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Original article

Smoking in relation to anxiety and depression: Evidence from a large population survey: The HUNT study

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Abstract

Smoking is reported to be associated with depression and anxiety. The present study (a) examines these associations taking comorbidity into account, (b) investigates possible confounders, (c) examines how former smokers compared to current and never-smokers in terms of anxiety and depression, and if anxiety and depression decline by time since cessation. Participants (66%) aged 20–89 years in a population-based health survey ($N = 60{,}814$) were screened employing the HADS. (a) The association with smoking was strongest in comorbid anxiety depression, followed by anxiety, and only marginal in depression. Associations were stronger in females and younger participants. (b) Variables partly accounting for the association comprised somatic symptoms, socio-demographics, alcohol problems, and low physical activity. (c) Anxiety and depression were most common in current smokers, followed by quitters, and then never-smokers. No decline in anxiety or depression was found with time since cessation. Previous studies of associations between depression and smoking might have overestimated the association when ignoring comorbid anxiety.

Keywords: Smoking; Anxiety; Depression; Epidemiology; Comorbidity

1. Introduction

The detrimental effects from smoking on health are well known and mortality attributable to smoking is high [13]. Smoking has been found to be associated with a wide range of mental disorders [8,16,26,29,30,35,41,45,46]. In World Health Organisation surveys daily smoking is reported by 30% of the population in the western world [44]. Epidemiological studies have found that people with a mental disorder are twice as likely to smoke compared to the general population [33], and are high consumers of cigarettes [22]. Considering the most prevalent mental disorders, associations between depression and smoking have been shown repeatedly [8,11,18,20], but more recent work has also highlighted the importance of anxiety disorders [5,16,21,28,30,34,35,41,46,47]. Anxiety and depression are commonly comorbid [38]. However, the degree to which smoking is uniquely associated with anxiety, as opposed to be associated with co-occurring depression, is unclear [35].

Other factors may confound associations between smoking and anxiety/depression, including somatic health, other health-related behaviours, socio-economic status, age and gender. A recent literature review on anxiety and smoking call for more focus on moderators and mechanisms for improved understanding of aetiology [35]. Psychosocial factors and comorbid mental disorders have been implicated as important confounders in young adults [2,17]. Failure to take such confounders into account may have led to ungrounded optimism

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in causal theories on the link between smoking and specific mental disorders.

The public health response to smoking has usually consisted of campaigns directed at cessation or discouraging initiation of smoking. Previous research supports these policies, suggesting improved mood and stress-relief post cessation [39,40], and authors have emphasised the need to focus on cessation in people with mental disorders [22,23,33]. On the other hand, abstaining smokers with a history of major depression disorder (MDD) have an increased risk of developing a new episode of MDD over a 4 week [10] to 6 month [19] period. Beyond that time frame little is known about the long-term effects of quitting smoking in people with mental disorders. There are also speculations and some inconclusive empirical evidence that anxiety precludes cessation [35].

Finally, as to causality, there is evidence that smoking increases the risk of depression [29,31]. As to certain anxiety disorders [35], and in particular post traumatic stress disorder [3,16], evidence suggest the opposite causality. There is evidence for shared genetic effects in smoking and depression [31], and also in nicotine dependency and post traumatic stress disorder [30]. Quitters are reported to have non-increased risk for a new depressive episode compared to never-smokers [29], but there are power issues in most such studies. Comparisons of quitters and never-smokers (and time since cessation in quitters) in terms of mental illness might shed light on these issues of causality.

The aim of this study was to address these issues in a secondary analysis of data from a large community population. Specific objectives were as follows: (a) to investigate the association between smoking, anxiety and depression taking into account comorbidity between the two mental disorders; (b) to investigate the extent of confounding by other health-related behaviour, somatic health complaints, and socio-demographic factors; (c) to investigate anxiety and depression in former smokers: in particular associations with time since cessation. We hypothesized (a) increased anxiety, depression and comorbid anxiety depression in smokers compared to non-smokers, (b) and that these associations are not entirely explained by confounding factors. (c) Further, we hypothesized that there would be increased anxiety and depression in quitters compared to never-smokers (hypothesizing a trait-association), but also a normalization over anxiety and depression to never-smoker levels by elapsing time (hypothesizing a state-association).

2. Methods

2.1. Design, participants and procedures

In the cross-sectional Health Study of Nord-Trøndelag County (HUNT-II), self-reported data on smoking, mental and physical health, and demographic information and socio-economic status was collected. In addition, body mass index (BMI) and blood pressure were measured by trained community nurses [25]. Of 92,100 eligible inhabitants aged 20–89, 60,814 (66%) participated with completed variables relevant for the present study. The female proportion of the sample was 52.7%, and the ethnic diversity was minimal [25].

2.2. Definition of depression and anxiety

The Hospital Anxiety and Depression scale (HADS) is a self-report questionnaire comprising 14 four-point Likert-scaled items: seven for anxiety (HADS-A) and seven for depression (HADS-D) with reference to the two preceding weeks [38]. Somatic symptoms and sleep/appetite disturbance are specifically excluded to avoid false positive cases in individuals with physical disorders. A cut-off score of 8 on each subscale was found to give an optimal balance between sensitivity and specificity (both about 0.8) for depression and anxiety according to DSM-III and IV, or ICD-8 and 9 [3]. Applying these cut-offs, two dichotomies for case-level anxiety and depression were computed. For the purpose of examining pure and comorbid conditions of anxiety depression, an additional variable was computed with four groups for anxiety only, depression only, comorbid anxiety and depression, and a reference group with no case-level disorder [43]. In accordance to previous publications employing HADS [36], we performed secondary analyses using anxiety and depression as dimensional scores.

2.3. Smoking

To investigate the association between current smoking and anxiety/depression, current smokers were compared to all other participants. Smoking was defined as current daily smoking of cigarettes, cigars or pipe. Next, comparisons were made between never-smokers and both current and former smokers. Finally, prevalence rates of anxiety and depression among former smokers were compared according to time since cessation.

2.4. Confounding variables

Confounding factors were operationalized according to previous analyses carried out on the HUNT database [36,37], and the variables are described in more detail in previous publications [25]. Information on age and gender was obtained from the national population registry [25]. Age was encoded in decades with 20–29 years as reference group. As in previous publications, physical health was assessed with one variable on the number of organ systems from which *somatic symptoms* were reported (symptoms) and one on number of *somatic diagnoses* (diagnoses) [36,37]. The index for somatic symptoms was computed as the number of (up to six) organ systems from which symptoms were reported [36,37]. The index for somatic diagnoses was computed as the number of (up to 15) reported diagnoses enquired about as part of the survey. Both indexes were entered with a range of 0–4 (values >4 truncated to 4) [36,37]. Socio-demographic factors consisted of educational level (primary school, high school, and university level), marital status (living with spouse or partner versus not) [36,37], and socio-economic status derived from current