

Susceptibility to Upper Respiratory Tract Infection and Touching of the Eyes or Nose: A Cross-sectional Study of Japanese Workers

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Abstract: Susceptibility to Upper Respiratory Tract Infection and Touching of the Eyes or Nose: A Cross-sectional Study of Japanese Workers: Yasushi FUKUNAKA, et al. Department of Safety and Health, Tokyo Gas Co., Ltd.—Objectives: This study was a cross-sectional survey of Japanese workers regarding the relationship between touching the eyes or nose and susceptibility to URTI in workers. Methods: The survey respondents were 4,663 Japanese workers. Subjects were surveyed via a self-administered questionnaire regarding their susceptibility to URTI and how often they touched their eyes or nose. In addition, subjects were surveyed regarding their preventive behaviors and routine behaviors thought to be associated with URTIs. A multiple logistic regression model was used to assess the relationship between susceptibility to URTI and how often the eyes or nose are touched. Results: Responses from 3,663 individuals who answered the self-administered questionnaire were analyzed. There were 1,590 individuals (42.9%) with a "frequent incidence of URTIs", defined as URTIs more than once a year. In terms of how often the eyes or nose are touched, the odds ratios (95% CI) for a frequent incidence of URTIs among the groups responding "sometimes" and "often" were 1.41 (1.21-1.63) and 1.96 (1.59-2.42) (trend test: p<0.001) compared with the groups responding "never" and "almost never". Multivariate-adjusted odds ratios adjusted for confounding factors, i.e., behaviors to prevent URTIs, routine behaviors associated with URTIs, age, sex and BMI, were 1.33 (1.14-1.54) and 1.69 (1.36–2.09) (trend test: *p*<0.001). **Conclusions**: The present cross-sectional study indicates that suscep-

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Correspondence to: Y. Fukunaka, Department of Safety and Health, Tokyo Gas Co., Ltd., 1–5–20 Kaigan, Minato-ku, Tokyo 105-8527, Japan (e-mail: ya_fukunaka@tokyo-gas.co.jp) tibility to URTI and how often the eyes or nose are touched are significantly associated in Japanese workers, independent of preventive behaviors and routine behaviors associated with URTIs. (J Occup Health 2013; 55: 66–73)

Key words: Common cold, Contact infection, Influenza, Lifestyle, Preventive behavior, Routine behavior

An upper respiratory tract infection (URTI) is the most common illness in humans, and URTIs are also highly prevalent. In the US, the general population suffers an average of 2–4 viral respiratory infections per person each year^{1, 2)}. In addition, URTIs are one of the primary causes of absences from work in different jobs and cause a massive loss of work productivity. Fendrick *et al.* reported that in the US, workdays lost by individuals suffering from a non-influenza-related viral respiratory infection totalled 70 million days annually; they also reported that the total economic impact of direct costs such as medical expenses and indirect costs such as workdays lost by affected individuals and the increased burden on caregivers totalled \$40 billion annually³.

The U.S. Centers for Disease Control and Prevention cited "clean your hands: washing your hands often will help protect you from germs" and "avoid touching your eyes, nose, or mouth" as behaviors to further prevent influenza infection in the workplace⁴⁾. To the extent known, however, no studies appear to have epidemiologically studied the practice of touching the eyes or nose and susceptibility to URTI (including influenza) in workers. Thus, in the current study, a cross-sectional survey of Japanese workers was performed regarding the association

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between the practice of touching the eyes or nose, which is a behavior thought to increase the risk of URTIs, and susceptibility to URTI.

Methods

Subjects

The job field surveyed covered firms developing energy-related projects in the Tokyo metropolitan area of Japan. The survey respondents were 4,663 Japanese workers scheduled for a routine checkup from April 1 to August 31, 2009. First, 606 individuals who had not undergone a checkup at the scheduled time were excluded as subjects. Next, 350 individuals who had not submitted the self-administered questionnaire on susceptibility to URTI and how often the eyes or nose are touched were excluded as subjects. In addition, 44 individuals who had failed to complete the self-administered questionnaire were also excluded as subjects. Ultimately, the study subjects were 3,663 individuals who underwent a checkup at the scheduled time and who correctly completed the self-administered questionnaire (valid response rate: 78.6%).

Survey methods and items

Pursuant to the Industrial Safety and Health Act, businesses in Japan must conduct routine medical checkups. Workers must also undergo these routine checkups. Thus, most of the subjects of the current study received a routine checkup each year pursuant to the Industrial Safety and Health Act. One month prior to the scheduled routine checkup, a self-administered questionnaire was distributed to survey subjects regarding their susceptibility to URTI and how often the eyes or nose are touched; completed questionnaires were collected during the routine checkup. The purpose of the study, study details and the fact that personal information would be handled carefully pursuant to Japan's Act Concerning Protection of Personal Information were explained to potential subjects in writing. Only potential subjects who consented to these conditions were asked to complete the self-administered questionnaire.

To provide an index of susceptibility to URTI, the self-administered questionnaire asked about the past frequency of "colds" or "influenza", and subjects were asked to select the most appropriate answer from among 4 choices: "several times a year", "about once a year", "once every few years" and "almost never". In addition, subjects were asked to answer how often the eyes or nose are touched by selecting the most appropriate answer from among 4 choices: "often", "sometimes", "almost never" and "never". To further adjust for confounding factors, the self-administered questionnaire asked about behaviors to prevent URTIs, i.e., receipt or lack of influenza vaccination during

the previous flu season, "hand washing" or "gargling" upon returning home and how often one "wears a flu mask" while away from home when "colds" are spreading. Subjects were asked to select the most appropriate answer from among 4 choices: "always", "sometimes", "almost never" and "never". In addition, subjects were also surveyed regarding routine behaviors thought to be associated with URTIs, i.e., smoking status, sleep duration (in hours), time on public transportation while commuting (minutes) and whether eyeglasses or contact lenses are worn.

Statistical analysis

With regard to susceptibility to URTI, subjects who described the frequency of URTIs as "several times a year" or "about once a year" were considered highly susceptible to URTI and were defined as individuals with a frequent incidence of URTIs. With regard to how often the eyes or nose are touched, how often the hands are washed or how often one gargles, the proportion of individuals who responded "never" was 4.2%, 0.8% and 2.3%, respectively. These proportions were small, so the 2 groups responding "never" and "almost never" were incorporated into a single group, and the 3 resulting groups were statistically analyzed.

Initially, differences in age, the ratio of men, BMI, behaviors to prevent URTIs and routine behaviors thought to be associated with URTIs in terms of how often the eyes or nose are touched (3 groups) were examined. Continuous variables were examined using one-way analysis of variance, while categorical data were examined using a chi-square test or the Kruskal-Wallis test. Next, the relationship between subjects' physical characteristics and behaviors to prevent URTIs, i.e., receipt or lack of influenza vaccination, how often the hands are washed (3 groups), how often one gargles (3 groups) and how often a flu mask is worn (4 groups), and susceptibility to URTI was assessed using a multiple logistic regression model. Next, the relationship between smoking status, sleep duration (quartiles), time on public transportation while commuting (quartiles) and whether eyeglasses or contact lenses are worn, i.e., routine behaviors thought to be associated with URTIs, and susceptibility to URTI was also assessed using a multiple logistic regression model. Univariate analysis using a logistic regression model was then performed to assess the relationship between susceptibility to URTI and how often the eyes or nose are touched. Afterwards, multivariate-adjusted odds ratios adjusted for age (continuous variable), sex (male/female), BMI (continuous variable), receipt or lack of influenza vaccination, how often the hands are washed, how often one gargles, how often a flu mask is worn, smoking status, sleep duration, time on public transportation while commuting and whether eyeglasses or contact lenses are worn and 95% confidence intervals were calculated using a multiple logistic regression model.

SPSS 15.0J for Windows (SPSS, Chicago, IL, USA) was used for statistical analysis. The level of significance was set at a p value of 0.05, with p<0.05 deemed to indicate a statistically significant difference.

Ethical approval

The company's health authority approved the secondary use of this data for the present study, and all participants provided written consent for generic use of the health checkup data for research purposes during the checkups. All data were provided anonymously. This study was approved by the ethics committee of the National Institute of Health and Nutrition.

Results

Characteristics of the subjects analyzed

The characteristics of the 3,663 subjects analyzed are shown in Table 1. The median age of the subjects (quartile range) was 48 years (39-56 years of age). Broken down by sex, the subjects consisted of 3,226 men (49 years; 40-56 years of age) and 437 women (44 years; 38-54 years of age). Individuals with a frequent incidence of URTIs accounted for 41.8% of men and 51.3% of women; a higher proportion of women than men had a frequent incidence of URTIs. With regard to how often the eyes or nose are touched, 4.2% of subjects responded "never" (154 individuals), while 29.4% responded "almost never" (1,077 individuals), 52.7% responded "sometimes" (1,929 individuals) and 13.7% responded "often" (503 individuals). In addition, no major differences between men and women were noted, but women tended to account for a somewhat smaller percentage.

With regard to behaviors to prevent URTIs, 45.6% of men and 60.9% of women responded that they had received an influenza vaccination during the previous flu season. Comparison by sex indicated that a somewhat higher proportion of women than of men responded that they practiced preventive behaviors in terms of receipt or lack of influenza vaccination, how often the hands are washed, how often one gargles and how often a flu mask is worn.

With regard to routine behaviors thought to be associated with URTIs, men had a higher rate of smoking and responded that they spent more time on public transportation while commuting than did women. That said, there were no obvious differences between men and women in terms of sleep duration. With regard to whether eyeglasses or contact lenses are worn, more than half of both men and women responded that they wear eyeglasses or contact lenses. A higher percentage of men than of women wore eyeglasses, while a higher percentage of women than men wore contact lenses.

Subject characteristics in terms of how often the eyes or nose are touched

Subjects' physical characteristics, behaviors to prevent URTIs and routine behaviors thought to be associated with URTIs in terms of how often the eyes or nose are touched are shown in Table 2. Younger subjects tended to respond that they touched their eyes or nose more frequently, and many individuals responded that they had received an influenza vaccination during the previous flu season. In addition, subjects tended to respond that they wore a flu mask often while away from home when "colds" were spreading. In addition, subjects who touched their eyes or nose less often tended to smoke more often.

Susceptibility to URTI in terms of subject characteristics

The relationship between susceptibility to URTI and subjects' physical characteristics, behaviors to prevent URTIs and routine behaviors thought to be associated with URTIs was assessed using a multiple logistic regression model, the results of which are shown in Table 3. With regard to physical characteristics, BMI and susceptibility to URTI were found to be associated. With regard to behaviors to prevent URTIs, how often a flu mask was worn and influenza vaccination were associated with susceptibility to URTI. Statistically significant association between other behaviors to prevent URTIs, i.e., how often the hands are washed and how often one gargles, and susceptibility to URTI was not noted. With regard to routine behaviors thought to be associated with URTIs, sleep duration and susceptibility to URTI were found to be inversely associated. In addition, wearing eyeglasses and susceptibility to URTI were found to be associated. A statistically significant association between other routine behaviors associated with URTIs, i.e., time on public transportation while commuting and wearing contact lenses, and susceptibility to URTI was not noted.

How often the eyes or nose are touched and susceptibility to URTI

The relationship between susceptibility to URTI and how often the eyes or nose are touched was assessed using a logistic regression model, the results of which are shown in Table 4. In terms of how often the eyes or nose are touched, the odds ratios (95% CI) for frequent incidence of URTIs among the groups responding "sometimes" and "often" were 1.41 (1.21–1.63) and 1.96 (1.59–2.42) (trend test: p<0.001)

	Table 1.	Characteristics	of the subje	ects (n=3,663)
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	Overall	Male	Female
No. of subjects	3,663	3,226	437
Age (years) ^b	48 (39,56)	49 (40,56)	44 (38,54)
Body mass index (kg/m ²) ^c	23.5 ± 3.4	23.9 ± 3.3	20.7 ± 2.8
Frequent incidence of URTIs (%) ^d	1,574 (43.0)	1,350 (41.8)	224 (51.3)
How often the eyes or nose are touched			
Never	154 (4.2)	127 (3.9)	27 (6.2)
Almost never	1,077 (29.4)	935 (29.0)	142 (32.5)
Sometimes	1,929 (52.7)	1,738 (53.9)	191 (43.7)
Often	503 (13.7)	426 (13.2)	77 (17.6)
Behaviors to prevent URTIs			
Influenza vaccination (previous season) (%)	1,737 (47.4)	1,471 (45.6)	266 (60.9)
Hand washing upon returning home			
Never	28 (0.8)	28 (0.9)	0 (0.0)
Almost never	158 (4.3)	152 (4.7)	6 (1.4)
Sometimes	992 (27.1)	940 (29.1)	52 (11.9)
Always	2,485 (67.8)	2,106 (65.3)	379 (86.7)
Gargling upon returning home			
Never	85 (2.3)	75 (2.3)	10 (2.3)
Almost never	496 (13.5)	441 (13.7)	55 (12.6)
Sometimes	1,397 (38.1)	1,268 (39.3)	129 (29.5)
Always	1,685 (46.0)	1,442 (44.7)	243 (55.6)
Wearing a flu mask while away from home ^e			
Never	795 (21.7)	747 (23.2)	48 (11.0)
Almost never	1,222 (33.4)	1,089 (33.8)	133 (30.4)
Sometimes	1,299 (35.5)	1,107 (34.3)	192 (43.9)
Always	347 (9.5)	283 (8.8)	64 (14.6)
Routine behaviors			
Smoking (%)	1,314 (35.9)	1,287 (39.9)	27 (6.2)
Time on public transportation while commuting (min) ^c	51.7 ± 25.1	53.3 ± 25.1	34.0 ± 21.9
Sleep duration (in hours) ^c	6.1 ± 0.9	6.1 ± 0.9	6.0 ± 0.9
Wearing eyeglasses or contact lenses			
Naked eyes	1,773 (48.4)	1,572 (48.7)	201 (46.0)
Eyeglasses	1,436 (39.2)	1,321 (40.9)	115 (26.3)
Contact lenses	454 (12.4)	333 (10.3)	121 (27.7)

URTIs: upper respiratory tract infections. ^aData are expressed as numbers (%). ^bMedian (25th percentile, 75th percentile). ^cMean ± standard deviation. ^dFrequent incidence of URTIs: Defined as URTIs more than once per year. ^eWhen colds are spreading.

in comparison with the groups responding "never" and "almost never". Multivariate-adjusted odds ratios were then calculated using a multiple logistic regression model adjusted for confounding factors, but no major changes in either association were noted. In addition, the odds ratio for "very frequent incidence of URTIs", which was defined as "URTIs more than several times a year", was assessed. The odds ratios (95% CI) for very frequent incidence of URTIs among the groups responding "sometimes" and "often" were 1.89 (1.41–2.55) and 3.66 (2.59–5.17) (trend test: p<0.001)

in comparison with the groups responding "never" and "almost never" (multivariate-adjusted odds ratios of 1.75 and 3.02, respectively). Moreover, the relationship between how often the eyes or nose are touched and susceptibility to URTI was assessed in terms of how often the hands are washed, but no major changes in either association were noted.

Discussion

The current study examined the relationship between susceptibility to URTI and touching the eyes

	How often the eyes or nose are touched				
	Overall	Never/ Almost never	Sometimes	Often	p value ^f
No. of subjects	3,663	1,231	1,929	503	
Age (years) ^b	48 (39,56)	51 (41,56)	48 (39,56)	44 (36,54)	<0.001 ^g
Male	3,226 (88.1)	1,062 (86.3)	1,738 (90.1)	426 (84.7)	<0.001 ^h
Body mass index (kg/m2) ^c	23.5 ± 3.4	23.6 ± 3.6	23.5 ± 3.3	23.3 ± 3.5	0.472 ^g
Frequent incidence of URTIs (%) ^d	1,574 (43.0)	448 (36.4)	860 (44.6)	266 (52.9)	<0.001 ^h
Behaviors to prevent URTIs					
Influenza vaccination (previous season) (%)	1,737 (47.4)	559 (45.4)	917 (47.5)	261 (51.9)	0.049 ^h
Hand washing upon returning home					0.724 ⁱ
Never or almost never	186 (5.1)	54 (4.4)	100 (5.2)	32 (6.4)	
Sometimes	992 (27.1)	355 (28.8)	508 (26.3)	129 (25.6)	
Always	2,485 (67.8)	822 (66.8)	1,321 (68.5)	342 (68.0)	
Gargling upon returning home					0.865 ⁱ
Never or almost never	581 (15.9)	197 (16.0)	306 (15.9)	78 (15.5)	
Sometimes	1,397 (38.1)	472 (38.3)	737 (38.2)	188 (37.4)	
Always	1,685 (46.0)	562 (45.7)	886 (45.9)	237 (47.1)	
Wearing a flu mask while away from home ^e					< 0.001 ⁱ
Never	795 (21.7)	321 (26.1)	371 (19.2)	103 (20.5)	
Almost never	1,222 (33.4)	421 (34.2)	647 (33.5)	154 (30.6)	
Sometimes	1,299 (35.5)	382 (31.0)	721 (37.4)	196 (39.0)	
Always	347 (9.5)	107 (8.7)	190 (9.8)	50 (9.9)	
Routine behaviors					
Smoking (%)	1,314 (35.9)	458 (37.2)	704 (36.5)	152 (30.2)	0.016 ^h
Time on public transportation while commuting (min) ^c	51.7 ± 25.1	52.2 ± 25.1	51.9 ± 25.4	49.8 ± 23.8	0.191 ^g
Sleep duration (in hours) ^c	6.1 ± 0.9	6.1 ± 0.9	6.1 ± 0.9	6.0 ± 0.9	0.087^{g}
Wearing eyeglasses or contact lenses					0.287 ^h
Naked eyes	1,773 (48.4)	621 (50.4)	914 (47.4)	238 (47.3)	
Eyeglasses	1,436 (39.2)	463 (37.6)	780 (40.4)	193 (38.4)	
Contact lenses	454 (12.4)	147 (11.9)	235 (12.2)	72 (14.3)	

Table 2. Subject characteristics in terms of how often the eyes or nose are touched (n=3,663)

URTIs: upper respiratory tract infections. ^aData are expressed as numbers (%). ^bMedian (25th percentile, 75th percentile). ^cMean ± standard deviation. ^dFrequent incidence of URTIs: Defined as URTIs more than once per year. ^eWhen colds are spreading. ^fStatistical significance; ^gANOVA; ^bChi-square test; ⁱKruskal Wallis test.

or nose in a cross-section of Japanese workers. The current study indicated that susceptibility to URTI and how often the eyes or nose are touched were significantly associated.

The U.S. Centers for Disease Control and Prevention cited "avoid touching your eyes, nose, or mouth" as a behavior to further prevent influenza infection in the home, school and workplace⁴⁾. In a school setting, Stebbins S, *et al.* studied the efficacy of nonpharmaceutical intervention including the recommendation to "avoid touching your eyes, nose, or mouth" to reduce the spread of influenza⁵⁾. To the extent known, however, no studies appear to have epidemiologically studied the practice of touching the eyes or nose and susceptibility to URTI (including influenza) in workers. URTIs occur in the upper respiratory tract, i.e., sites ranging from the nasal vestibule on down to the nasal cavity, pharynx, and larynx. They include the common cold, pharyngitis, tonsillitis, laryngitis and epiglottitis. The most frequent URTI is the common cold and the primary pathogens responsible are viruses such as rhinoviruses, coronaviruses, respiratory syncytial virus, parainfluenza viruses and adenoviruses⁶. Infection with the influenza virus presents mainly with respiratory symptoms primarily in the form of an upper respiratory infection, so it is considered a URTI. Thus, the current study defined a URTI by specifying "the common cold" and "influenza". Transmission of viruses that cause a URTI can occur by any of the three major

Table 3.	Odds ratios (95% CI) for free	uent incidence	of URTIs in	terms of subject	t characteristics
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	n (%) ^a	Frequent incidence of URTIs ^b	Adjusted OR ^d (95% CI)	p^{d}
Age (years)			0.98 (0.97-0.99)	< 0.001
Sex				
Male	3,226 (88.1)	41.8	1.00	_
Female	437 (11.9)	51.2	1.17 (0.93-1.47)	0.180
Body mass index (kg/m ²)			0.97 (0.95-0.99)	0.009
Behaviors to prevent URTIs				
Influenza vaccination (previous season) (%)				
Unvaccinated	1,926 (52.6)	38.8	1.00	
Vaccinated	1,737 (47.4)	47.6	1.21 (1.05–1.39)	0.008
Hand washing upon returning home				0.942 ^e
Never or almost never	186 (5.1)	33.7	1.00	
Sometimes	992 (27.1)	41.9	1.27 (0.87-1.83)	0.211
Always	2,485 (67.8)	44.1	1.18 (0.81-1.72)	0.399
Gargling upon returning home				0.460 ^e
Never or almost never	581 (15.9)	36.9	1.00	
Sometimes	1,397 (38.1)	43.2	1.16 (0.93-1.46)	0.199
Always	1,685 (46.0)	44.8	1.13 (0.88–1.46)	0.327
Wearing a flu mask while away from home ^c				<0.001°
Never	795 (21.7)	34.3	1.00	
Almost never	1,222 (33.4)	41.4	1.26 (1.04–1.53)	0.018
Sometimes	1,299 (35.5)	47.8	1.52 (1.25–1.84)	< 0.001
Always	347 (9.5)	49.7	1.68 (1.28-2.19)	< 0.001
Routine behaviors				
Smoking				
No	2,349 (64.1)	45.2	1.00	_
Yes	1,314 (35.9)	39.0	0.89 (0.77-1.03)	0.130
Time on public transportation while commuting (min)				0.880 ^e
Q1 (lowest)	897 (24.5)	42.7	1.00	_
Q2	795 (21.7)	44.8	1.11 (0.91–1.35)	0.310
Q3	1,008 (27.5)	45.7	1.24 (1.03–1.50)	0.026
Q4 (highest)	963 (26.3)	38.6	0.98 (0.80-1.19)	0.819
Sleep duration (in hours)				0.001 ^e
Q1 (lowest)	952 (26.0)	45.4	1.00	
Q2	1,564 (42.7)	45.6	1.00 (0.85-1.18)	0.994
Q3	190 (5.2)	41.1	0.85 (0.62-1.18)	0.339
Q4 (highest)	957 (26.1)	36.5	0.75 (0.62-0.90)	0.003
Wearing eyeglasses or contact lenses				
Naked eyes	1,773 (48.4)	40.2	1.00	—
Eyeglasses	1,436 (39.2)	44.5	1.19 (1.03–1.38)	0.020
Contact lenses	454 (12.4)	48.9	1.04 (0.83–1.30)	0.755

URTIs: upper respiratory tract infections; OR, odds ratio; CI, confidence interval. ^aData are expressed as numbers (%). ^bFrequent incidence of URTIs: Defined as URTIs more than once per year. ^cWhen colds are spreading. ^dAdjusted for the other 10 of the 11 factors in the table and for touching of the eyes or nose. ^ep for trend.

	Crude		Adjusted ^b	
	OR (95% CI)	р	OR (95% CI)	р
How often the eyes or nose are touched		<0.001°		<0.001°
Never or almost never	1.00	_	1.00	—
Sometimes	1.41 (1.21–1.63)	< 0.001	1.33 (1.14–1.54)	< 0.001
Often	1.96 (1.59-2.42)	< 0.001	1.69 (1.36-2.09)	< 0.001

 Table 4. Odds ratios (95% CI) for frequent incidence of URTIs in terms of how often the eyes or nose are touched

URTIs: upper respiratory tract infections; OR, odds ratio; CI, confidence interval. ^aFrequent incidence of URTIs: Defined as URTIs more than once per year. ^bAdjusted for age, sex, body mass index, influenza vaccination, hand washing upon returning home, gargling upon returning home, wearing a flu mask while away from home, smoking, time on public transportation while commuting, sleep duration and wearing eyeglasses or contact lenses. ^cp for trend.

modes: 1) hand contact with secretions that contain the virus, 2) small-particle aerosols lingering in the air for an extended time or 3) direct contact with largeparticle aerosols from an infected person. Of these, "small-particle aerosols" are thought to be the major mode of transmission for the influenza virus^{6,7)}. In contrast, the most efficient mode of transmission for rhinoviruses, the pathogens that most often cause the common cold, is "hand contact"; the viruses are ultimately transmitted to an individual through contact of the hands with the mucosa of the eyes or nose^{7–9)}. Thus, reducing instances in which the eyes or nose are touched by the hands or fingers as part of everyday activities is considered to be an effective precaution to prevent URTIs caused by rhinoviruses.

The current study indicated that susceptibility to URTI and how often the eyes or nose are touched are significantly associated. The results suggested that avoiding touching the eyes or nose may help to prevent URTIs caused by rhinoviruses.

This study had several merits. It was the first to epidemiologically study touching of the eyes or nose and susceptibility to URTIs (including influenza) in workers. In addition, it surveyed over 3,000 workers. Behaviors to prevent URTIs and routine behaviors thought to be associated with URTIs were studied as confounding factors, and their effects were adjusted for using a multivariate analysis technique.

This study had several limitations. The first is that it was a cross-sectional study. The causal relationship between behaviors to prevent URTIs (which include how often the eyes or nose are touched) and routine behaviors associated with URTIs and susceptibility to URTI cannot be determined based on the results of this study. The second limitation is the potential for recall bias. Nevertheless, "not touching the eyes or nose" is not necessarily widely perceived as a behavior to prevent URTIs, so recall bias may have had little effect. The third limitation is that the current study surveyed subjects via a self-administered questionnaire, but the reliability and validity of this questionnaire were not tested. There are limits to the accuracy with which susceptibility to URTI, behaviors to prevent URTIs and routine behaviors associated with URTIs can be ascertained. Fourthly, there are several differences between the common cold and influenza such as the impact of the symptoms or the prescription medications. Therefore, we should have analyzed them separately regarding the relationship between the practice of touching of the eyes or nose and susceptibility to URTI. However, the subjects were asked to answer about the past frequency of the common cold and influenza together, and it would have been difficult for them to distinguish between them from memory. Thus we could not analyze them separately in this study. In addition, the appropriateness of the definition of a frequent incidence of URTIs as "more than once a year" in this study needs to be determined. Even though "frequent incidence of URTIs" was redefined as "URTIs more than several times a year", the results were the same except that statistically significant associations with BMI and sleep duration were no longer noted. The fifth limitation is that we did not include several variables that may be risk factors affecting the susceptibility to URTI, such as family environment (i.e., living with children) and medical history (i.e., chronic respiratory disease and diabetes). Moreover, the current study surveyed only workers at specific firms residing in or around Tokyo, so there is a question of whether this sample is representative of workers as a whole. In addition, this study's population has an issue concerning generalizability to the general population, such as the confounding factor of the healthy worker's effect.

The current study indicated that susceptibility to URTI and how often the eyes or nose were touched are significantly associated. Because it was a crosssectional study, it was unable to determine a causal relationship between the two. That said, the results suggested that avoiding touching the eyes or nose may help to prevent URTIs. The causal relationship between how often the eyes or nose are touched and susceptibility to URTI should be clearly identified in the future via a cohort study, randomized controlled trial or similar means.

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