ORIGINAL INVESTIGATION

Weight Concerns Among Finnish Ever-Smokers: A Population-Based Study

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ABSTRACT

Introduction: Concern over weight gain after smoking cessation has been hypothesized to discourage quit attempts and consequently reduce smoking cessation rates. The aim of this study was to examine the association between smoking status and weight concerns among a population-based sample of Finnish ever-smokers.

Methods: Data were collected in conjunction with the National FINRISK 2007 Study from a population-based sample of 25- to 74-year-old Finns. These analyses were based on a subsample of 1,614 ever-smokers. Participants were divided into 4 groups (daily smokers, occasional smokers, recent quitters, and former smokers) based on the self-reported smoking status. Weight concerns were analyzed as a sum score including 6 items (range 0–24). Regression analyses were used to examine the association between smoking status and weight concerns, while adjusting for multiple confounders.

Results: Smoking status was significantly associated with weight concerns, current daily smokers reporting the highest levels of weight concerns. After adjusting for potential confounders (age, gender, body mass index, socioeconomic status, and health behavior), the weight concerns of daily smokers remained significantly higher in comparison with all other groups. Although women were more concerned about their weight than men, no gender-specific associations were found between weight concerns and smoking status.

Conclusions: Current daily smokers are more concerned about their weight than recent quitters, as well as former and occasional smokers. Weight concerns should be taken into account in tobacco dependence treatment.

INTRODUCTION

Tobacco smoking is the leading cause of preventable premature mortality worldwide (World Health Organization [WHO], 2011). Twenty-two percent of working-age men and 16% of working-age women in Finland are daily smokers (Helakorpi, Pajunen, Jallinoja, Virtanen, & Uutela, 2011). Six out of ten of those who smoke want to quit (Helakorpi et al., 2011). More than half of smokers have repeatedly tried to quit (Larabie, 2005). Smoking cessation has major and immediate health benefits: former smokers live longer than continuing smokers (Gerber, Myers, & Goldbourt, 2012; US Department of Health and Human Services, 2010), and smoking cessation reduces the risk of many serious diseases (US Department of Health and Human Services, 2004).

The difficulty of quitting is well established. Weight concerns have been suggested as one of the barriers to quitting

smoking (Doherty, Militello, Kinnunen, & Garvey, 1996; Jeffery, Henrikus, Lando, Murray, & Liu, 2000; Meyers et al., 1997). Because weight gain is often unwanted due to self-esteem, appearance, and health reasons, it is proposed that fear of postcessation weight gain might lower the motivation to quit and even reduce cessation rates. It has also been hypothesized that initial concerns about expected postcessation weight gain rather than directly experienced weight gain might lower motivation or self-efficacy for smoking cessation and thereby indirectly increase the risk of relapse after smoking cessation (Meyers et al., 1997; Weekley, Klesges, & Reylea, 1992).

However, results from prospective studies on the matter have been contradictory. One clinical study revealed an association between postcessation weight gain and relapse among abstainers (Borrelli & Mermelstein, 1998), whereas other studies have observed postcessation weight gain to predict higher abstinence rates (Hall, Ginsberg, & Jones, 1986;

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Norregaard, Tonnesen, & Petersen, 1993; Swan & Carmelli, 1995).

The majority of studies addressing weight concerns and smoking have been based on clinical or cohort samples or selected data. In some of these studies, weight concerns have not been found to significantly differ in relation to smoking status or to have an effect on quit attempts or the cessation outcome (Borrelli & Mermelstein, 1998; Glasgow, Strycker, Eakin, Boles, & Whitlock, 1999; Zhou et al., 2009). However, smoking-specific weight concerns appear to have been higher among current smokers in some studies compared with former smokers (French & Jeffery, 1995) or recent quitters (Clark et al., 2006). Nevertheless, in other studies, quitters have had greater weight concerns compared with continued smokers (Sepinwall & Borrelli, 2004), and this association may affect cessation results.

We have found only one published population-based study on weight concerns among current daily, current occasional, and former smokers (Pisinger & Jorgensen, 2007). In that study, a general weight concern question was asked, and it was found that daily smokers were less likely to be frequently concerned about their weight than never-smokers. Furthermore, female former smokers were more likely to be frequently concerned about their weight than female never-smokers. However, there was no statistically significant finding regarding the weight concerns of occasional smokers.

General weight concerns are found to be more prevalent among female than among male smokers (Pisinger & Jorgensen, 2007; Sánchez-Johnsen, Carpentier, & King, 2011). Smoking-specific weight concerns have also been demonstrated to be higher in women than in men in several studies (Clark et al., 2006; Meyers et al., 1997; Pirie, Murray, & Luepker, 1991; Pisinger & Jorgensen, 2007; Pomerleau & Snedecor, 2008; Sánchez-Johnsen et al., 2011). Weight concerns and intolerance of possible weight gain might be one reason why women are less likely to successfully quit smoking than men (Levine, Perkins, & Marcus, 2001; Perkins, 2001).

Among those seeking smoking cessation treatment, half of female and a quarter of male smokers report weight concerns (Clark et al., 2006). In addition, the level of actual postcessation weight gain has been shown to be higher in women than in men (Borrelli & Mermelstein, 1998). Half of female smokers and one-third of male smokers report cessation-related weight gain as a reason for relapse (Pisinger & Jorgensen, 2007). One study has also suggested that weight-concerned female smokers are especially unlikely to seek treatment or to attempt to quit on their own (Pomerleau, Zucker, & Stewart, 2001).

These somewhat contradictory findings could arise from the fact that different studies have used varying measures of weight concern. Questions targeted at smoking-specific weight concerns might better predict smoking behavior than unspecific general weight concerns or body image problems (Jeffery et al., 2000) because there are findings suggesting that general weight concerns do not differ according to smoking status (French & Jeffery, 1995). Moreover, contrary to smoking-specific weight concerns, general weight concerns have been linked to improved cessation outcomes (Cooper, Dundon, Hoffman, & Stoevers, 2006; French, Jeffery, Pirie, & McBride, 1992).

Several other factors might also be associated to both weight concerns and smoking behavior, such as gender (Clark et al., 2006; Meyers et al., 1997; Pisinger & Jorgensen, 2007;

Sánchez-Johnsen et al., 2011), age (Aubin, Berlin, Smadja, & West, 2009), and the body mass index (BMI) (Aubin et al., 2009; French & Jeffery, 1995).

Because very few studies on weight concerns among ever-smokers have been conducted at the population level, the primary objective of this study was to examine the level of weight concern among subgroups of ever-smokers in a Finnish population-based sample. The secondary objective was to explore gender differences in the associations between weight concerns and smoking status. We hypothesized that those who have been able to quit would have a lower degree of weight concern, whereas current daily smokers would have the highest levels of concern. Furthermore, we hypothesized that occasional smokers would have a lower level of weight concern than daily smokers.

METHODS

Study Population

Data were collected in conjunction with the National FINRISK 2007 Study (Peltonen, 2008). A random sample was drawn from the Finnish Population Information System, stratified according to sex, 10-year age groups, and 6 geographical areas (the cities of Helsinki and Vantaa [the metropolitan area], the areas of Turku and Loimaa, and the provinces of North Savo, North Karelia, Oulu, and Lapland). The total sample size was 11,953 persons aged 25–74 years and the response rate was 67%. The survey included a self-administered questionnaire and a health examination, in which anthropometric measurements were carried out.

Among a subsample forming the Dietary, Lifestyle and Genetic factors in the development of Obesity and Metabolic syndrome (DILGOM) project, all participants who reported having smoked more than 100 cigarettes in their lifetime were classified as ever-smokers. After the health examination, an additional questionnaire was administered to this subpopulation of ever-smokers (1,922 participants), with 1,746 responding to the questionnaire (90% response rate). Ever-smokers were categorized as current daily smokers, current occasional smokers, recent quitters, and former smokers. Pregnant women ($n = 8$) were excluded from the sample and we used those with nonmissing data on both smoking and weight concerns, leading to a data set of 1,614 ever-smokers.

Measures

Weight Concerns

Weight concerns were measured by six questions that inquired the opinions of former and current smokers on the importance of weight control-related issues within their smoking behavior (Table 1). All items used a Likert scale that ranged from 1 (*not at all or very little*) to 5 (*very much*), which enabled the creation of a sum score variable representing various smoking-related weight concerns. Our weight concern scale was based on the Borelli scale (Borrelli & Mermelstein, 1998), with a slight modification to include questions relevant for former smokers and current smokers who do not necessarily plan to quit. Instructions for these questions guided the former smokers to think about the time before quitting. The scale was found to have high internal consistency in our data (Cronbach $\alpha = 0.84$, $n = 1,646$). Subsequently, a sum score was constructed from

Table 1. Weight Concern Question Mean Scores With Standard Deviations (SD) by Smoking Status in Men and Women^{a,d}

	Men (1–5) Women (1–5)				<i>p</i> value
	Daily smokers (ref)	Occasional smokers	Recent quitters ^b	Former smokers ^c	
Question 1: How important is losing weight or maintaining your current weight compared with other personal health concerns?	2.93 (1.33), 3.36 (1.34)	3.06 (1.24), 3.53 (1.23)	2.86 (1.21), 3.34 (1.33)	2.97 (1.31), 3.22 (1.36)	.77, .20
Question 2: People smoke for many reasons. Compared with all of your reasons for smoking, how important is smoking to control your weight?	1.92 (1.06), 2.30 (1.28)	1.30 (0.68), 1.45 (0.88)	1.40 (0.79), 1.39 (0.89)	1.67 (1.02), 1.77 (1.12)	<.001, <.001
Question 3: How much do cigarettes help you to control your weight?	1.92 (1.08), 2.22 (1.28)	1.27 (0.63), 1.50 (0.90)	1.30 (0.56), 1.32 (0.86)	1.78 (1.11), 1.90 (1.26)	<.001, <.001
Question 4: How concerned are you about gaining weight as a result of quitting smoking?	2.57 (1.36), 3.09 (1.51)	1.62 (0.97), 1.83 (1.14)	1.72 (1.03), 1.70 (1.23)	2.24 (1.29), 2.34 (1.39)	<.001, <.001
Question 5: How likely do you think it is that you will gain weight as a result of quitting?	2.86 (1.30), 3.32 (1.48)	1.77 (0.95), 2.04 (1.28)	1.93 (1.16), 1.77 (1.15)	2.66 (1.37), 2.65 (1.55)	<.001, <.001
Question 6: How important is replacing meals with cigarettes/snus for your weight control?	1.84 (1.05), 1.93 (1.19)	1.31 (0.72), 1.37 (0.81)	1.37 (0.82), 1.36 (0.84)	1.74 (1.04), 1.85 (1.18)	<.001, <.001

Note. ^aAll items used a Likert scale that ranged from 1 (*not at all or very little*) to 5 (*very much*).

^bQuit ≤6 months ago.

^cQuit >6 months ago.

^dStatistical method used one-way analysis of variance.

the six items each scoring 0–4 points, resulting in a continuous variable ranging from 0 to 24. This weight concern sum score was used as a continuous variable to describe the level of overall weight concern in the regression model.

Smoking Status

Participants were divided into four categories as follows: (a) daily smokers, (b) occasional smokers (i.e., those who had answered that he/she smokes occasionally and his/her last smoking time was 2 days to 1 month ago), (c) recent quitters (i.e., those who had quit smoking less than 6 months previously), and (d) former smokers (i.e., those who had quit smoking 6 or more months previously).

Other Variables

At the study sites, specially trained nurses measured weight and height using standardized international protocols (Tolonen et al., 2008). BMI was calculated as the weight in kilograms divided by the squared height in meters (kg/m²). The exact age at the time of responding was calculated using the birth date and the date of response of the participants. Self-reported education was graded to primary (comprehensive school), secondary (vocational school, upper secondary school, and polytechnics), and tertiary (academic) levels of education and transformed into years of education. Marital status was measured as self-reported and was divided into two categories, living with partner and living alone, and used as a dichotomous variable. The level of physical activity was measured as the self-reported frequency

of weekly leisure time physical activity that caused sweating and lasted at least 20 min. This was used as a continuous variable in the regression model, and for the descriptive table, a cut-off of three or more times of reported physical activity per week was used to separate physically active and inactive participants (Haskell et al., 2007). The level of alcohol consumption was measured as the self-reported use of alcohol products in the previous 12 months, calculated as the average daily alcohol consumption in grams and used in the regression models. For statistical analyses, participants were classified into three groups according to alcohol consumption: abstainers, light to moderate users, and heavy users. The boundary between moderate and heavy alcohol consumption was set to 14 standard drinks per week for men and 7 for women (National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2012). Dietary behavior was assessed according to the daily fat and fiber intake (g/day), which was calculated from the questionnaire data and used in the regression model (Kaartinen et al., 2011; Männistö, Virtanen, Mikkonen, & Pietinen, 1996).

Statistical Methods

All data analyses were carried out using Stata 11.0 software (StataCorp, 2009). The level of statistical significance was set to $p < .05$. A set of multiple regression models was used to test the association of smoking status with the weight concern sum score, allowing adjustment for confounding factors. The models were adjusted for age, BMI, socioeconomic status (education and marital status), and other relevant health behaviors

(physical activity, daily intake of fiber and fat, and average daily alcohol consumption). The correlations between the confounding variables were not very high ($r < 0.5$), indicating that all potential confounders could be simultaneously included in the final model. Potential confounding variables (age, BMI, socioeconomic status, and health behaviors) were selected based on earlier literature (Aubin et al., 2009; Clark et al., 2006; French & Jeffery, 1995; Meyers et al., 1997; Pisinger & Jorgensen, 2007; Pistelli et al., 2009; Sánchez-Johnsen et al., 2011).

RESULTS

Descriptive Results

The interaction between gender and smoking status was tested. Although such interaction only approached statistical significance ($p = .086$), the results are reported for men and women separately, justified by earlier literature (Clark et al., 2006; Meyers et al., 1997; Pisinger & Jorgensen, 2007; Sánchez-Johnsen et al., 2011).

Five out of six items of the weight concern scale differed significantly between smoking categories. Daily smokers had the highest and former smokers had the second highest mean scores, regardless of gender, in items 2–6. Occasional smokers had the lowest mean scores among men, and recent quitters had lowest mean scores among women in the same items. No differences were observed between smoking categories when the participants were asked to compare weight concerns with other health concerns (Question 1). The mean scores of all the weight concern items in relation to the smoking status for men and women are presented in Table 1.

The mean sum score of weight concern derived from the six items was 6.93 ($SD = 5.4$) for men and 8.25 ($SD = 6.4$) for women, being significantly higher for women ($p < .001$). Daily smokers had the highest and former smokers had the second highest mean weight concern sum scores in both men (7.99, $SD = 5.8$, and 7.08, $SD = 5.4$, respectively) and women (10.2, $SD = 6.7$, and 7.75, $SD = 6.2$). Recent quitters had the lowest weight concern sum scores among women (4.98, $SD = 4.8$), whereas among men, occasional smokers (4.32, $SD = 3.6$) had the lowest scores (Table 2).

Descriptive information on selected relevant characteristics in relation to smoking status for men and women is presented in Table 2. Of the ever-smokers, 56.2% were men. The proportions of men and women varied significantly among the smoking categories. Occasional and daily smokers had the lowest BMI means, whereas former smokers and recent quitters had the highest BMI means. Weight concern sum scores were significantly higher among overweight and obese participants than normal weight participants. Daily smokers were less frequently living with a partner than others, had the lowest educational level, were least physically active, and had the highest fat intake and lowest fiber intake. There were no statistically significant differences in alcohol use between the smoking classes or between the genders.

Regression Analyses

In comparison with daily smokers (reference group), occasional smokers (men: $\beta = -3.53$; women: $\beta = -4.61$), recent quitters (men: $\beta = -3.35$; women: $\beta = -5.27$), and former

smokers (men: $\beta = -1.11$; women: $\beta = -2.41$) had significantly lower weight concern sum scores in the regression model adjusted only for age (Model 1) (Table 3).

BMI as such was most strongly associated with weight concerns (men: $\beta = 0.41$; women: $\beta = 0.40$ /BMI unit). However, adjustment for BMI and age did not change the associations between smoking status and weight concerns. Furthermore, no other confounding factors entered into the model clearly attenuated the associations of smoking status with weight concern sum scores.

In the final, fully adjusted models, smoking status remained statistically significantly associated with weight concerns. Age was significantly associated with weight concern sum scores in women. BMI was more strongly associated with weight concern sum scores than other variables. All other smoking categories, compared with daily smoking, had weaker although independent associations with weight concerns, more visibly so in women than in men.

DISCUSSION

We found that daily smokers were more worried about postcessation weight gain than occasional smokers, recently quit smokers, and former smokers. Daily smokers also perceived weight issues as more likely to affect their potential smoking cessation, considered smoking to be more important and helpful in weight control, and used cigarettes to replace meals more often than respondents in other smoking categories. This is in line with earlier findings of smoking-specific weight concerns being more prevalent among current smokers (French & Jeffery, 1995). It also possibly indicates that measuring smoking-specific weight concerns, such as the fear of postcessation weight gain, could be better and more accurate than measuring general weight concern when examining effects on smoking cessation (Cooper et al., 2006; French et al., 1992). Indeed, we found no significant differences between smoking categories in the item describing general weight concern. This is also consistent with earlier studies (Cooper et al., 2006; French & Jeffery, 1995; French et al., 1992; Pisinger & Jorgensen, 2007).

Recent quitters and occasional smokers had the lowest smoking-specific weight concerns. Their scores on the separate weight concern items were relatively equal, but in the regression analysis recent quitters had the weakest association with weight concerns of all the ever-smokers. Former smokers, having quit smoking at least 6 months previously, had higher smoking-specific weight concerns than recent quitters. Recent quitters, on average, were clearly less worried about postcessation weight gain and saw it as less likely to occur than daily smokers or former smokers. One possible explanation for this low level of weight concern could be the high motivation and/or self-efficacy among recent quitters, who had recently made the decision to quit smoking. An alternative hypothesis is that recent quitters perceived fewer reasons to fear, possibly having not yet experienced the often eventual postcessation weight gain during their less than 6 months of abstinence, whereas former smokers had already come to experience it all too well. This explanation does not seem very plausible; however, because the BMIs of former smokers and recent quitters were relatively similar; unfortunately, earlier weight information was not available. This is consistent with the finding that

Table 2. Descriptive Information on Selected Characteristics for Men and Women by Smoking Status

	Daily smokers		Occasional smokers		Recent quitters ^a		Former smokers ^b		Total		<i>p</i> value
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	
	<i>n</i> = 353	<i>n</i> = 287	<i>n</i> = 130	<i>n</i> = 113	<i>n</i> = 51	<i>n</i> = 50	<i>n</i> = 423	<i>n</i> = 296	<i>n</i> = 957	<i>n</i> = 746	
Age, mean (<i>SD</i>)	51.1 (12.6)	49.2 (12.2)	45.0 (13.7)	41.5 (11.8)	49.6 (13.5)	44.9 (13.8)	58.51 (11.3)	52.5 (11.8)	53.6 (13.2)	49.2 (12.7)	.11 ^d
Weight concern sum score, mean (<i>SD</i>)	7.99 (5.76)	10.2 (6.66)	4.32 (3.58)	5.72 (4.67)	4.58 (3.80)	4.98 (4.80)	7.08 (5.39)	7.75 (6.21)	6.93 (5.42)	8.25 (6.37)	<.001 ^d
BMI, mean (<i>SD</i>)	27.3 (4.80)	26.6 (5.29)	26.7 (3.45)	25.2 (4.93)	28.4 (5.08)	27.6 (5.99)	28.5 (4.17)	27.1 (5.21)	27.8 (4.41)	26.7 (5.27)	.01 ^d
Educational years, mean (<i>SD</i>)	11.6 (3.28)	12.2 (3.25)	14.2 (3.85)	15.0 (3.43)	12.6 (4.41)	14.0 (4.17)	11.8 (3.96)	13.0 (3.85)	12.1 (3.80)	13.0 (3.69)	<.001 ^d
Percent living with partner	66.7	62.0	76.4	67.3	74.5	70.0	80.8	68.1	74.3	65.8	<.001 ^c
Percent physically active	27.5	36.8	45.3	47.3	38.8	61.2	54.0	53.4	42.3	46.7	<.001 ^d
Average daily consumption alcohol (g), mean (<i>SD</i>)	13.0 (17.6)	5.35 (7.27)	15.2 (14.4)	6.15 (5.09)	10.4 (9.7)	6.98 (8.42)	12.4 (17.4)	5.82 (7.63)	13.0 (17.1)	5.75 (7.17)	.28 ^d
Weekly consumption of fat, mean (<i>SD</i>)	102 (40.6)	76.1 (28.6)	93.7 (36.9)	72.3 (22.7)	103 (38.6)	75.7 (27.2)	94.9 (41.9)	75.3 (30.7)	97.9 (40.7)	75.2 (28.6)	.03 ^d
Weekly consumption of fiber, mean (<i>SD</i>)	26.2 (10.9)	26.5 (12.2)	26.8 (11.5)	27.6 (10.0)	30.4 (12.5)	26.9 (8.8)	30.8 (13.1)	29.9 (12.3)	28.6 (12.3)	28.1 (11.8)	<.001 ^d

Note. ^aQuit ≤6 months ago.^bQuit >6 months ago.^cDetermined by Pearson chi-square test.^dDetermined by analysis of variance.

Table 3. Results of the Multiple Regression Models for Weight Concern Sum Scores Among Different Subgroups of Ever-Smokers

Daily smokers, weight concern sum score, mean (<i>SD</i>)	Men			Women		
	7.99 (5.76)			10.2 (6.66)		
	Model 1 ^a	Model 2 ^b	Final model ^c	Model 1 ^a	Model 2 ^b	Final model ^c
<i>R</i> ²	0.06	0.17	0.18	0.08	0.19	0.20
Occasional smokers						
β	-3.53	-3.43	-3.25	-4.61	-4.34	-4.21
<i>p</i> value (95% CI)	<.001 (-4.62, -2.44)	<.001 (-4.46, -2.41)	<.001 (-4.34, -2.21)	<.001 (-5.99, -3.23)	<.001 (-5.65, -3.04)	<.001 (-5.57, -2.87)
Recent quitters ^d						
β	-3.35	-3.76	-3.87	-5.27	-5.93	-5.53
<i>p</i> value (95% CI)	<.001 (-5.02, -1.68)	<.001 (-5.33, -2.19)	<.001 (-5.54, -2.21)	<.001 (-7.25, -3.31)	<.001 (-7.79, -4.07)	<.001 (-7.46, -3.59)
Former smokers ^e						
β	-1.11	-1.47	-1.51	-2.41	-2.51	-2.55
<i>p</i> value (95% CI)	<.01 (-1.90, -0.31)	<.001 (-2.22, -0.72)	<.001 (-2.33, -0.69)	<.001 (-3.43, -1.39)	<.001 (-3.47, -1.55)	<.001 (-3.56, -1.53)
<i>n</i>	899	899	847	715	715	683

Notes. β Coefficients and *p* values with 95% confidence intervals (CI) are calculated by using daily smokers as the reference group.

^aModel 1 adjusted for age.

^bModel 2 adjusted for age and BMI.

^cFinal model adjusted for age, BMI, education, marital status, physical exercise, alcohol consumption, fat and fiber intake.

^dQuit ≤ 6 months ago.

^eQuit > 6 months ago.

much of the weight gain appears during the first 6 months after smoking cessation (Pistelli et al., 2009). It could also be that recent quitters view their recent weight gain as transient or related to the other immediate and temporary effects of smoking cessation, rather than a permanent change in their body. The explanation could also be that because the recent quitters have survived withdrawal symptoms and experienced the positive sides of cessation, this initially increases their self-esteem, which then dissipates as abstinence continues.

BMI had a statistically significant association with weight concerns, but it is clearly not the only determinant of weight concerns. For example, although daily smokers had lower BMIs than former smokers among both sexes, in line with earlier studies (French & Jeffery, 1995), they also had higher weight concerns. Occasional smokers had the lowest BMIs among all smoking classes, which to our knowledge has not been reported in earlier studies, but is in line with earlier findings of light and occasional smokers being more highly educated and having more favorable health behavior than heavy smokers (Hukkinen, Kaprio, Broms, Koskenvuo, & Korhonen, 2009; Korhonen, Broms, Levälähti, Kaprio, & Koskenvuo, 2009). In women, recent quitters were the least concerned about their weight, whereas in men this was the case for recent quitters and occasional smokers. For occasional smokers, this might be partly because of their low BMIs, or perhaps because they, possibly correctly, had little fear of postcessation weight gain due to their nondaily smoking habit.

Women were more worried about their weight than men, even when measured by all individual items, regardless of the smoking status. However, the differences in weight concerns according to smoking classes were still largely identical in both

men and women. Thus, even though women were more concerned about weight, gender did not significantly modify the association between smoking status and weight concerns, as the gender by smoking interaction did not reach significance. To our knowledge, this lack of a gender-specific association between smoking status and weight concerns has not previously been reported. It could imply that the possible negative effects of weight concerns on smoking cessation rates and success affect men and women. However, the possible influence of weight concerns on smoking cessation success rates, and the possible gender differences of such an influence, needs to be investigated in a longitudinal study rather than a cross-sectional one (Pogun & Yazarbas, 2009; Torchalla et al., 2012).

Earlier research has demonstrated a strong association between nicotine dependence and weight concerns (Jeffery et al., 2000; Pomerleau et al., 2001). However, we did not adjust our analyses for nicotine dependence because it is not equally relevant to all smoking classes. Moreover, in our data, only few occasional smokers responded to these questions (Fagerström Test for Nicotine Dependence).

The data for this study were collected from a random sample derived from an adult population with high response rates. Even though it only contained ever-smokers, the unselected study material is the study's main strength. As such, it is only the second study, carried out on a population basis, that has examined weight concerns in relation to smoking (Pisinger & Jorgensen, 2007).

Our weight concern scale, which was modified from the one used in an earlier study (Borrelli & Mermelstein, 1998), proved to be consistent and thus justified the creation of a continuous sum variable. Five of the six questions that measured weight

concerns more specific to smoking varied significantly in relation to the smoking status. This supports the notion that more smoking-specific measures rather than one simple general weight concern question would probably be better in investigating and identifying smokers with high weight concerns.

No information on the income of research participants was available to further adjust for economic status. However, there is no reason to assume an effect of income on the studied association. The coefficient of determination (R^2) reached to 18%–20% in the final regression models, suggesting that most of the variation in weight concerns was not explained by our variables, indicating the complex origins of the measured weight concerns. Finally, in this cross-sectional study, we were only able to examine associations, and not to determine cause–effect relationships. Therefore, it is impossible to state, for example, whether high weight concerns lead to smoking persistence, or whether persistent smoking leads to higher weight concerns.

More research is needed on the correlation between the smoking status and smoking-specific weight concerns, and the possible factors mediating their association, such as motivation and self-efficacy toward cessation. It is also still unclear whether and how weight concerns affect cessation attempts, and there is no consensus on the effectiveness of targeting weight concerns in smoking cessation interventions (Parsons, Shraim, Inglis, Aveyard, & Hajek, 2009). Several alternative approaches have been proposed, such as reducing weight concerns by physical activity (Kinnunen, Korhonen, Craft, & Perna, 2010), controlling weight with dieting or pharmaceuticals (French & Jeffery, 1995), and redirecting attention from weight to other aspects of the body image on which smoking cessation has a positive impact (Pomerleau et al., 2001). Future studies should examine the effects of weight concerns on smoking cessation in longitudinal settings to determine whether such weight concerns hinder smoking cessation attempts, quit rates, and their success.

CONCLUSIONS

Among ever-smokers, there was a significant association between smoking status and smoking-specific weight concerns: those who were current daily smokers reported the highest levels of weight concerns and the recent quitters the lowest ones. Although this seems to suggest that weight concerns are a hindrance to successful quitting, the direction of this association or causality is yet to be determined. Factors such as gender, age, body mass index, socioeconomic status, and health behaviors could potentially impact this relationship. In our results, BMI and age were associated with weight concerns, but did not alter the association between smoking status and the level of weight concerns. Consistent with previous research, women were more concerned about their weight than men. However, significant association between smoking status and the level of weight concerns was found among both genders. And therefore weight concerns should be taken into account in tobacco dependence treatment.

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DECLARATION OF INTERESTS

Jaakko Kaprio served as a consultant to Pfizer in 2011–2012 on tobacco dependence treatments, and received a speaker fee from Pfizer in 2012 in conjunction with the Society for Research on Nicotine and Tobacco (SRNT) Europe meeting. Tellervo Korhonen consulted for Pfizer on tobacco dependence in 2011 and 2012. Taru Kinnunen consulted for Pfizer on tobacco dependence treatments in 2012. The other authors have no conflicts to declare.

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