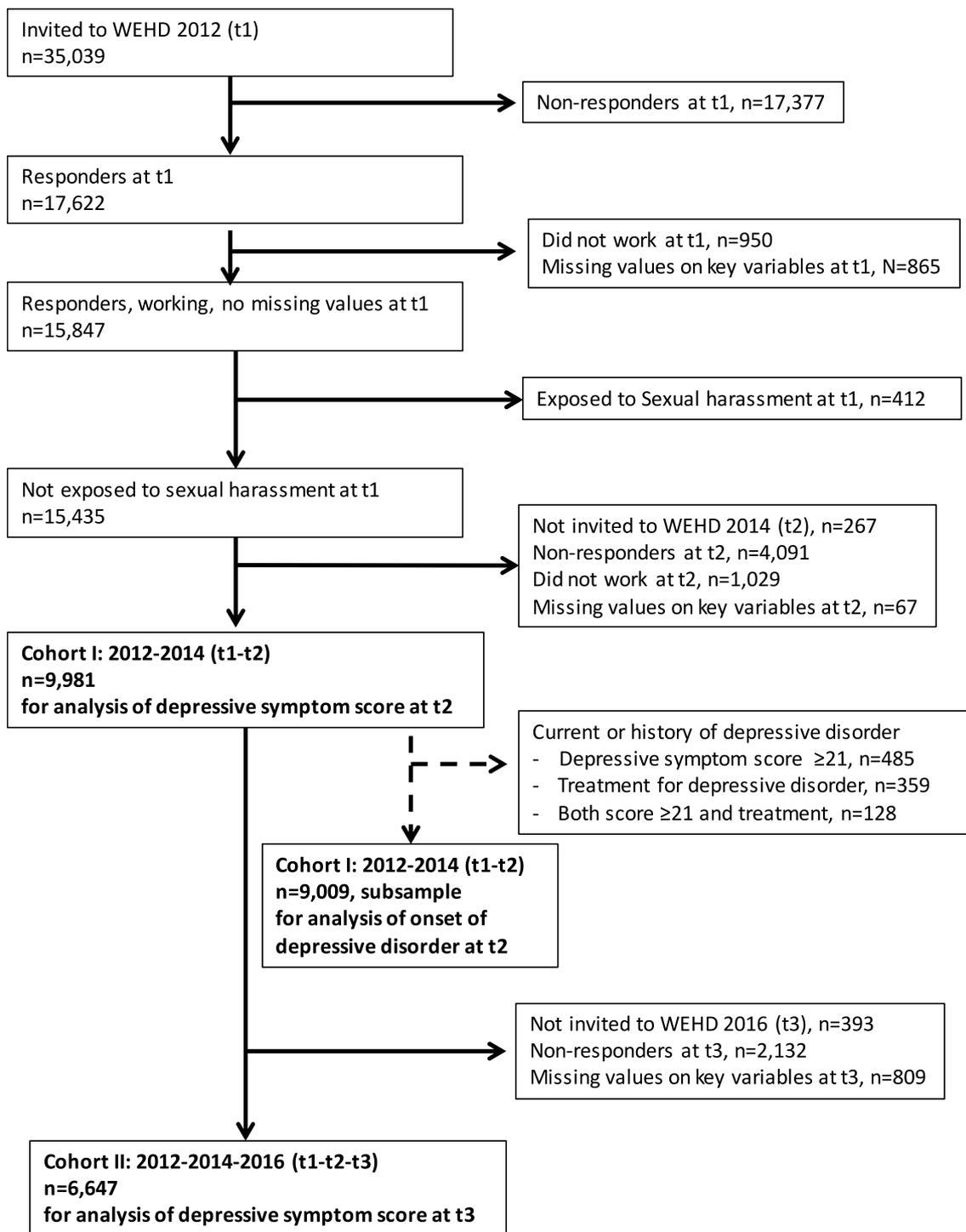


Fig. 2. Flow-chart of the construction of cohort I and cohort II.

became exposed.

From t1 to t2, depressive symptom levels remained stable among those who remained unexposed to sexual harassment (Group 1, change of  $-0.07$  points) and increased among those who became exposed to sexual harassment by non-workplace personnel (Group 2,  $+0.94$  points) and workplace personnel (Group 3,  $+2.49$  points). Consequently, at t2, depressive symptom levels were statistically significantly higher among participants exposed to sexual harassment by both non-workplace personnel (Group 2, mean: 11.17, SD: 7.98, estimate (B): 1.61, 95% CI: 0.51 to 2.72,  $p = 0.004$ ) and workplace personnel (Group 3, mean: 14.49, SD: 9.97, B: 3.85, 95% CI: 2.51 to 5.20,

$p < 0.001$ ) compared to participants that were not exposed (Group 1, mean: 7.64, SD: 7.25) after adjustment for all covariates, including depressive symptom level at t1.

When we stratified the analyses by sex, there was no clear indication that the short-term association between sexual harassment and depressive symptoms may be different for women and men (see e-Table 1, Online appendix).

**Table 1**  
Characteristics of the two cohorts in 2014.

	Cohort I (2012–2014) N = 9981	Cohort II (2012–2014–2016) N = 6647
<b>Age, mean (SD)</b>	46.26 (10.23)	46.69 (9.38)
<b>Sex</b>		
Women, n (%)	5281 (52.91)	3543 (53.30)
Men, n (%)	4700 (47.09)	3104 (46.70)
<b>Cohabitation</b>		
Yes, n (%)	7985 (80.00)	5414 (81.45)
<b>Education</b>		
High, n (%)	1375 (13.78)	937 (14.10)
Medium high, n (%)	3196 (32.02)	2170 (32.65)
Medium low, n (%)	4225 (42.33)	2792 (42.00)
Low, n (%)	1134 (11.36)	721 (10.85)
Not known, n (%)	51 (0.51)	27 (0.41)
<b>Occupational Status</b>		
Senior manager, n (%)	483 (4.84)	301 (4.53)
Job requiring high skill level, n (%)	2312 (23.16)	1587 (23.88)
Job requiring intermediate skill level, n (%)	2458 (24.63)	1704 (25.64)
Job requiring basic skill level, n (%)	3078 (30.84)	2018 (30.36)
Other/not classified, n (%)	1650 (16.53)	1037 (15.60)
<b>Occupational Sector</b>		
Agriculture, forestry and fishing, n (%)	100 (1.00)	67 (1.01)
Manufacturing, mining, quarrying, utility services, n (%)	1369 (13.72)	918 (13.81)
Construction, n (%)	368 (3.69)	229 (3.45)
Trade and transport, n (%)	1718 (17.21)	1128 (16.97)
Information and communication, n (%)	379 (3.80)	260 (3.91)
Financial and insurance, n (%)	406 (4.07)	261 (3.93)
Real estate, n (%)	160 (1.60)	98 (1.47)
Other business services, n (%)	953 (9.55)	629 (9.46)
Public administration, education and health, n (%)	4124 (41.32)	2771 (41.69)
Arts, entertainment, other services, n (%)	404 (4.05)	286 (4.30)
<b>Sexual harassment</b>		
Never, n (%)	9806 (98.25)	6544 (98.45)
Rarely, n (%)	146 (1.46)	87 (1.31)
Monthly or more often, n (%)	29 (0.29)	16 (0.24)
<b>Perpetrator for sexual harassment</b>		
Group 1: No harassment	9806 (98.25)	6544 (98.45)
Group 2: Harassment by non-workplace personnel, n (%) (Client, Customer, Patient, Student)	105 (1.05)	67 (1.01)
Group 3: Harassment by workplace personnel, n (%) (Colleague, Supervisor, Subordinate)	70 (0.70)	36 (0.54)

### 3.2. Onset of sexual harassment in the 12 months before t2 and incident depressive disorder at t2 (short-term association)

Of the 9009 participants who were free of a depressive disorder in 2012, 355 (3.9%) were classified with a depressive disorder in 2014. The incidence rate of depressive disorder was 3.8%, 9.8% and 25.0% in Groups 1, 2 and 3, respectively. Table 2 shows the odds ratios and 95% CI for the association between onset of sexual harassment and incident depressive disorder. Compared to the reference group with no exposure to sexual harassment (Group 1), the odds ratio for incident depressive disorder was 1.92 (95% CI: 0.88 to 4.19,  $p = 0.10$ ) among participants exposed to sexual harassment by non-workplace personnel (Group 2), and 5.26 (95% CI: 2.68 to 10.31,  $p < 0.001$ ) among participants exposed to sexual harassment by workplace personnel (Group 3) after adjustment for all covariates, including depressive symptom level at t1.

### 3.3. Onset of sexual harassment in the 12 months before t2 and depressive symptoms at t3 (long-term association)

Fig. 4 shows changes in depressive symptom levels from t1 to t2 to t3 for the three groups from cohort II. As in cohort I, also cohort II participants who later became exposed to sexual harassment (Group 2 and 3) had already at t1 higher depressive symptom levels than participants who not later became exposed (Group 1).

From t1 to t3, depressive symptom levels remained stable in the non-exposed group (Group 1, +0.04 points) and increased for participants who became exposed to sexual harassment by non-workplace personnel (Group 2, +0.24 points) and workplace personnel (Group 3, +1.80 points). At t3, depressive symptom levels were statistically

significantly higher among participants exposed to sexual harassment by workplace personnel (Group 3, mean: 12.22, SD: 9.92, B: 2.54, 95% CI: 0.62 to 4.46,  $p = 0.01$ ) compared to participants that were not exposed (Group 1, mean: 7.64, SD: 7.25) after adjustment for covariates, including depressive symptom level at t1 and treatment for depressive disorder at t1 (model 1). After further adjustment for depressive symptom level at t2 and treatment for a depressive disorder at t2, the estimate attenuated and statistical significance was lost (model 2,  $p = 0.22$ ). Group 2 did not differ statistically significantly in depressive symptom levels at t3 from Group 1, neither in the analyses in model 1 ( $p = 0.29$ ) nor in model 2 ( $p = 0.93$ ).

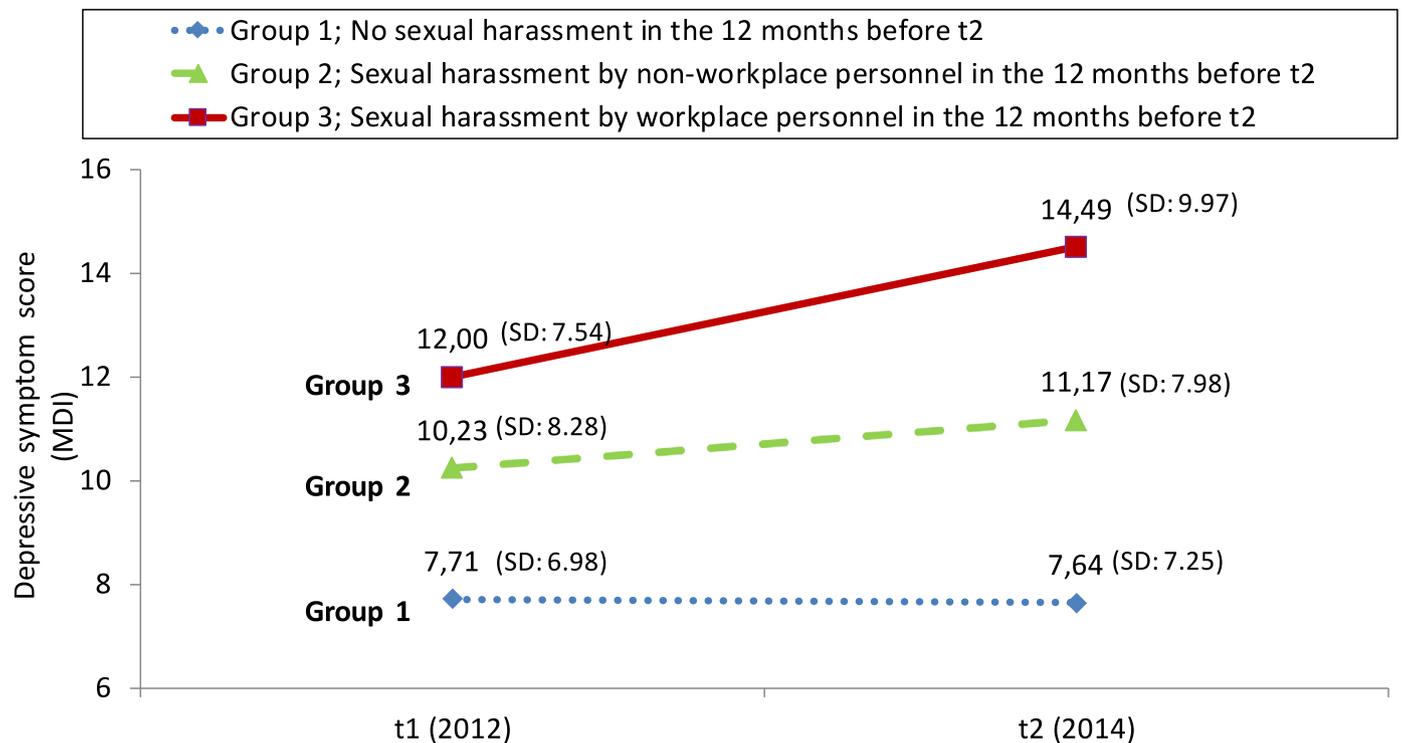
When we stratified the analyses by sex, there was no clear indication that the long-term association between sexual harassment and depressive symptoms may be different for women and men (see e-Table 2, Online appendix).

When we excluded participants, who were not exposed to sexual harassment in the 12 months preceding t2 (Group 1) but became exposed in the 12 months preceding t3, results were similar to the main analyses (data available upon request).

## 4. Discussion

### 4.1. Interpretation of the results

The results of this study of the Danish workforce show that onset of workplace sexual harassment, particularly from workplace personnel, was associated with elevated depressive symptoms and risk of incident depressive disorder. Particularly striking was the five-fold higher risk of incident depressive disorder among participants exposed to onset of



	Crude		Adjusted	
	Est.	(95% CI)	Est.	(95% CI)
Group 1; No sexual harassment (n=9,806)	Ref.		Ref.	
Group 2; Sexual harassment by non-workplace personnel (n=105)	3.53	(2.13 to 4.93)***	1.61	(0.51 to 2.72)**
Group 3; Sexual harassment by workplace personnel (n=70)	6.85	(5.14 to 8.56)***	3.85	(2.51 to 5.20)***

Linear regression analysis. Estimates are adjusted for age, sex, cohabitation, education, occupational status, occupational sector, depressive symptom level at t1 and self-reported treatment for depressive disorder at t1; \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Fig. 3. Short-term association between onset of sexual harassment in the 12 months before t2 and depressive symptom level at t2 among 9981 women and men who were not exposed to sexual harassment at t1.

sexual harassment by workplace personnel compared to those who remained unexposed, after adjustment for baseline depressive symptom level (short-term association analysis).

That the association between sexual harassment and depressive symptoms and disorder was stronger when the harassment came from workplace personnel, such as a colleague or supervisor, and weaker when harassment came from non-workplace personnel, such as a customer, client or patient, is in agreement with results from an earlier cross-sectional analysis conducted in a subsample of our study population (Friborg et al., 2017). Sexual harassment by colleagues or supervisors may be experienced as particularly adverse as it is often necessary to collaborate with the perpetrator on a daily basis, which may be emotionally taxing. Further, revealing the sexual harassment at the

workplace may sometimes negatively change the social relations to other colleagues and supervisors, which could be a further source of emotional strain.

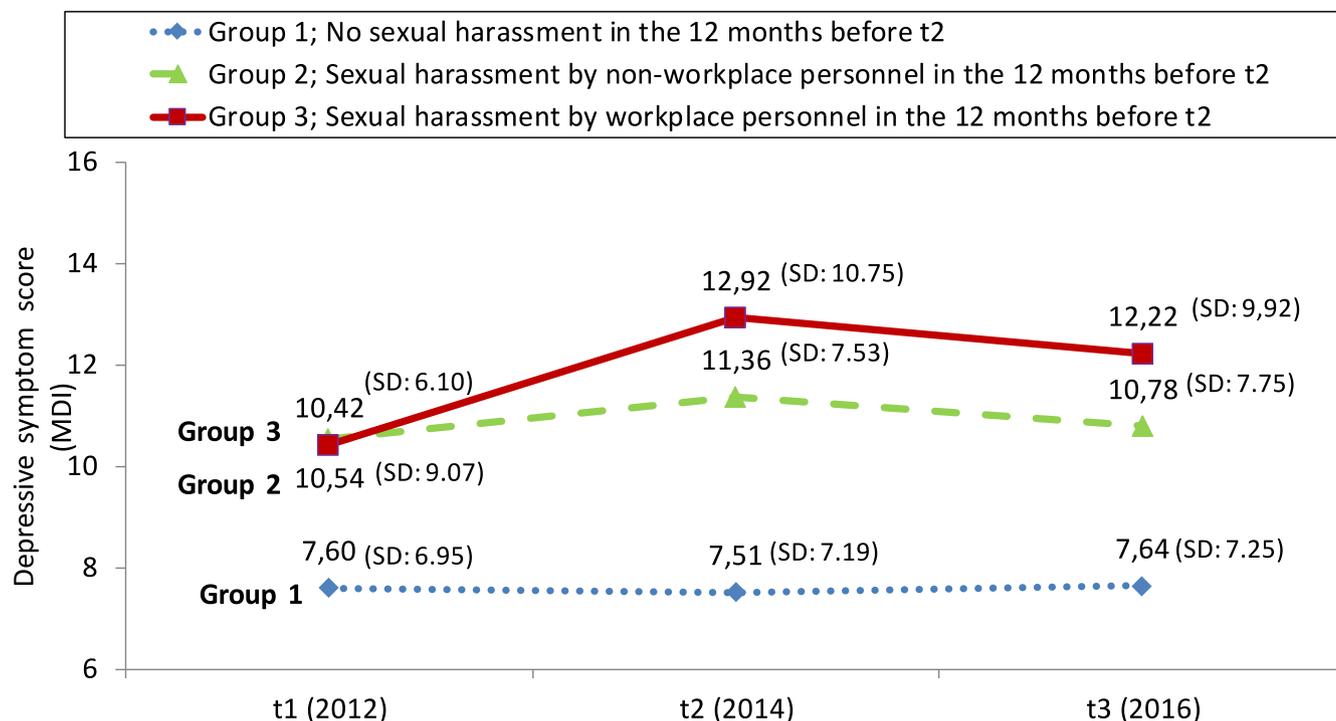
Sexual harassment by non-workplace personnel often includes harassment by individuals who may not be responsible for their behavior, such as eldercare home residents with dementia or institutionalized individuals with severe mental health conditions (Nielsen et al., 2017). A recent qualitative interview study showed that care workers often consider handling sexual harassment by patients and clients as a mark of professionalism (Nielsen et al., 2017). Further, at workplaces with a relatively high prevalence of sexual harassment by non-workplace personnel, employees might get habituated to the exposure to a certain extent, and those employees who find it difficult to get habituated

Table 2

Short-term association between onset of sexual harassment in the 12 months before t2 and risk of incident depressive disorder at t2 among 9009 women and men who were at t1 both free of a depressive disorder and not exposed to sexual harassment.

	N	Cases (%)	Crude OR (95%CI)	Adjusted OR (95%CI)
Group 1; No sexual harassment	8871	333 (3.75%)	1 Reference	1 Reference
Group 2; Sexual harassment by non-workplace personnel	82	8 (9.76%)	2.77 (1.33–5.80)	1.92 (0.88–4.19)
Group 3; Sexual harassment by workplace personnel	56	14 (25.00%)	8.55 (4.62–15.80)	5.26 (2.68–10.31)

Logistic regression analysis. Estimates are adjusted for age, sex, cohabitation, education, occupational status, occupational sector and, depressive symptom score at t1. Individuals with indications of depressive disorder at t1 (either MDI-score ≥21 or self-reported treatment of depressive disorder at t1 or the year before t1) were excluded.



	Crude	Model 1	Model 2
	Est.	Est.	Est.
	(95% CI)	(95% CI)	(95% CI)
Group 1; No sexual harassment (n=6,544)	Ref.	Ref.	Ref.
Group 2; Sexual harassment by non-workplace personnel (n=67)	3.14	0.76	0.05
	(1.39 to 4.89)***	(-0.65 to 2.18)	(-1.22 to 1.33)
Group 3; Sexual harassment by workplace personnel (n=36)	4.58	2.54	1.08
	(2.20 to 6.96)***	(0.62 to 4.46)**	(-0.66 to 2.81)

Linear regression analysis. Estimates in model 1 are adjusted for age, sex, cohabitation, education, occupational status, occupational sector; depressive symptom level at t1, and self-reported treatment for depressive disorder at t1. Estimates in model 2 are further adjusted for depressive symptom level at t2 and self-reported treatment for depressive disorder at t2; \*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Fig. 4. Long-term association between onset of sexual harassment in the 12 months before t2 and depressive symptom level at t3 among 6647 women and men who were not exposed to sexual harassment at t1.

might not last long at the workplace and in the profession (Nielsen et al., 2017). That all said, it is important to note that although the association of sexual harassment with depressive symptoms was weaker for harassment by non-workplace personnel than by workplace personnel, also harassment by non-workplace personnel predicted an elevated level of depressive symptoms that was statistically significant. Thus, sexual harassment by non-workplace personnel is by no mean harmless, but it is likely qualitatively different and maybe harmful to a lesser extent compared to sexual harassment by workplace personnel.

We adjusted all estimates for depressive symptoms in 2012 (t1) when all participants were unexposed to sexual harassment. Exposure to sexual harassment between 2012 and 2014 was assessed in 2014 (t2) by asking participants if they had been exposed to sexual harassment during the last 12 months. Thus, our analyses showed the association between a relatively recent onset of exposure to sexual harassment and subsequent depressive symptoms and disorder, while adjusting for depressive symptom level before onset of exposure. We believe that this approach, adjusting for baseline depressive symptom level before the onset of exposure had occurred, is superior to a traditional longitudinal design that would have adjusted for baseline depressive symptoms measured concurrently with the measurement of exposure, as it is plausible that in the traditional design the baseline depressive symptoms already had been impacted by the prevalent exposure.

A disadvantage of our approach, though, is that we asked the participants to recall the occurrence of sexual harassment during the last 12 months at the same time in 2014 when we also assessed depressive

symptoms and disorder. We cannot rule out that an unknown number of study participants developed elevated depressive symptoms from 2012 to 2014 for other reasons than onset of workplace sexual harassment and that these elevated depressive symptoms in 2014 had led them to overestimate exposure to sexual harassment during the last 12 months.

We followed participants further until 2016 (t3), analyzing the association between onset of sexual harassment in the 12 months before 2014 (t2) with depressive symptoms in 2016 (t3). For participants reporting harassment by workplace personnel, we still found an association between harassment and depressive symptoms in 2016 (t3) after adjustment for depressive symptoms in 2012 (t1). However, the association, was attenuated and lost statistical significance after adjustment for depressive symptoms in 2014 (t2). This was unsurprising, as we had expected that the impact of exposure to sexual harassment in the 12 months preceding the 2014 (t2) survey on depressive symptoms would be mainly seen in higher depressive symptoms in 2014 (t2) and that a further increase in depressive symptoms from 2014 (t2) to 2016 (t3) was unlikely.

An unexpected result of our study was that individuals who reported onset of sexual harassment in the 2014 survey, already in 2012, when they were unexposed, had higher depressive symptom levels compared to participants who were unexposed in both 2012 and 2014. Different explanations for this result are conceivable. First, individuals with elevated depressive symptoms may, for reasons unknown, be at higher risk for becoming exposed to sexual harassment, suggesting that the association between sexual harassment and depressive may be bi-

directional. Second, elevated depressive symptoms may make individuals more likely to perceive certain behaviors as sexual harassment. Third, some individuals may have been exposed to sexual harassment in the more distant past, i.e. longer than the 12 months before t1 that we assessed with our questionnaire and this history of previous sexual harassment may have influenced both the level of depressive symptoms at t1 and the risk of onset of sexual harassment at t2. Fourth, specific adverse working conditions, e.g., conflicts at work or poor social relations among employees and between employees and management, may contribute to a higher risk of both onset of sexual harassment and elevated depressive symptoms. These potential explanations are important topics to be examined in future studies. For the present study, it was key that we had the data on depressive symptoms in 2012 (t1) available, and that we therefore were able to adjust all analyses for depressive symptoms prior onset of exposure.

#### 4.2. Comparison with earlier studies

To the best of our knowledge, our study is the first one that examined the longitudinal association between onset of workplace sexual harassment and risk of elevated depressive symptoms and disorder. Further, we believe that our study is also the first to examine sexual harassment and depressive symptoms and disorder in a large cross-occupational sample of a national workforce, with repeated measurements of both exposures and outcomes.

Cross-sectional associations between sexual harassment and symptoms of mental-ill health and reduced psychological well-being have been documented in several previous studies (McDonald, 2012; Sojo et al., 2016). Recently, a cross-sectional study showed a dose-response association between frequency of sexual harassment and prevalent depressive disorder among US and Canada based flight attendants (Gale et al., 2019).

Longitudinally, Nielsen and Einarsen (2012) reported in a Norwegian study, that women exposed to sexual harassment had a two-fold higher risk of psychological distress, measured with the Hopkins Symptoms Checklist-25 (HSCL-25) a screening instrument for common psychiatric problems, including but not limited to depressive symptoms (Nettelbladt et al., 1993). Thus, the outcome was broader and less specific than the outcome in our study. Nielsen and Einarsen used a more comprehensive assessment of sexual harassment than the present study, applying the 11 item Bergen Sexual Harassment scale (Nielsen et al., 2010), whereas our measurement of sexual harassment was limited to a single item.

#### 4.3. Strengths and limitations

Strengths of the study include the longitudinal design, the large study population comprising a wide range of occupations in the Danish workforce, and the measurement of depressive symptoms and disorder with a clinically validated rating scale. To our knowledge, this is the first cohort study demonstrating an association between onset of exposure to workplace sexual harassment and subsequent risk of elevated depressive symptoms and incident depressive disorder.

Several important limitations should be noted. First, we measured sexual harassment with a single global item, which might have caused an underestimation of the prevalence of sexual harassment. Using a scale providing specific examples of sexual harassment e.g., about unwanted touching or verbal sexual suggestions, might have resulted in the reporting of higher number of events of harassment, particularly of events that may have been regarded by the study participants as less severe (Nielsen et al., 2010).

Second, we measured depressive disorder with the MDI, an instrument that has previously been validated in clinical studies (Bech et al., 2001, 2015; Olsen et al., 2003). The strong association between onset of sexual harassment and a five-fold higher risk of incident depressive disorder is an important result of this study, as it indicates that sexual

harassment not only affects individuals' well-being but may also contribute to the development of a clinical disorder. However, caution is needed in the interpretation of the result, as the gold standard measure for assessing a depressive disorder in research studies is a clinical diagnostic interview, which was not available in this large population-based study. The MDI is focused on the frequency and duration of symptoms of clinical depression, but, unlike a clinical diagnostic interview, does not assess impairment in different areas of living. Therefore, the results on incident depressive disorder need to be replicated in further clinical studies.

Third, individuals who later experienced onset of sexual harassment had already at baseline higher levels of depressive symptoms than individuals who later did not experience sexual harassment. As we adjusted all estimates for baseline depressive symptoms, our results were not biased by this unexpected finding. However, as described in detail above, further research on explanations for this finding is needed.

Fourth, as delineated in the section "interpretation of the results", we measured onset of exposure to sexual harassment during the last 12 months retrospectively in the 2014 (t2) survey and we cannot rule out that elevated depressive symptoms in 2014 that had other reasons than exposure to sexual harassment, may have led participants to overestimate the occurrence of harassment. We attempted to mitigate this potential bias by adjusting for depressive symptoms in 2012 (t1).

Fifth, although we analyzed data of almost 10,000 individuals with two measures (cohort I) and more than 6600 individuals with three measures (cohort II), the study sample was still not large enough for performing a number of desirable subgroup analyses, as both onset of exposure to sexual harassment and incident depressive disorder was rare. For example, we could not analyze whether the frequency of the harassment or the status of the perpetrator within the group of workplace personnel (colleague, supervisor or subordinate) were related to the subsequent level of depressive symptoms and risk of depressive disorder. When further waves of WEHD with more study participants become available in the future, we may be able to perform some of these subgroup analyses.

Sixth, because of the low number of individuals with onset of sexual harassment, the results from the sex-stratified analyses need to be viewed with caution. In these subgroup analyses, the exposure groups were small, particularly among men, and although we did not find evidence for that pattern of associations were different for women and for men, we cannot rule out that such different patterns may have emerged in a larger study sample.

## 5. Conclusion

Onset of workplace sexual harassment is associated with elevated depressive symptoms and higher risk of incident depressive disorder in the Danish workforce. A particularly strong association was found for the association of onset of sexual harassment from workplace personal and incident depressive disorder, with an odds ratio of more than five. Workplace sexual harassment may be a potential contributing factor in the aetiology of depressive symptoms and disorder.

### Declaration of Competing Interest

All authors declare no conflict of interest.

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## Author Contributions

RR and IEHM conceived the study. RR, IEHM and KS designed the analyses. KS conducted the data analysis and JKS assisted in conducting the data analysis. All authors interpreted the data and discussed the results. RR wrote the first draft of the manuscript and all authors revised the draft critically for important intellectual content. All authors read and approved the final version for submission.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2020.06.058.

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