Associations between work stress and suicidal ideation: Individual-participant data from six cross-sectional studies

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ABSTRACT

Objective: Epidemiological evidence suggests that work stress is associated with suicidal ideation (SI). However, only few studies in this area have drawn on well-established theoretical work stress models (i.e., the job-demand-control [JDC] model, the effort-reward-imbalance [ERI] model, and the model of organizational injustice [OJ]). Utilization of such models allows though for theory-based assessments and workplace interventions. Since evidence on those models' relationship with suicide-related outcomes is currently inconclusive (with regard to JDC), markedly sparse (OJ) or lacking (ERI), we aimed to provide additional or initial evidence.
Methods: We drew on original data from six cross-sectional studies, which were conducted in four countries (i.e., South Korea, China, Australia, and Germany). Work stress was measured by established questionnaires and was categorized into tertiles. In each study, SI was assessed by either one or two items taken from validated scales. Associations of work stress with SI were estimated for each study and were pooled across studies using multivariate random-effects logistic modeling.
Results: In the pooled analyses ($n = 12,422$) all three work stress models were significantly associated with SI with odds ratios fluctuating around 2. For instance, the pooled odds ratios for highest versus lowest work stress exposure in terms of job strain, OJ, and ERI equalled 1.91 (95% confidence interval [CI] = 1.52, 2.41), 1.98 (95% CI = 1.48, 2.65), and 2.77 (95% CI = 1.57, 4.88), respectively. Patterns of associations were largely consistent across the individual studies.
Conclusion: Our study provides robust evidence of a positive association between work stress and SI.

1. Introduction

Suicidal ideation (SI) at some point in life is common in the general population [1] and is a strong risk factor of subsequent suicide attempts [2]. It has been suggested that most risk factors for suicide attempts (e.g. female gender or low educational levels) exert their predictive properties because they are associated with an increased risk of SI [3]. Insights into the determinants of SI are thus of utmost interest to develop effective measures aiming at its prevention and to thereby enable early prevention of suicide attempts. Research has suggested that one important set of risk factors for SI relates to potential or actual unemployment and the associated distress [4–7]. However, the risk of suicide-related outcomes is not only elevated in individuals facing unemployment, but possibly also among those in active employment, in particular when exposed to work stress [8–16].

With regard to the measurement of work stress, research has made significant strides with the development of conceptual models. Among the best-established and most widely utilized models are the job-demand-control model (JDC), the effort-reward-imbalance model (ERI), and the model of organizational justice (OJ) [17–21]. These three models are generally considered to be complementary and thus each emphasize different work characteristics that may be experienced as stressful. Briefly, the JDC model mainly focuses on task characteristics proposing that work stress (termed "job strain") stems from simultaneous exposure to high demands (e.g., high work load) and low job control (e.g., high pace, low variety of tasks, low decision latitude). The ERI model, by contrast, adopts a more sociological view building on the key

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notion that failed reciprocity in employment relationships induces stress. Specifically, the ERI model's posits that work stress results from high work-related efforts which exceed the received rewards (i.e. salary, recognition, job security and promotion prospects) [22]. Finally, OJ emphasizes the role of fairness perceptions related to the distribution of resources (i.e. distributive justice), to decision-making processes in the organization (i.e. procedural justice), and to social interactions for instance with supervisors (i.e. interactional justice) [20,21]. Utilization of the three above-mentioned well-established conceptual work stress models allows for theory-based assessments and interventions in the workplace. In addition, those models are generic rather than profession-specific and may thus be applied across working populations from various occupational sectors. Numerous prospective studies have demonstrated that the work stress conceptualizations provided by those three models are powerful and consistent predictors of adverse health outcomes [17], including psychiatric outcomes such as depression [23–26]. Given that (untreated) mood disorders represent a key risk factor for SI and suicide-related behavior [2,27], it seems plausible that ERI, JDC and OJ are predictive of SI.

The potential links between work stress and suicide-related outcomes have been examined in a number of studies [8–14,28]. Evidence based on the three dominant work stress models remains however sparse or is lacking: to our knowledge, no study has yet examined the ERI model as a determinant of SI. With regard to OJ, one small-scale survey had been conducted among Finnish anesthesiologists ($n = 328$) suggesting that low OJ is closely associated with more frequent reports of suicide-related thoughts, plans, or attempts [12]. Thus, evidence for OJ is limited and additional data is needed to examine the generalizability of findings from that single prior study to other countries or other professional groups (i.e. groups with less pronounced stress exposure than anesthesiologists). Finally, the JDC model has not yet been examined as a determinant of SI. Three epidemiological studies have however addressed JDC as a predictor of completed suicide [13,14,29]. Notably, those studies, which were conducted in Germany [29], Canada [13] and Japan [14], yielded largely conflicting findings: in the German study, job strain was not associated with suicide mortality [29]. By contrast, the Japanese study suggested that elevated suicide rates were predicted by low job control, but not by job demands [14]. The study from Canada did not confirm a potential link between job control and suicide; however, *low* demands were found to be related to elevated odds of completed suicide [13]. The latter finding is not only in disagreement with the observation from the other two prior studies, but also with key assumptions of the JDC model (i.e. postulating that *high* demands contribute to poor health). Synthesizing their findings with other evidence [9], the authors of the Canadian study hypothesized that exposure to both high and low levels of demands may contribute to suicide when compared to intermediate levels [13]. At present, it appears thus unclear whether work stress according to the JDC model is associated with suicide-related outcomes, including which specific JDC components may operate as main determinants (i.e. demands, control, or both) and what shape their association with suicide outcomes may take (i.e. linear or U-shaped). To sum up, evidence on the potential relationship of the three most widely used and best-established work stress models with suicide-related outcomes is currently inconclusive (JDC), markedly sparse (OJ) or lacking (ERI). We therefore aimed to quantify those associations based on data from multiple epidemiological studies.

2. Methods

2.1. Study populations

Initiated by the PI, we drew on our professional networks to identify epidemiological studies that a) contained the data required to address the research aim and b) have not yet published findings on the potential work stress-SI association. We consistently requested original data and did so without prior knowledge of the statistical results. Also, we

included all the data we were able to obtain to avoid publication bias. The transferred data were de facto anonymized (that is, free of variables or files that would have made participants identifiable to the analyst). Overall, we obtained original individual-level data from six cross-sectional studies which were conducted in four countries (see Table 1). Study 1 had been carried out in 2005 in Seoul, South Korea among workers from a large metro company ($n = 6051$). Study 2 had been conducted in 2009 among industrial blue-collar workers in Jinan, China, contributing data from 824 textile factory workers. Study 3, completed in 2013, included hospital nurses in Urumqi, China ($n = 498$). Study 4 was carried out from 2009 to 2011 and represents a nationally representative survey of the Australian working population ($n = 3923$). Study 5 had been conducted in 2007 among workers in an airplane manufacturing company in southwest Germany ($n = 721$). Study 6, carried out in 2014, included young hospital physicians from Munich, Germany ($n = 405$). Additional details on the studies are available in a supplementary online file. All studies adhered to the Declaration of Helsinki and have received ethical approval from their respective local Institutional Review Board. All participants provided written consent.

2.2. Questionnaires

With regard to the JDC model, the original Job Content Questionnaire [30] was applied in Study 1, 4, and 5 to assess demands (5 items) and control (9 items). In Study 6, a proxy questionnaire (Work Analysis Instrument) was validated and used to measure demands (4 items) and control (7 items) [31]. The ratio between demand and control was used to define job strain. The ERI model was operationalized by the original effort-reward imbalance questionnaire [18] in Study 2, 5, and 6 measuring effort by 6 items and reward by 11 items. In Study 3, a shortened validated ERI questionnaire (3 items for effort and 7 items for reward) was applied [32]. The ratio between effort and reward was calculated and weighted by the number of items to quantify effort-reward imbalance. A validated OJ questionnaire with 7 items for procedural justice and 4 items for interactional justice was used Study 5 and 6 [33]. A sum score of procedural justice and interactional justice was used to represent overall organizational justice. The work stress scales showed good internal consistency (see Table 1).

Table 2 provides a summary of the measurement of SI and its operationalization across the included studies. Overall, SI was measured by either one or two items generally taken from well-established questionnaires assessing mental health. In addition, information on age, gender, marital status, and socioeconomic status was collected in each study. We defined socioeconomic status based on educational levels in the Study 1, 2, 4, and 5. In Study 3 and 6, which were conducted in health care staff, socioeconomic status was defined according to reports of having a leadership position because the health care workers in each study (nurses or physicians, respectively) had homogenous education background. We categorized socioeconomic status into low vs high.

2.3. Data analysis

Logistic regression was applied to quantify associations between work stress and SI for each study, adjusting for age, gender, marital status, and socioeconomic status. We decided a-priori not to adjust for depressive symptoms based on conceptual considerations: Depressive symptoms might operate as an intermediate variable as they are a potential consequence of work stress [23–26] and in turn a potential causes of SI [2,27]. In epidemiological research it is not recommended to adjust for such variables [34].

The results are shown as odds ratios (ORs) and 95% confidence intervals (CIs). We also collapsed the data across all six studies and estimated pooled associations using random-effects logistic modeling. In the present statistical analyses, we created three equally sized exposure groups related to adverse psychosocial work conditions based on tertiles (by