Research Article

Mental Health Symptoms and Associations with Tobacco Smoking, Dependence, Motivation, and Attempts to Quit: Findings from a Population Survey in Germany (DEBRA Study)

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Abstract

Introduction: This study aimed to estimate prevalence rates of mental health symptoms (anxiety, depression, and overall psychological distress) by tobacco smoking status, and associations between such symptoms and the level of dependence, motivation, and attempts to quit smoking in the German population. ***Methods:*** Cross-sectional analysis of data from six waves of a nationally representative household survey collected in 2018/19 ($N = 11,937$ respondents aged ≥18). Mental health symptoms were assessed with the Patient Health Questionnaire-4. Associations with smoking status, dependence, motivation to quit, and ≥1 past-year quit attempt (yes/no) were analysed with adjusted regression models among the total group, and among subgroups of current ($n = 3,248$) and past-year smokers (quit ≤12 months ago, $n = 3,357$). ***Results:*** Weighted prevalence rates of mental health symptoms among current, former, and never smokers were: 4.1%, 2.4%, 2.5% (anxiety), 5.4%, 4.7%, 4.0% (depression), and 3.1%, 2.5%, 2.4% (psychological distress). Current versus never smokers were more likely to report symptoms of anxiety and depression. Smokers with higher versus lower levels of dependence were more likely to report higher levels of all three mental health symptoms. Higher versus lower levels of overall psychological distress were associated with a higher motivation to quit smoking and, among past-year smokers, with higher odds of reporting a past-year quit attempt. ***Conclusions:*** We found various relevant associations between mental health symptoms and smoking behaviour. Healthcare professionals need to be informed about these associations and trained to effectively support this vulnerable group in translating their motivation into abstinence.

Introduction

Individuals with mental health conditions (MHCs) die on average 10 years earlier than those without [1]. Tobacco smoking substantially contributes to this difference in life expectancy [2] by increasing the odds of developing oncological, cardiovascular, or respiratory diseases [3].

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International data show that smoking is about two to three times more prevalent among individuals with MHCs than among those without [2, 4]. In turn, according to recent data from the English population, for example, about one-third of smokers report a MHC [5].

MHCs and smoking are known to be strongly associated with lower socioeconomic status, but previous studies indicate that the association between MHC and smoking cannot be explained by the association between MHC and socioeconomic status (e.g., [6]). Previous research has highlighted that difficulties in emotion regulation (i.e., reduced capability to adapt to emotional distress) are related to psychological distress, anxiety, and depression and might play a key role in the association between psychological distress and the maintenance of smoking (e.g., [7, 8]). Smokers may use smoking as a maladaptive emotion regulatory function [7, 9]. Although the causal link between smoking and mental health is not yet fully understood [10, 11], the latest evidence suggests that smoking might be a causal risk factor for the development of MHCs, including depression and schizophrenia [12]. Moreover, smoking cessation has shown to improve mental health compared with continuing to smoke [13].

Smokers with MHCs smoke more heavily [14], and report higher nicotine dependence [5, 15] and withdrawal symptoms [16] when trying to quit than other smokers. Recent data from Finland demonstrated that among current smokers, higher levels of dependence were associated with higher odds of depressive symptoms [17]. Contrary to common perception, smokers with MHCs are both similarly willing – in terms of motivation and of having attempted to quit [5, 18, 19] – and able to stop smoking [19–21] as the general smoking population.

Whereas tobacco control policies in countries such as the United Kingdom (UK), Australia, and the USA have led to a decline in smoking prevalence, smoking rates remain substantially higher among people with MHCs compared to the general population [4, 22, 23]. In the UK, e.g, smoking prevalence declined from approximately 30% in 1993 to 20% in 2014 among those without any MHC, whereas it fell from 45% to 34% during the same period among people with a MHC [19].

In Germany, smoking prevalence has remained high, with 28% of the population currently smoking [24]. Every year, about 125,000 people in Germany die prematurely from direct physical harms caused by smoking [3]. In addition, depression and anxiety disorders rank among the most common MHCs in Germany [25]. However, little is known so far about associations between smoking, or the level of tobacco dependence in current smokers, and the presence of MHCs in the population of Germany. Furthermore, there is a lack of data on associations between the presence of MHCs and motivation and attempts to quit smoking in the general population in Germany.

From a public health perspective, such national data are urgently needed to identify healthcare needs in supporting smokers with MHCs to quit harmful tobacco use and to raise awareness among healthcare professionals (HPs) and health policy makers about the detrimental health effects of comorbid smoking in people with MHCs. The recently updated German guideline on the treatment of tobacco addiction generally recommends that "people with mental disorders should be offered guideline-based professional tobacco cessation" [26] but so far, there is no broad acknowledgement in the German healthcare system that smoking should be addressed systematically and comprehensively in people with MHCs, and no specific recommendations can be found in the national guidelines on the treatment of anxiety or depressive disorders [27, 28]. In contrast, the guidelines of the UK National Institute for Health and Care Excellence recommend that HPs in mental health services routinely provide additional stop-smoking support [29]. Even with this guidance, support for smoking patients with MHCs seems to be limited and important opportunities to promote smoking cessation among this vulnerable group are missed [30].

Among a nationally representative sample of adults from an ongoing household survey, the present study therefore aimed to assess the following preregistered research questions: osf.io/twn4e/

1. What are the current prevalence rates of symptoms of anxiety, depression, and overall psychological distress (as an aggregate of symptoms of depression and anxiety) according to tobacco smoking status?
2. To what extent is tobacco smoking status associated with the presence of symptoms of anxiety, depression, and overall psychological distress?
3. To what extent is the level of tobacco dependence (operationalized by urges to smoke) among current smokers associated with the level of symptoms of anxiety, depression, and overall psychological distress?
4. To what extent is the level of overall psychological distress among current smokers associated with motivation to quit smoking?
5. To what extent is the level of overall psychological distress in current and past-year smokers (<12 months since quitting) associated with having attempted to stop smoking during the past year?

Materials and Methods

Study Design

We conducted a cross-sectional analysis using data from the German Study on Tobacco Use (DEBRA: "Deutsche Befragung zum Rauchverhalten"): a representative household survey on tobacco use in the German population (www.debra-study.info) [31]. The study is registered at the German Clinical Trials Register (DRKS00011322, DRKS00017157) and has received approval from the Medical Ethics Committee of the Heinrich-Heine-University Düsseldorf (HHU 5386R).

Since 2016, the DEBRA study collects data every other month from computer-assisted, face-to-face household interviews of people aged 14 and over. Data on mental health symptoms were collected across six waves of the study (13–18) between June 2018 and May 2019, with each wave comprising approximately 2,000 respondents. Respondents were selected by using a multistage, multistratified random probability sampling approach (online suppl. File 1; see www.karger.com/doi/10.1159/000523973 for all online suppl. material). Details on the general sample selection have been published in a study protocol [31].

Study Population

For the present analysis, data of all respondents aged 18 and over from these six survey waves were aggregated ($N = 11,937$ respondents). Respondents aged 14–17 ($N = 283$) were excluded from the main analyses, as it was assumed that adolescents differ from adults with regard to the presence of mental health symptoms (e.g., depression is less prevalent among adolescents [32]), and smoking behaviour, e.g., most adolescents do not smoke on a daily basis and smoking prevalence, and intensity is lower than among adults [33, 34]. Research questions 1 and 2 were repeated for this small group of adolescents, though, and are reported in the online supplementary materials.

Outcome Measures

Mental health symptoms were measured using the validated German version of the Patient Health Questionnaire-4 (PHQ-4) [35, 36]. Given the sensitive topic, PHQ-4 questions were optional and 11.7% of the respondents ($n = 1,397$) declined to answer these questions.

Respondents were asked: "*How often have you felt affected by the following complaints over the last 2 weeks?*", asked about (i) "*little interest or pleasure in doing things,*" (ii) "*depression, melancholy or hopelessness,*" (iii) "*nervousness, anxiety or on edge,*" (iv) "*not being able to stop or control worrying.*" There were four response options: (a) *not at all* (coded 0); (b) *on several days* (coded 1); (c) *on more than half of the days* (coded 2); and (d) *nearly every day* (coded 3). The first two items (i and ii) reflect symptoms of a major depression, the last two items (iii and iv) symptoms of generalized anxiety [35, 36]. Both subscales have a range of 0–6, with a score of 3 or above considered positive for screening purposes. In addition, the composite PHQ-4 scale offers a total score (range 0–12), with a score of 6 or greater representing overall psychological distress. This means, for example, that someone with a score of 3 on the depression scale (= positive) but a score of 2 on the anxiety scale (= negative) would not be considered positive on the overall psychological distress scale (<6) [35, 36]. To answer research questions 1 and 2, PHQ-4 scales were used as binary variables by using these cut-offs. For research questions 3–5, PHQ-4 scales were used as continuous variables.

Motivation to quit smoking was assessed in current smokers by using the validated German version of the single-item Motivation to Stop Scale (MTSS), which reliably predicts attempts to quit [37]. Respondents were asked: "*Which of the following best describes you?*" This question was followed by seven answer options reflecting the level of motivation (from 1 = no motivation to 7 = highest motivation), and an option to refuse response:

1. I do not want to stop smoking
2. I think I should stop smoking but do not really want to
3. I want to stop smoking but have not thought about when
4. I REALLY want to stop smoking, but I do not know when I will
5. I want to stop smoking and hope to do soon
6. I REALLY want to stop smoking and intend to in the next 3 months
7. I REALLY want to stop smoking and intend to in the next month.

Since motivation to stop is not linearly distributed in the German population [37], we used the MTSS as a binary variable: "motivated" (answers 5–7) versus "not motivated" (answers 1–4).

Quit attempts were collected in all current smokers and past-year smokers (those who had quit during the past 12 months) by asking: "*How many serious attempts to stop smoking have you made in the last 12 months? By serious attempt I mean you decided that you would try to make sure you never smoked again. Please include any attempt that you are currently making and please include any successful attempt made within the last year.*" The number of attempts was recoded into a binary variable "yes" (= at least one attempt) versus "no attempt," since the distribution of the number of quit attempts in Germany is strongly skewed, with almost two-thirds of smokers who attempted to quit reporting only one attempt during the past year [33].

Explanatory Variables

For the present analyses, tobacco smoking status of respondents was categorized into current smokers (cigarettes and other non-electronic tobacco products), former smokers, or never smokers (never smoked ≥1 year). Research question 5 on quit attempts was analysed in a fourth subgroup: past-year smokers (see above).

The level of tobacco dependence was operationalized using the German version of the Strength of Urges to Smoke Scale (SUTS) [38] which has shown to be a relatively stable measure in cross-sectional surveys of the urges to smoke from pre- to post-quitting in people who quit smoking during the past 12 months [39]. The SUTS consists of two items which were included as continuous variables (range 1–6) for the analyses: (i) – time spent with urges to smoke – asks "How much of the time have you felt the urge to smoke in the past 24 h?" (response options: "*not at all,*" "*a little of the time,*" "*some of the time,*" "*a lot of the time,*" "*almost all of the time,*" "*all the time,*" and (ii) – strength of urges to smoke – asks "*In general, how strong have the urges to smoke been?*" (*response options: "light," "moderate," "strong," "very strong," "extremely strong,"* and *"zero/none"* for those who answered "*not at all*" on item ii).

Potential Confounding Variables

We included the following potential confounding variables in our adjusted statistical analyses: age (continuous variable), sex (male, female), survey wave (continuous: 1–6), educational qualification (low [9 years of education, or no graduation], middle [10

years of education], high [≥12 years of education]), and monthly net household income per person in the household as continuous variable for regression analyses and as a categorical variable (low, middle, high) for descriptive purposes; see online supplementary File 1. As research questions 4–5 were analysed in the subgroups of current and past-year smokers, the SUTS items [38] were used to adjust for potential confounding by tobacco dependence for the respective analyses.

Statistical Analyses

A study protocol including an analysis plan was preregistered at the Open Science Framework: https://osf.io/twn4e/ research question 1 were weighted to be representative of the adult population in Germany accounting for personal and household characteristics. In line with the multistage sampling procedure, the weighting was conducted in separate stages to differentiate between the design weighting (which corrects unequal selection probabilities due to sample design and is calculated by an analytical approach) and the outcome weighting (which reweights cases who actually participated in the survey compared with known general population parameters and is calculated as rim-weighting within an iterative process). All regression analyses were conducted using unweighted data.

To answer research question 1, we report the weighted proportion (and 95% confidence interval [95% CI]) of the population of adults who were screened positive for symptoms of anxiety, depression, and overall psychological distress according to the PHQ-4 cut-off scores. These prevalence estimates were stratified by smoking status, and reported using complete case data (i.e., excluding PHQ-4 non-responders).

Three separate, adjusted, multivariable logistic regression analyses were used to address research question 2 on associations between respondents' smoking status (current and former smokers vs. never smokers) and the three binary outcomes: symptoms of anxiety (yes/no), depression (yes/no), and overall psychological distress (yes/no).

In the subgroup of current smokers, three separate, adjusted, multivariable linear regression analyses were used to address research question 3 on associations between the respondents' level of strength of urges to smoke and time spent with urges (as continuous variables), independently of each other, and the three continuous outcomes: level of symptoms of anxiety, depression, and overall psychological distress (scores range from 0 to 6 per subscale, and from 0 to 12 on the overall scale).

In the same subgroup, one adjusted multivariable logistic regression analysis was conducted to answer research question 4 on associations between the respondents' level of overall psychological distress (as continuous variable) and the dichotomous outcome "motivation to stop smoking" (motivated vs. not motivated). We did not include the anxiety and depression scores as additional predictors in the model since both were highly correlated with each other (correlation coefficient $r = 0.7$) as well as with the aggregated overall distress score ($r > 0.9$), posing a risk for collinearity [40].

In the subgroup of past-year smokers, one adjusted multivariable logistic regression analysis was applied to answer research question 5 on associations between the respondents' level of overall psychological distress (as continuous variable) and the dichotomous outcome "past-year quit attempt" (yes vs. no). Again, we did not include the anxiety and depression scores as additional predictors.

We used multiple imputation to impute missing data of respondents who refused to answer the PHQ-4 (11.7%), and sparse missing values (<1.5%) of other variables included in the regression models. Missingness was expected to be predictable based on various person characteristics. Imputations were based on predictive mean matching (for continuous variables) and logistic regression models (for dichotomous and categorical variables) using the multivariate imputation by chained equations algorithm [41] in IBM SPSS Statistics Version 25.0 to create 10 imputed datasets (with 10 iterations per dataset) [42]. All variables included in the analyses were used as predictors. Results of analyses across the imputed datasets were combined using Rubin's rules [43].

Results

Sociodemographic and smoking characteristics of the final analytic sample, and unweighted prevalence rates of anxiety, depression, and overall psychological distress related to these characteristics are reported in Table 1. The mean age of this group was 52.6 years (standard deviation = 18.9), with 30.8% current smokers ($n = 3,248$), 17.9% former smokers ($n = 1,890$), and 50.8% ($n = 5,354$) never smokers (0.5% missing data). In the general subsample of past-year smokers, 15.4% ($n = 517/3,357$) reported at least one attempt to quit smoking during the past year.

Online supplementary Table 1 shows the basic sociodemographic characteristics of the total sample of respondents aged 18 years and above ($N = 11,937$) stratified by whether they refused (non-responders, $n = 1,397$; 11.7%) or agreed (responders/analytic sample, $n = 10,540$, $n_{weighted}$ (n_w) = 10,495) to answer the PHQ-4 questions.

Research Question 1: Prevalence of Mental Health Symptoms according to Smoking Status

The weighted prevalence rates of symptoms of anxiety were 4.1% ($n_w = 128/3,133$) among current smokers, 2.4% ($n_w = 44/1,856$) among former smokers, and 2.5% ($n_w = 136/5,396$) among never smokers; and for symptoms of depression: 5.4% ($n_w = 171/3,141$) among current smokers, 4.7% ($n_w = 87/1,858$) among former smokers, and 4.0% ($n_w = 214/5,388$) among never smokers. The weighted prevalence rates of symptoms of psychological distress were 3.1% ($n_w = 96/3,130$) among current smokers, 2.5% ($n_w = 46/1,852$) among former smokers, and 2.4% ($n_w = 130/5,382$) among never smokers. Unweighted prevalence rates of these symptoms related to person characteristics are presented in Table 1. Prevalence of anxiety and depressive symptoms, and overall psychological distress among the subgroup of adolescents are presented in online supplementary File 1.

Table 1. Sociodemographic and smoking characteristics of the total adult sample (aged ≥18 years) who answered the PHQ-4 questions (N = 10,540) and of the subsamples of respondents who were screened positive for symptoms of overall psychological distress, anxiety, and depression (unweighted data)

	Total adult sample who answered the PHQ-4[§] (N = 10,540)	Subsample with overall distress (cut-off ≥6)[§] 3.4% (N = 357)	Subsample with anxiety (cut-off ≥3)[§] 3.6% (N = 380)	Subsample with depression (cut-off ≥3)[§] 5.6% (N = 589)
Gender				
Male	47.3 (4,986)	2.5 (126)	2.7 (134)	4.8 (238)
Female	52.7 (5,554)	4.2 (231)	4.4 (246)	6.3 (351)
Age in years				
18–24	9.0 (947)	3.3 (31)	3.7 (35)	4.6 (43)
25–39	20.0 (2,109)	3.1 (65)	3.6 (76)	4.3 (90)
40–64	39.6 (4,178)	3.8 (156)	3.9 (163)	6.0 (251)
65+	31.4 (3,306)	3.2 (105)	3.2 (106)	6.2 (205)
Educational qualification[†]				
Low	33.4 (3,518)	4.4 (153)	4.9 (172)	7.5 (262)
Middle	36.1 (3,801)	3.1 (117)	3.1 (116)	5.2 (196)
High	29.2 (3,076)	2.7 (82)	2.8 (87)	4.1 (124)
Person net household income class				
Low	16.2 (1,706)	7.6 (129)	7.8 (132)	12.2 (207)
Middle	64.4 (6,792)	2.9 (196)	3.2 (215)	4.7 (320)
High	19.4 (2,042)	1.6 (32)	1.6 (33)	3.0 (62)
Tobacco smoking status				
Current smoker	30.8 (3,248)	4.4 (141)	5.2 (167)	7.0 (226)
Former smoker	17.9 (1,890)	3.1 (59)	3.0 (56)	5.9 (112)
Never smoker	50.8 (5,354)	2.9 (156)	2.9 (156)	4.7 (250)
Subsample of current smokers	30.8 (3,248)	4.4 (141)	5.2 (167)	7.0 (226)
Motivation to stop smoking[#]				
Do not want to stop	49.2 (1,599)	3.9 (62)	4.5 (72)	6.5 (104)
I should, but do not want to	26.4 (858)	4.9 (42)	5.7 (49)	6.8 (58)
I want, have not thought when	10.4 (338)	3.6 (12)	5.1 (17)	6.6 (22)
I really want, hope to do soon	2.3 (76)	4.0 (3)	6.6 (5)	6.7 (5)
I really want, next 3 months	8.5 (276)	5.5 (15)	6.5 (18)	9.8 (27)
I really want, next 3 months	1.2 (39)	5.1 (2)	7.7 (3)	10.3 (4)
I really want, intend to next months	1.0 (33)	12.5 (4)	9.4 (3)	15.2 (5)
Strength of urges to smoke[¥] (mean ± SD) [32]	2.1±1.0	2.3±1.0	2.3±1.0	2.2±1.0
Time spent with urges to smoke[¥] (mean ± SD) [32]	3.3±1.1	3.7±1.2	3.6±1.2	3.6±1.2
Subsample of past-year smokers	31.9 (3,357)	4.4 (147)	5.1 (171)	7.1 (237)
Quit attempt during past year				
≥1 attempt	15.4 (517)	6.0 (31)	6.6 (34)	9.7 (50)
No attempt	83.1 (2,790)	4.1 (115)	4.9 (137)	6.7 (185)

Data are presented as percentage (number). [†] German educational qualification levels: low (9 years of education or no graduation), middle (10 years of education), high (≥12 years of education). [§] Patient Health Questionnaire-4 [29, 30]. [¥] Both items measured with the German version of the Strength of Urges to Smoke Scale (SUTS) [32] with values ranging from 1 = lowest to 6 = highest urges. [#]Items of the Motivation to Stop Smoking Scale ranging from 1 = "I don't want to stop smoking" to 7 = "I really want to stop and intend to in the next month," number of single missing values in the PHQ-4 scales: total distress = 0.7% (n = 69), depressive symptoms = 0.4% (n = 42), anxious symptoms: 0.4% (n = 44).

Research Question 2: Association between Smoking Status and the Presence of Mental Health Symptoms

Being a current smoker compared to being a never smoker was positively associated with the presence of anxiety and depressive symptoms. No statistically signif-icant association was found for overall psychological distress, or when comparing ex-smokers with never smokers (Table 2). Results for the subgroup of adolescents are presented in online supplementary File 1.

Table 2. Results of the regression analyses on associations between tobacco smoking status and the presence of mental health symptoms (research question 2) in the adult population of Germany (imputed and unweighted data: total $N = 11,937$)

	Presence of mental health symptoms according to PHQ-4[§] (yes/no), aOR (95% CI)		
	overall distress (cut-off ≥6)	anxiety (cut-off ≥3)	depression (cut-off ≥3)
Smoking status			
Never smoker (reference)	1	1	1
Ex-smoker	1.05 (0.83–1.32)	1.03 (0.81–1.33)	1.13 (0.92–1.38)
Current smoker	1.12 (0.93–1.36)	**1.22 (1.02–1.48)**	**1.20 (1.02–1.42)**

Data are presented as adjusted odds ratios (aORs) and 95% confidence interval (CI) around OR, ORs printed in bold are statistically significant ($p < 0.05$). The analyses were adjusted for sex, age, educational level (from highest to lowest: high = high school equivalent and advanced technical college equivalent, middle = secondary school equivalent, and low = junior high school equivalent or no qualification), monthly net household income (in EUR) per person, and for the variable "survey wave" (as design factor). [§] Patient Health Questionnaire-4 [29, 30].

Research Question 3 (among Current Smokers): Association between the Level of Tobacco Dependence and the Level of Mental Health Symptoms

Among the subgroup of current smokers, the level of tobacco dependence measured with the SUTS subscale "strength of urges to smoke" was positively associated with the level of symptoms of anxiety, depression, and overall psychological distress (Table 3). For example, an increase of one level on this subscale (range from 0 to 6) was associated with an increase of $B = 0.21$ (95% CI = 0.07–0.34) points on average on the PHQ-4 overall distress scale. No statistically significant associations were observed for the SUTS subscale "time spent with urges to smoke."

Research Question 4 (among Current Smokers): Association between the Level of Overall Psychological Distress and Motivation to Stop Smoking

The level of overall psychological distress among current smokers was positively associated with high motivation to quit smoking (adjusted odds ratio = 1.10 per level on the 12-level overall distress scale, 95% CI = 1.04–1.14).

Research Question 5 (among Past-Year Smokers): Association between the Level of Overall Psychological Distress and Having Made an Attempt to Quit Smoking

In the adjusted regression analysis, the level of overall psychological distress among past-year smokers was positively associated with the presence of at least one self-reported quit attempt during the past year (adjusted odds ratio = 1.07 per level on the 12-level overall distress scale, 95% CI = 1.03–1.11).

Discussion/Conclusion

Among a large representative sample of the adult population in Germany, current tobacco smokers were more likely to report symptoms of anxiety and depression than never smokers. Smokers with higher urges to smoke – a proxy measure of dependence – were more likely to report higher levels of symptoms of anxiety, depression, and overall psychological distress than smokers with lower urges. When adjusting for relevant potential confounders including urges to smoke, smokers with higher levels of mental health symptoms were more likely to be motivated to quit smoking and to report at least one quit attempt during the past year than smokers with lower levels of symptoms.

The prevalence of mental health symptoms determined in our study is somewhat lower than estimates reported from other national [25, 44] and international surveys [45, 46], which might result from methodological differences between the studies (e.g., various health system contexts, various study populations, different periods of data collection, or differences in the use of screening instruments and in the definition of outcomes). However, the focus of our study was not to determine the prevalence of mental health symptoms in the German population, but rather to explore potential associations between such symptoms and smoking status and cessation behaviour. Such associations have not yet been systematically investigated on a population-level in Germany.

In this regard, our findings are consistent with findings from population surveys from England, Finland, and

Table 3. Results of the regression analyses on associations between the level of tobacco dependence and the level of mental health symptoms (research question 3) in the subsample of adult current smokers in Germany (imputed and unweighted data, $n = 3,624$)

	Level of mental health symptoms according to PHQ-4[§] (continuous), adjusted B (95% CI)		
	overall distress (scale 0–12)	anxiety (scale 0–6)	depression (scale 0–6)
Level of dependence[a¥]			
Time with urges (scale 0–6)	0.07 (−0.06 to 0.20)	0.02 (−0.05 to 0.88)	0.05 (−0.01 to 0.12)
Strength urges (scale 0–6)	**0.21 (0.07–0.34)**	**0.12 (0.05–0.20)**	**0.09 (0.02–0.16)**

Data are presented as adjusted regression coefficients B and 95% CI around B; Bs printed in bold are statistically significant ($p < 0.05$). Analysis was adjusted for sex, age, educational level (from highest to lowest: high = high school equivalent and advanced technical college equivalent, middle = secondary school equivalent, and low = junior high school equivalent or no qualification), monthly net household income (in EUR) per person; and for the variable "survey wave" (as design factor). [§] Patient Health Questionnaire-4 [29, 30]. [a] As continuous variables. [¥] Both items measured with the German version of the Strength of Urges to Smoke Scale (SUTS) [32] with values ranging from 1 = lowest to 6 = highest urges.

the USA, reporting not only a positive association between current smoking and the presence of MHCs but also between higher tobacco dependence and MHCs [5, 15, 17]. Our findings also confirm data from international population surveys [5, 19, 47] and from one multi-country European survey (including data from ~900 smokers from Germany [48]) showing that smokers with MHCs were more motivated to quit and more likely to have made at least one past-year quit attempt than those unaffected from MHCs.

It is encouraging that smokers with MHCs in Germany are motivated to quit and attempt to do so. However, international evidence on success in quitting remains inconsistent, with studies indicating lower success rates in smokers with MHCs [14, 18], while others reporting comparable rates between smokers with and without MHCs when adjusting for heavy smoking or urges to smoke [19, 20].

With around 28%, the prevalence of tobacco smoking in Germany remains high [24], whereas the rate of attempts to quit smoking is relatively low (<20%, [33]). Our findings point out the need to raise awareness on associations between MHCs and higher levels of dependence, stronger motivation to quit, and higher rates of quit attempts among affected smokers, HPs, and health policy makers. It is already known that smokers with MHCs particularly benefit from the use of evidence-based pharmacological cessation treatment and its combination with behavioural interventions [21]. However, such methods are rarely used by smokers in Germany to assist their quit

attempt (<13%, [33]), and although patients may usually expect HPs to recommend the most effective method, this expectation is not met when it comes to smoking cessation. In Germany, evidence-based smoking cessation treatments are only rarely recommended by HPs (<5%, [49]).

This problem is assumed to be even more pronounced in smokers with MHCs. A previous mixed-method systematic review found a negative attitude among mental HPs towards smoking cessation in people with MHCs [50]. The most commonly held beliefs of healthcare workers were that patients with MHCs are not motivated to quit and that smoking cessation would be too much for these patients to take on. None of the included studies were conducted in Germany. However, a previous analysis from the DEBRA study found a similarly attitude among the general population in Germany, who were less likely to support the routine provision of smoking cessation treatments to smokers with MHCs than to smokers with physical conditions [51].

Although there is significant comorbidity between smoking and MHCs, no specific recommendations on smoking cessation can be found in the current German guidelines on the treatment of anxiety or depressive disorders [27, 28]. Though the recently updated national guideline on the treatment of tobacco dependence recommends evidence-based cessation treatment methods for smokers with comorbid anxiety or depressive disorders, it does not include any information on motivation to quit and higher rates of quit attempts among this group

[26]. Since people with poor mental health die on average 10 years earlier than those without MHCs [1], and smoking substantially contributes to this difference in life expectancy [2], important opportunities to promote smoking cessation among this vulnerable group are thus missed.

Limitations

One limitation represents the cross-sectional study design with retrospective information on quit attempts. All data were self-reported, increasing the risk for potential under-reporting of MHCs and tobacco consumption, as well as over-reporting of socially desirable behaviours such as quit attempts. Mental health symptoms were collected with the ultra-brief screening instrument PHQ-4, which – although showing good psychometric properties [52] – cannot replace a medically verified diagnosis. In addition, persons with a severe diagnosis of a MHC who could not participate in an interview were excluded in this survey.

Another limitation is the relatively high non-response of participants who declined to answer question on their mental health. Since the comparison of PHQ-4 responders and non-responders revealed differences on sociodemographic characteristics and smoking status, missingness was expected to be predictable based on these characteristics, and missing data were therefore imputed. However, other population studies with comparable rates (~16% [5]) of missing data used complete case analyses and report similar findings on associations between mental health and smoking behaviour or quit attempts. Moreover, associations with smoking cessation were not analysed due to the cross-sectional study design and the relatively low sample size of respondents who had attempted to quit. Finally, we did not assess emotion regulation as a potential determinant of the association between psychological distress and smoking and quitting behaviour. Previous studies suggest, for example, that difficulties in emotion regulation may influence the relationship between psychological distress and use of smoking to reduce negative affect as well as the relationship with perceived barriers for smoking cessation [7, 53].

Conclusion

Our findings suggest that in Germany current compared to never smokers and smokers who are more dependent are more likely to report symptoms of anxiety, depression, and overall psychological distress. Furthermore, smokers reporting higher levels of such symptoms seem to be more motivated to quit and more likely to have attempted to do so than those who are less or not burdened. HPs should therefore be sensitised to these associations by explicitly referring to the evidence on the topic in the national guidelines for the treatment of tobacco addiction [26], as e.g., in the "Primary care guidance on smoking and mental disorders" in the UK [54]. In addition, HPs should be trained to further encourage, and effectively support, smokers with MHCs in translating their motivation to quit into successful abstinence. Training in the effective treatment of tobacco addiction is not standard in the medical education in Germany, although such training can substantially increase HPs' provision of advice on smoking cessation and of recommendation on the use of evidence-based cessation treatments [55]. For smokers with MHC who are motivated to quit but have difficulties to achieve abstinence, medical counselling and, in particular, the recommendation of evidence-based behavioural support and cessation medication are of particular importance [21]. Therefore, on top of the broad implementation of such training for HPs, training content should incorporate information on associations between mental health and smoking (as e.g., here [56]).

Statement of Ethics

The study protocol has been peer-reviewed and approved by the Ethics Committee of the Heinrich-Heine-University Duesseldorf, Germany (HHU 5386/R). The fieldwork is conducted by the market research institute Kantar, Germany. Interviewers from Kantar make sure that all participants give oral informed consent. This method of consent has been approved by the Ethics Committee.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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final version. Daniel Kotz conceived the DEBRA study, supervised the analyses, critically revised the study protocol and the manuscript, and agreed on its final version.

Author Contributions

Sabrina Kastaun: coordinates the DEBRA study, conceptualized and drafted the analysis protocol, drafted the manuscript, analysed and interpreted the data. Leonie S. Brose: provided expert advice on the study protocol, critically revised the manuscript, and agreed on its final version. Esther Scholz: prepared the data with regard to coding and descriptive statistics, critically revised the manuscript, and agreed on its final version. Wolfgang Viechtbauer provided expert advice on statistical methods and critically revised the analysis protocol and the manuscript, and agreed on its

Data Availability Statement

The data underlying this study are third-party data and are available to researchers on reasonable request from the corresponding author (sabrina.kastaun@med.uni-duesseldorf.de). All proposals requesting data access will need to specify how it is planned to use the data, and all proposals will need approval of the DEBRA study team before the data release. The study protocol and statistical analyses plan have been published (https://osf.io/twn4e/).

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