

Concealing Emotions at Work Is Associated with Allergic Rhinitis in Korea

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Concealing emotions at work can cause considerable psychological stress. While there is extensive research on the adverse health effects of concealing emotions and the association between allergic diseases and stress, research has not yet investigated whether concealing emotions at work is associated with allergic rhinitis. Allergic rhinitis is a common disease in many industrialized countries, and its prevalence is increasing. Thus, our aim was to determine the strength of this association using data from three years (2007-2009) of the 4th Korean National Health and Nutrition Examination Survey. Participants (aged 20-64) were 8,345 individuals who were economically active and who had completed the questionnaire items on concealing emotions at work. Odds ratio (OR) and 95% confidence intervals (95% CIs) were calculated for allergic rhinitis using logistic regression models. Among all participants, 3,140 subjects (37.6%) reported concealing their emotions at work: 1,661 men and 1,479 women. The OR (95% CIs) for allergic rhinitis among those who concealed emotions at work versus those who did not was 1.318 (1.148-1.512). Stratified by sex, the OR (95% CIs) was 1.307 (1.078-1.585) among men and 1.346 (1.105-1.639) among women. Thus, individuals who concealed their emotions at work were significantly more likely to have a diagnosis of AR in comparison to those who did not. Because concealing emotions at work has adverse health effects, labor policies that aim to reduce this practice are needed.

Keywords: allergic rhinitis; allergy; concealing emotion; Korea; stress

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Introduction

Allergic rhinitis (AR) is a common disease in many industrialized countries (Settipane 2001; Meltzer et al. 2009), and the prevalence of AR and other allergic diseases is increasing (Abdulrahman et al. 2012). AR is associated with reduced quality of sleep (Woods and Craig 2006) and quality of life (Abdulrahman et al. 2012), as well as increases hospital utilization (Schatz et al. 2008) and decreased work productivity (Woods and Craig 2006), thereby leading to considerable economic loss (Schatz et al. 2008). Recently, AR has received more attention in Korea, mainly because of its particularly high prevalence therein (Cho et al. 2014).

Several studies have reported sex differences in AR prevalence (Matheson et al. 2011; Pesut et al. 2014). Others have shown that AR is related to age (Park et al. 2009), smoking (Saulyte et al. 2014), alcohol consumption (Bendtsen et al. 2008), obesity (Irei et al. 2005), residential

area (Sly 2002), socioeconomic status (Sly 2002), and various occupational factors (Ng and Tan 1994).

Concealing emotions at work is a key element of the concept of "emotional labor" (Brotheridge and Grandey 2002), and can cause considerable psychological stress (Cheng et al. 2013). Occupational stress has a strong effect on both physical and mental health (Salovey et al. 2000), and can even lead to development of several diseases such as cardiovascular disease (De Bacquer et al. 2005). Occupational stress can be so severe that it leads to sick leave, and thereby economic loss (Slany et al. 2014). The effects of concealing emotions at work on health have been studied extensively (Chapman et al. 2013; Yoon and Kim 2013). For instance, individuals who concealed emotions at work were found to have increased medical service utilization notably this effect was stronger among women (Seok et al. 2014). However, the association between concealing emotions and specific diseases has not been extensively studied. Despite evidence that stress can aggravate allergic

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diseases (Lee et al. 2012), to the best of our knowledge, no studies have investigated the association between AR and concealing emotions at work.

We sought to investigate the association between concealing emotions at work and AR using a multiple logistic regression model controlling for sex, age, smoking, alcohol consumption, body mass index (BMI), region, income, education, occupational type, and work type. In addition, we conducted a sex-stratified analysis to clarify possible sex differences in this association. We expect that our results will provide important information on the association between concealing emotions at work and AR using a nationally representative nationwide survey.

Methods

Study design

In this study, we utilized data from the 4th Korean National Health and Nutrition Examination Survey (KNHANES IV) collected from 2007 to 2009. All KNHANES IV participants took part in the study voluntarily and provided written informed consent for their participation. The original study was approved by the Institutional Review Board (IRB) of the Korea Centers for Disease Control and Prevention. (IRB: 2007-02-CON-04-P, 2008-04EXP-01-C, 2009-01CON-03-2C).

The KNHANES is a cross-sectional nationally representative nationwide survey conducted by the Korea Ministry of Health and Welfare. Briefly, the sampling procedure involved selecting households at random based on the local structure of the population of Korea using multi-step stratified sampling. The KNHANES IV employed 600 sampling units stratified by geographical location and ultimately selected 13,800 households. The response rate for the KNHANES IV was 78.4%.

Participants

We secured 3 years of KNHANES IV data from surveys conducted between 2007 and 2009. There were a total of 24,871 participants in these three surveys, including 4,594 participants in 2007, 9,744 in 2008, and 10,533 in 2009. Using the questionnaire items on economic activity, we selected 10,062 participants who were economically active at the time of survey. Of these, 8,619 participants were eligible, as we excluded those who were over 64 and those who were under 20 years of age because most such individuals would not have participated in economic activities. The final dataset comprised 8,345 participants, after excluding those who did not complete the questionnaire items of interest for our study or who had missing values for covariates. Fig. 1 shows the selection process.

Concealing emotions at work

We used the item, “I should conceal my actual emotions while working” to categorize participants by whether they concealed emotions or not. Individuals who answered this item with “sometimes” or “always” made up the concealing emotions (CE) group, while individuals who answered “never” or “rarely” made up the non-concealing emotions (non-CE) group.

Definition of allergic rhinitis

We used the question “Have you been diagnosed with AR by a doctor?” to define an AR diagnosis. The AR group was identified as those who answered “yes,” and the non-AR group was identified as those who answered “no” or “not applicable (have never suffered from AR)”.

Covariant factors

Participants who drank one or more glasses of alcohol per month over the past year made up the drinking alcohol group, whereas those who drank less than one glass or no alcohol at all were considered the non-drinking group. Alcohol consumption was calculated in terms of glasses of “soju” or “yangju”, one can of beer was

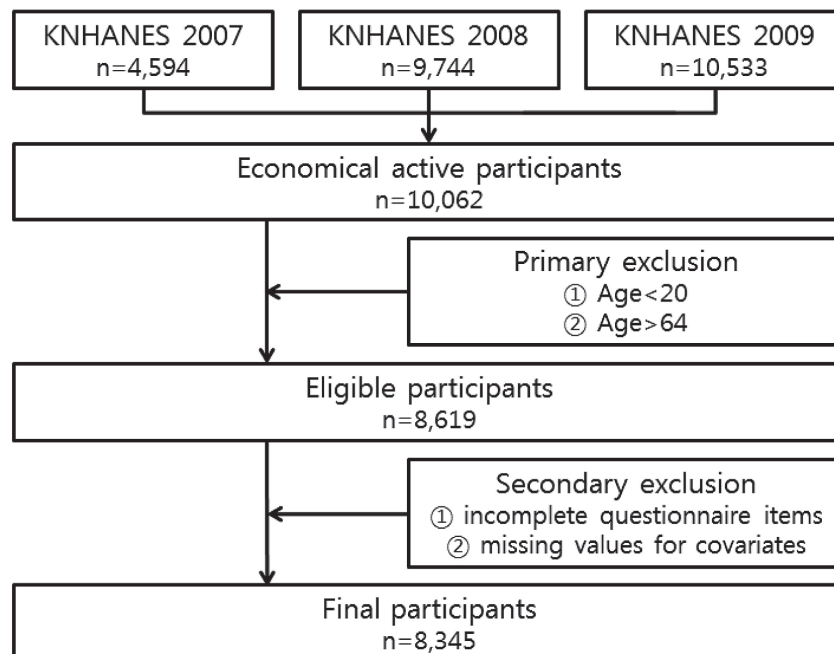


Fig. 1. Flowchart of study participants.

calculated as 1.6 glasses of either of these drinks. One glass equaled about 12 g of ethanol. We categorized individuals who were current smokers, past smokers, and non-smokers. The low BMI group comprised those with BMI < 18.5, the normal group those with BMI ≥ 18.5 and < 25, and the obese group those with BMI ≥ 25.

Using participants' place of residence at the time of data collection, we classified participants as urban or rural residences. The urban group comprised all individuals who lived in Seoul, Pusan, Daegu, Incheon, Kwangju, Daejeon, or Ulsan. All others were considered to live in rural areas. The KNHANES IV classified participant income as top, upper-middle, lower-middle, and bottom based on the four income brackets. For education, the "low education group" comprised those with a middle school education or less, the "middle education group" comprised high school dropouts and those who had completed high school, and the "high education group" comprised those who had completed some undergraduate work or more. Occupation was categorized into two groups. Group 1 included "administrators and experts", "office workers", and "service and sales workers" whereas group 2 included "agriculture, forestry, and fishing workers", "features workers, device operation workers, and assembly workers", and "simple labor workers". Work type was classified into shift work for shift workers,

and otherwise, day workers.

Statistical analysis

We conducted a chi-square test to clarify the differences in demographics and AR between the CE and non-CE groups, both with and without sex stratification. Similarly, we conducted a chi-square test to clarify the differences in demographics and CE between the AR and non-AR groups, again both with and without sex stratification. We calculated odds ratio (OR) and 95% confidence intervals (95% CIs) to clarify the likelihood of having AR between the CE and non-CE groups using logistic regression analysis, with and without sex stratification. We used SAS 9.2 (SAS, Inc., Cary, NC, USA) for all of the statistical analyses, and statistical significance was defined as p-values < 0.05.

Results

Concealing emotions at work

The characteristics of the CE and non-CE groups are presented in Table 1. Women accounted for 44.5% of the non-CE group and 47.1% of the CE group, and this difference was statistically significant. Regarding residence,

Table 1. Overview of concealing emotions at work N (%).

	All			Men			Women		
	Yes	No	p-value	Yes	No	p-value	Yes	No	p-value
Sex			0.020						
Men	1,661 (52.9)	2,891 (55.5)		1,661 (100.0)	2,891 (100.0)				
Women	1,479 (47.1)	2,314 (44.5)					1,479 (100.0)	2,314 (100.0)	
Age			< 0.001			0.002			< 0.001
20 ~ 29	437 (13.9)	681 (13.1)		191 (11.5)	331 (11.5)		246 (16.6)	350 (15.1)	
30 ~ 39	880 (28.0)	1,297 (24.9)		515 (31.0)	773 (26.7)		365 (24.7)	524 (22.6)	
40 ~ 49	944 (30.1)	1,531 (29.4)		488 (29.4)	839 (29.0)		456 (30.8)	692 (29.9)	
50 ~ 59	681 (21.7)	1,200 (23.1)		350 (21.1)	669 (23.1)		331 (22.4)	531 (23.0)	
60 ~ 64	198 (6.3)	496 (9.5)		117 (7.0)	279 (9.7)		81 (5.5)	217 (9.4)	
Alcohol consumption			0.449			0.994			0.032
Yes	2,063 (65.7)	3,376 (64.9)		1,309 (78.8)	2,280 (78.9)		754 (51.0)	1,096 (47.4)	
No	1,077 (34.3)	1,829 (35.1)		352 (21.2)	611 (21.1)		725 (49.0)	1,218 (52.6)	
Smoking			0.275			0.087			0.035
Current smoker	970 (30.9)	1,541 (29.6)		859 (51.7)	1,397 (48.3)		111 (7.5)	144 (6.2)	
Past smoker	603 (19.2)	1,064 (20.4)		526 (31.7)	975 (33.7)		77 (5.2)	89 (3.9)	
Non smoker	1,567 (49.9)	2,600 (50.0)		276 (16.6)	519 (18.0)		1,291 (87.3)	2,081 (89.9)	
BMI*			0.598			0.944			0.690
Low	129 (4.1)	201 (3.9)		36 (2.2)	66 (2.3)		93 (6.3)	135 (5.8)	
Normal	1,977 (63.0)	3,239 (62.2)		976 (58.7)	1,687 (58.3)		1,001 (67.7)	1,552 (67.1)	
Obese	1,034 (32.9)	1,765 (33.9)		649 (39.1)	1,138 (39.4)		385 (26.0)	627 (27.1)	
Region			< 0.001			0.035			0.009
Urban	1,437 (45.8)	2,188 (42.0)		765 (46.1)	1,237 (42.8)		672 (45.4)	951 (41.1)	
Rural	1,703 (54.2)	3,017 (58.0)		896 (53.9)	1,654 (57.2)		807 (54.6)	1,363 (58.9)	
Income			0.706			0.418			0.647
Top	798 (25.4)	1,364 (26.2)		428 (25.8)	785 (27.1)		370 (25.0)	579 (25.0)	
Upper-middle	815 (25.9)	1,325 (25.4)		430 (25.9)	763 (26.4)		385 (26.0)	562 (24.3)	
Lower-middle	803 (25.6)	1,289 (24.8)		439 (26.4)	702 (24.3)		364 (24.6)	587 (25.4)	
Bottom	724 (23.1)	1,227 (23.6)		364 (21.9)	641 (22.2)		360 (24.4)	586 (25.3)	
Education			0.135			0.779			0.016
Low	828 (26.4)	1,475 (28.3)		364 (21.9)	644 (22.3)		464 (31.4)	831 (35.9)	
Middle	1,219 (38.8)	1,989 (38.2)		648 (39.0)	1,148 (39.7)		571 (38.6)	841 (36.3)	
High	1,093 (34.8)	1,741 (33.5)		649 (39.1)	1,099 (38.0)		444 (30.0)	642 (27.8)	
Occupational type			< 0.001			0.052			< 0.001
Group 1	1,947 (62.0)	2,935 (56.4)		911 (54.8)	1,498 (51.8)		1,036 (70.0)	1,437 (62.1)	
Group 2	1,193 (38.0)	2,270 (43.6)		750 (45.2)	1,393 (48.2)		443 (30.0)	877 (37.9)	
Work type			< 0.001			0.011			< 0.001
Shift worker	693 (22.1)	885 (17.0)		341 (20.5)	504 (17.4)		352 (23.8)	381 (16.5)	
Day worker	2,447 (77.9)	4,320 (83.0)		1,320 (79.5)	2,387 (82.6)		1,127 (76.2)	1,933 (83.5)	
Allergic rhinitis			< 0.001			0.003			< 0.001
Yes	428 (13.6)	538 (10.3)		208 (12.5)	280 (9.7)		220 (14.9)	258 (11.1)	
No	2,712 (86.4)	4,667 (89.7)		1,453 (87.5)	2,611 (90.3)		1,259 (85.1)	2,056 (88.9)	

*The low BMI group included those with BMI < 18.5, the normal group included those with BMI ≥ 18.5 and < 25, and the obese group included those with BMI ≥ 25.

42.0% of the non-CE group lived in urban areas, compared to 45.8% of the CE group. This difference was statistically significant with and without sex stratification. Occupation group 1 accounted for 56.4% of the non-CE group and 62.0% of the CE group. This difference was statistically significant for women, but not for men. A total of 17.0% of the non-CE group performed shift work, while 22.1% of the CE group did so. Again, this was statistically significant with and without sex stratification. AR was diagnosed in 10.3% of the non-CE group and 13.6% of the CE group. This was statistically significant with and without sex stratification.

Allergic rhinitis

Table 2 shows the characteristics of the AR and non-

AR groups. Among the entire sample, 10.7% of men and 12.6% of women had AR. Regarding smoking, 10.1%, 11.8%, and 12.4% of current smokers, past smokers, and non-smokers had AR, respectively, and these groups differed significantly among men, but not among women. Regarding obesity, 14.2%, 12.2%, and 10.1% of the low, normal, and obese groups had AR, respectively. The differences between these groups in terms of AR were statistically significant among women, but not among men. In terms of income, 13.2%, 12.3%, 10.8%, and 9.8% of top, upper-middle, lower-middle, and bottom income groups had AR, respectively. This difference was statistically significant in the total population and in men, but not in women. In terms of education, 6.1%, 11.6%, and 15.9% of the low, middle, and high education groups had AR, respec-

Table 2. Overview of allergic rhinitis N (%).

		All		p-value	Men		p-value	Women		p-value
		Yes	No		Yes	No		Yes	No	
Sex				0.008						
	Men	488 (10.7)	4,064 (89.3)		488 (10.7)	4,064 (89.3)				
	Women	478 (12.6)	3,315 (87.4)					478 (12.6)	3,315 (87.4)	
Age				< 0.001			< 0.001			< 0.001
	20 ~ 29	178 (15.9)	940 (84.1)		64 (12.3)	458 (87.7)		114 (19.1)	482 (80.9)	
	30 ~ 39	345 (15.8)	1,832 (84.2)		185 (14.4)	1,103 (85.6)		160 (18.0)	729 (82.0)	
	40 ~ 49	269 (10.9)	2,206 (89.1)		136 (10.2)	1,191 (89.8)		133 (11.6)	1,015 (88.4)	
	50 ~ 59	136 (7.2)	1,745 (92.8)		77 (7.6)	942 (92.4)		59 (6.8)	803 (93.2)	
	60 ~ 64	38 (5.5)	656 (94.5)		26 (6.6)	370 (93.4)		12 (4.0)	286 (96.0)	
Alcohol consumption				0.523			0.838			0.072
	Yes	639 (11.7)	4,800 (88.3)		387 (10.8)	3,202 (89.2)		252 (13.6)	1,598 (86.4)	
	No	327 (11.3)	2,579 (88.7)		101 (10.5)	862 (89.5)		226 (11.6)	1,717 (88.4)	
Smoking				0.015			0.049			0.214
	Current smoker	253 (10.1)	2,258 (89.9)		219 (9.7)	2,037 (90.3)		34 (13.3)	221 (86.7)	
	Past smoker	196 (11.8)	1,471 (88.2)		168 (11.2)	1,333 (88.8)		28 (16.9)	138 (83.1)	
	Non smoker	517 (12.4)	3,650 (87.6)		101 (12.7)	694 (87.3)		416 (12.3)	2,956 (87.7)	
BMI*				0.008			0.847			0.002
	Low	47 (14.2)	283 (85.8)		10 (9.8)	92 (90.2)		37 (16.2)	191 (83.8)	
	Normal	635 (12.2)	4,581 (87.8)		291 (10.9)	2,372 (89.1)		344 (13.5)	2,209 (86.5)	
	Obese	284 (10.1)	2,515 (89.9)		187 (10.5)	1,600 (89.5)		97 (9.6)	915 (90.4)	
Region				0.131			0.294			0.278
	Urban	442 (12.2)	3,183 (87.8)		226 (11.3)	1,776 (88.7)		216 (13.3)	1,407 (86.7)	
	Rural	524 (11.1)	4,196 (88.9)		262 (10.3)	2,288 (89.7)		262 (12.1)	1,908 (87.9)	
Income				0.004			0.008			0.300
	Top	285 (13.2)	1,877 (86.8)		152 (12.5)	1,061 (87.5)		133 (14.0)	816 (86.0)	
	Upper-middle	263 (12.3)	1,877 (87.7)		140 (11.7)	1,053 (88.3)		123 (13.0)	824 (87.0)	
	Lower-middle	226 (10.8)	1,866 (89.2)		110 (9.6)	1,031 (90.4)		116 (12.2)	835 (87.8)	
	Bottom	192 (9.8)	1,759 (90.2)		86 (8.6)	919 (91.4)		106 (11.2)	840 (88.8)	
Education				< 0.001			< 0.001			< 0.001
	Low	141 (6.1)	2,162 (93.9)		57 (5.7)	951 (94.3)		84 (6.5)	1,211 (93.5)	
	Middle	373 (11.6)	2,835 (88.4)		194 (10.8)	1,602 (89.2)		179 (12.7)	1,233 (87.3)	
	High	452 (15.9)	2,382 (84.1)		237 (13.6)	1,511 (86.4)		215 (19.8)	871 (80.2)	
Occupational type				< 0.001			< 0.001			< 0.001
	Group 1	693 (14.2)	4,189 (85.8)		316 (13.1)	2,093 (86.9)		377 (15.2)	2,096 (84.8)	
	Group 2	273 (7.9)	3,190 (92.1)		172 (8.0)	1,971 (92.0)		101 (7.7)	1,219 (92.3)	
Work type				0.390			0.087			0.631
	Shift worker	193 (12.2)	1,385 (87.8)		105 (12.4)	740 (87.6)		88 (12.0)	645 (88.0)	
	Day worker	773 (11.4)	5,994 (88.6)		383 (10.3)	3,324 (89.7)		390 (12.7)	2,670 (87.3)	
Concealing emotion				< 0.001			0.003			< 0.001
	Yes	428 (13.6)	2,712 (86.4)		208 (12.5)	1,453 (87.5)		220 (14.9)	1,259 (85.1)	
	No	538 (10.3)	4,667 (89.7)		280 (9.7)	2,611 (90.3)		258 (11.1)	2,056 (88.9)	

*The low BMI group included those with BMI < 18.5, the normal group included those with BMI ≥ 18.5 and < 25, and the obese group included those with BMI ≥ 25.

Table 3. Association between concealing emotions at work and allergic rhinitis.

	Crude	Model I*	Model II†
All	1.369 (1.196 ~ 1.568)	1.330 (1.160 ~ 1.525)	1.318 (1.148 ~ 1.512)
Men	1.335 (1.103 ~ 1.615)	1.317 (1.088 ~ 1.595)	1.307 (1.078 ~ 1.585)
Women	1.393 (1.148 ~ 1.689)	1.344 (1.105 ~ 1.635)	1.346 (1.105 ~ 1.639)

*Model I: Adjusted for Sex, Age, Alcohol consumption, Smoking and Obesity.

† Model II: Model I + Adjusted for Region, Income, Education, Occupation type and Work type.

tively, and these groups differed significantly among both men and women. For occupation type, 14.2% of group 1 and 7.9% of group 2 had AR, and this difference was statistically significant with and without sex stratification.

Association between concealing emotions at work and allergic rhinitis

Without sex stratification, with non-CE as the reference group, the crude OR (95% CIs) for AR among those in the CE group was 1.369 (1.196-1.568). Regarding the analysis after adjusting for covariates, Models I and II are described in detail in Table 3. Briefly, Model I accounted for basic demographic and behavioral characteristics and Model II additionally accounted for socioeconomic factors. The adjusted ORs (95% CIs) were 1.330 (1.160-1.525) and 1.318 (1.148-1.512) for Models I and II, respectively.

When stratified by sex, the results were as follows. Among men, with non-CE as the reference, the crude OR (95% CIs) for AR among those in the CE group was 1.335 (1.103-1.615), while the adjusted ORs (95% CIs) were 1.317 (1.088-1.595) and 1.307 (1.078-1.585) for Models I and II, respectively. Among women, the crude OR (95% CIs) was 1.393 (1.148-1.689). The adjusted ORs (95% CIs) were 1.344 (1.105-1.635) and 1.346 (1.105-1.639) for Models I and II, respectively (Table 3).

Discussion

General results

Members of the CE group were significantly more likely to have a diagnosis of AR than were members of the non-CE group (OR = 1.369). These odds remained significant for both men (OR = 1.335) and women (OR = 1.393) after stratifying by sex. Additionally, after adjusting for sex, age, alcohol consumption, smoking, obesity, region, income, education, occupation type, and work type, the likelihood of a diagnosis of AR was significantly greater among members of the CE group than among members of the non-CE group. Therefore, concealing emotions at work might increase the likelihood of AR among both men and women.

Mechanism

A possible mechanism through which concealing emotions at work influence AR is as follows. Allergic diseases, including AR, are closely related with increased production of Th2 cells (Montoro et al. 2009). This increase in Th2 cells count leads to a concomitant increase in cytokine, which is secreted by Th2 cells. Cytokine produces a reac-

tion in B cells, which then begin producing specific immunoglobulin E (IgE) antigen (Montoro et al. 2009). These specific IgE antigens combine with mast cells (MacGlashan 2008), which results in mast cells mediated reaction (Uermosi et al. 2014), thereby producing an excess supply of histamine in the body (Uermosi et al. 2014).

With regard to stress, psychological stress stimulates the central nervous system, including the hypothalamus (Montoro et al. 2009), which then secretes adrenocorticotropin hormone (ACTH) in response to the secretion of corticotropin releasing hormone. ACTH in turn stimulates the secretion of corticoids in the adrenal cortex (Chrousos 1995). Corticoids reduce concentrations of interleukin (IL)-12 and increase concentrations of IL-4, IL-10, and IL-13, and these alterations in IL destroys existing Th1 cells and stimulate production of Th2 cells (Montoro et al. 2009). Ultimately, these alterations in Th cell count can cause allergic disease (Montoro et al. 2009). This allergic reaction is considered a mechanism of many allergic diseases (Dave et al. 2011).

The KNHANES IV contained items assessing stress. To support our hypothesized mechanism, we determined the associations between concealing emotions at work and stress, and between stress and AR. We used the question “Do you usually feel a certain degree of stress during daily life?” to categorize participants into stress groups. Individuals who answered “sometimes” and “always” made up the stress group, and those who answered “rarely” and “little” made up the non-stress group. Using a logistic regression analysis, the crude OR (95% CIs) for stress among the CE group versus the non-CE group was 2.968 (2.696-3.268). Furthermore, the crude OR (95% CIs) for AR among those who felt stress in daily life versus those who did not was 1.493 (1.300-1.715). These results supported our suggested mechanism.

Stress refers to the psychological and physical reactions that accompany exposure to stressors in the environment (Montoro et al. 2009). When sustained chronically, stress can exacerbate inflammatory disease in the human body (Gelis et al. 2007). According to previous studies, stress can contribute to serve chronic diseases such as obesity (Vgontzas et al. 2008), depression (Clays et al. 2007), diabetes (Golden 2007), dyslipidemia (Golden 2007), hypertension (Montoro et al. 2009), cerebrovascular disease (Hoffmann 1998), and cardiovascular disease (St-Jean et al. 2005) as well as unhealthy behavior (McEwen 2007). Animal experiments have shown that allergic diseases can be induced by psychological stress (Joachim et al. 2004).

This was subsequently confirmed in studies with humans, wherein stress was found to be associated with allergic disease (Wainwright et al. 2007; Lee et al. 2012). Furthermore, the negative psychological effects of AR can influence its progression (Gelis et al. 2007), and patients with AR who are exposed to high psychological stress tend to present with more upper respiratory tract infections (Jaber 2002). Given our results, we cautiously suggest that occupational stress caused by concealing emotions at work induces AR through changes in the immune system.

Emotional labor

Emotional labor has a number of definitions. For instance, assuming that feelings are experienced in both public and private areas, emotional labor would be defined as performing private acts in a public space with an exchange of value (Diefendorff et al. 2005). Emotional labor refers to when service industry workers must manage their feelings to ensure a smooth interaction with consumers and produce an externally observable expression that conforms to the emotional rules of an organization (Brotheridge and Grandey 2002). Emotional labor is a strong contributor to occupational stress (Katayama 2010), and concealing emotions at work is considered an element of emotional labor.

At present, emotional labor is a salient issue in Korea and other Asian countries, as many service workers such as nurses, counselors, and flight attendants are forced to conceal their emotions at work. Poorly designed organizational policies can induce emotional labor and aggravate its negative effects. Thus policies that better consider the health of individuals who must engage in emotional labor are needed.

Given the association between concealing emotions at work and AR, we cautiously suggest the possibility that individuals who must regularly engage in emotional labor are more likely to be diagnosed with AR. However, further studies are needed to clarify whether emotional labor relates to AR, specifically by implementing a more precise definition and better measures of emotional labor. Nevertheless, our study provides a basis for better understanding the health of workers engaging in emotional labor.

Allergic rhinitis

Many allergic diseases, including AR, are associated with socioeconomic status. According to previous studies, individuals with high incomes or education levels appear more likely to have allergic diseases (Butland et al. 1997; Sly 2002). The proposed mechanism of this association is better hygiene (Sly 2002), wherein higher socioeconomic status is related to improve hygiene, which in turn leads to an increased prevalence of allergic diseases such as AR. This suggestion accords with the results of our study that AR was more prevalent in individuals with higher income. The ratio of AR was also highest in the high education group compared to the other education groups.

There was also a difference in AR prevalence accord-

ing to occupation type, with group 1 (administrators, experts, and office workers) having a higher prevalence than group 2 (agriculture, forestry, and fishery workers, features workers, and simple labor workers). Notably, compared to the non-CE group, a greater number of participants in the CE group were in group 1.

Limitations

There are several limitations of our study. First, this was a cross-sectional study, making it impossible to make any inferences on the sequential cause-and-effect relationship between the variables. Second, we used a questionnaire to assess the frequency of concealing emotions at work, which are highly subject to response bias. Third, we were unable to investigate other factors that might be related to occupational stress and emotional labor, such as high job demand, low job control, effort-reward imbalance, role stressors, and job insecurity. Additionally emotional labor is characterized by the frequency or its strength with which it is employed as well as to whom it is directed (e.g., customers or management), which we did not consider in our study. Although these points have been somewhat addressed in previous studies (Seok et al. 2014), more structured and comprehensive questionnaires are needed to further clarify the nature of this relationship between AR and concealing emotions at work. Fourth, classification of AR was made based on the self-reported question "Have you been diagnosed with AR by a doctor?" Although this method might introduce errors such as recall bias, many epidemiological studies have confirmed the presence or absence of AR using this method (Schatz et al. 2008; Dave et al. 2011; Abong et al. 2012). Additionally, although AR varies considerably in terms of severity and type, we investigated it without classification. Including different classification of AR would be needed in future studies.

Strengths

Despite these limitations, there were several strengths to our study. First, we examined more than 8,000 participants. Second, we confirmed the association between CE and AR and accounted for possible differences in this association by sex. Third, we examined the relationship after adjusting for age, alcohol consumption, smoking, obesity, region, income, education, occupation type, and work type. Finally, while previous studies investigated the relationship between stress and AR, this was the first, to the best of our knowledge, to directly examine the relation between concealing emotions at work and AR.

Conclusion

We examined the relation between concealing emotion at work and AR. We found that individuals who concealed their emotions at work were significantly more likely to have a diagnosis of AR in comparison to those who did not. This effect held for both men and women when stratified by sex. Given that concealing emotions at work has such

adverse health effects, labor policies that reduce the frequency or necessity of concealing emotions at work are needed.

Conflict of Interest

The authors declare no conflict of interest.

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