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Mindfulness and asthma symptoms: A study among college students

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ABSTRACT

Introduction: Given the known link between asthma and stress as well as the link between mindfulness and stress, we explore the possible association between trait mindfulness and asthma-related diagnosis and symptoms with a cross-sectional study. **Method:** In 2014, we surveyed a sample of college students in their freshman year, from a public university in Shanghai, China. We used three multilevel logistic regressions to estimate the association between trait mindfulness (measured by Mindful Awareness Attention Scale, MAAS) and self-report of ever having an asthma diagnosis, ever having had persistent dry cough, and ever having had wheezing symptoms. Age, gender, household registration status, and the frequency of smog in the respondent's hometown were used as control variables in the study. The home province of the student was used as the cluster variable in the multilevel models. **Results:** Among the 1392 students in the analysis sample (mean age = 18.3), 47 (3.4%) self-reported an asthma diagnosis, 251 (18.1%) reported having had persistent dry cough, and 100 (7.2%) reported having had wheezing symptoms. A one-unit increase in MAAS is negatively associated with having a self-reported asthma diagnosis (Odds Ratio (OR): 0.662, 95% Confidence Interval (CI): 0.452, 0.969, $p = 0.034$), having had persistent dry cough (OR: 0.658, 95% CI: 0.545, 0.795, $p < 0.001$), and wheezing (OR = 0.747, 95% CI: 0.569, 0.981, $p = 0.036$). **Discussion:** This is the first study to suggest a link between trait mindfulness and asthma. Our finding provides evidence that people with higher level of mindfulness are less likely to have had an asthma diagnosis and less likely to have the symptoms of persistent dry cough and wheezing.

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Introduction

The construct of mindfulness indicates consciously attending to one's present experience with open and receptive awareness and attention [1, 2]. As a naturally occurring trait of humans, mindfulness has both interindividual and intraindividual variations [3, 4]. A large body of literature has shown that the enhancement of mindfulness through both meditative and non-meditative exercise helps a variety of health outcomes among different populations [5–9]. For instance, mindfulness-based stress reduction (MBSR) is a curriculum for learning mindfulness meditation that has proven effects in reducing stress among different demographic groups [9]. Given the established link between stress and asthma [10, 11], it is plausible that mindfulness might play a role in affecting one's asthma-related outcome.

Due to the multifactorial nature of asthma, alternative approaches such as mindfulness training have been thought of as a promising mind-body approach for asthma management [12]. A randomized controlled

trial in Massachusetts evaluated the efficacy of the MBSR program in improving asthma-related quality of life as well as lung function among 81 adult asthma patients [13], and the MBSR group showed a significant improvement in asthma-related quality of life plus a significant improvement in perceived stress. However, there was no significant improvement in the lung function among the MBSR group as compared with the control group. A study in Ohio among 56 college students with asthma found that the training in use of acting with awareness (one mindfulness skill) significantly predicted fewer panic symptoms and decreased anxiety sensitivity [14]. However, both studies had relatively small sample sizes, which limit the generalizability of the findings. Besides, these studies focused on effects of mindfulness training instead of studying mindfulness as an inherent human capacity or dispositional trait. Given the known negative association between mindfulness and stress as well as the known positive association between stress and asthma symptoms [15, 16], in this study, we hypothesize that a more mindful per-

son might be less likely to experience asthma symptoms. We use a substantially larger sample than previous studies of mindfulness and asthma to explore the association between trait mindfulness and asthma outcomes. A better understanding of trait mindfulness and asthma through larger samples could be helpful in designing clinical trials where mindfulness training is used for asthma control.

Method

Study population

In December 2014, we surveyed a convenience sample of 1516 college freshmen in the Shanghai University of Finance and Economics (SUFU) (75% of this selective public university's two thousand freshmen) in Shanghai, China. In order to be eligible for the voluntary survey, each participant had to be a freshman at SUFU who had just finished their first semester and was still enrolled in school. This is the baseline sample of our longitudinal study of mindfulness and college health in SUFU. A detailed description of this sample has been published in an earlier paper of ours [17, 18].

Key variables

The main predictor of this study is mindfulness, which is measured using a widely used scale that consisted of 15 questions: Mindful Attention Awareness Scale (MAAS) [3]. This scale has been validated among Chinese adolescents in a 2012 study [19]. As reported in our previous publications, MAAS questionnaire items share a good internal consistency for this sample of Chinese college freshmen [17, 18].

This study has three outcomes related to asthma: the respondent's self-reported diagnosis of asthma ("have you ever been diagnosed as having asthma"), self-reported presence of persistent dry cough ("did you ever have the symptoms of persistent dry cough"), and the self-reported history of wheezing ("did you ever have the experience of wheezing"). While a diagnosis of asthma is a definitive indicator, symptoms associated with asthma, such as persistent dry cough and wheezing, can be indicative of asthma [20, 21]. Previous studies have used persistent dry cough and wheezing as indicators of asthma symptoms in lieu of a known diagnosis of asthma [20, 21], with dry cough defined as a cough that does not result in the production of phlegm and wheezing defined as struggled breathing with a wheezing sound located in the chest.

Statistical analysis

Three multilevel logistic regressions were conducted to examine the association between mindfulness and each of

the three outcomes related to asthma. The home province of the student was used as the cluster variable in the multilevel models, as the asthma risk could be geographically clustered [22, 23]. These logistic regression models include age and gender as demographic covariates since age and gender differences have been documented in asthma prevalence and severity [24–28]. The household registration status (urban vs. rural) of the student respondent prior to his or her admission to college was used as a covariate since the urban-rural disparity in Mainland China remained a very significant determinant of health outcomes [29], and asthma is a disease where severe disparity persists [30, 31]. The frequency of smog in the respondent's hometown was also used as a control variable in the study given the documented evidence about the link between smog and asthma [32, 33]. STATA 12.0 was used for both the descriptive and logistic regression analyses. In addition, we ran two logistic regression models, one about the outcome of wheezing and one about the outcome of persistent dry cough, among those who reported not ever being diagnosed as having asthma, to test the sensitivity of the association between trait mindfulness and asthma symptoms to the diagnosis of asthma.

Results

Table 1 exhibits the descriptive statistics of the study sample of students from SUFU. Of the 1516 students in the initial study sample, 124 were excluded due to missing data. Among the 1392 students in the analysis sample, the average value of MAAS score within this student sample analysis was 4.24 (standard error: 0.02). Among the analysis sample, 46 (3.3%) of the students had received a previous diagnosis of asthma; 247 (17.8%) reported having had persistent dry cough; and 97 (7%) reported having had wheezing symptoms. The mean age was 18.3 years (standard error: 0.02) and 37.6% were men. The majority of students (80.7%) had a registered residential status in Urban China. Approximately 22.8% of the students reported a history of smoking, while 36.6% of the students reported having smog in their hometown "often," "very often," or "daily" (this variable was recoded into a dummy variable of frequent smog at hometown whereby the responses of "often," "very often," and "daily" were coded as 1 and the responses of "no" and "seldom" were coded as 0).

Table 2 shows the results of logistic regressions examining the association between trait mindfulness and outcomes related to asthma. A one-unit increase in MAAS is negatively associated with having a self-reported asthma diagnosis (OR: 0.662, 95% CI: 0.452, 0.969, $p = 0.034$), having had persistent dry cough (OR: 0.658, 95% CI: 0.545, 0.795, $p < 0.001$), and wheezing (OR = 0.747, 95% CI: 0.569, 0.981, $p = 0.036$). MAAS remains negatively

Table 1. Characteristics of the 1,329 subjects enrolled.

	Mean (Standard error)		P of t-test	Mean (Standard error)		P of t-test	Mean (Standard error)		P of t-test
	Had asthma (47)	No asthma (1345)		Wheez-ing (100)	No wheezing (1292)		Had persistent dry cough (251)	No persistent dry cough (1141)	
Age	18.04 (0.25)	18.32 (0.02)	0.01	18.31 (0.06)	18.31 (0.02)	0.98	18.20 (0.06)	18.34 (.02)	0.01
Mindfulness-MAAS score	4.01 (0.01)	4.24 (0.02)	0.01	4.10 (0.08)	4.25 (0.02)	0.02	4.06 (0.04)	4.27 (0.02)	< 0.001
	Count (percentage)		P of χ^2	Count(percentage)		P of χ^2	Count(percentage)		P of χ^2
Ever smoked	12 (23.56%)	316 (25.53%)	0.75	33 (33%)	295 (22.83%)	0.02	64 (25.50%)	264 (23.14%)	0.43
Male	25 (38.15%)	506 (53.19%)	0.03	45 (45%)	485 (37.62%)	0.14	87 (34.66%)	444 (38.91%)	0.21
Urban	44 (81.47%)	1090 (93.62%)	0.03	91 (91%)	1043 (80.73%)	0.01	221 (88.05%)	913 (80.02%)	0.003
Serious smog in hometown	21 (37%)	494 (44.68%)	0.27	42 (42%)	472 (36.61%)	0.28	101 (40.24%)	414 (36.28%)	0.24
N	1392			1392			1392		

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

associated with having had persistent dry cough (OR = 0.663, 95% CI: 0.544, 0.807, $p < 0.001$) and having had wheezing (OR = 0.710, 95% CI: 0.515, 0.980, $p = 0.037$) after we limit the analysis sample to those who had no asthma diagnosis in the past.

Discussion

This is the first study to demonstrate a correlation between trait mindfulness and asthma symptoms with a relatively large nonclinical sample. As we have hypothesized, students with a higher level of mindfulness were less likely to have asthma diagnosis and persistent dry cough. The observed associational patterns are consistent with previous findings that mindfulness training could improve asthma-related quality of life, and the level of stress and anxiety among individuals with asthma [13, 14].

Though we suspected that the effects of one's trait mindfulness on asthma symptoms and diagnosis are

mediated by stress, our study is limited in that we did not measure stress. Thus, we cannot identify the underlying pathways of our observed effects of mindfulness on asthma symptoms using current data. However, we believe that our hypothesis about the association between trait mindfulness and asthma is plausible, based on findings from previous research on the link between mindfulness and stress [15, 16]. As the study is a four-year longitudinal study of college health, we plan to measure perceived stress among these college students in our next wave survey. Biomarkers of stress such as salivary cortisol [34] can also be collected to improve the understanding of the possible causal mechanisms between trait mindfulness and asthma.

We are also aware that the construct validity of the MAAS, the scale we used to measure trait mindfulness, has been recently questioned by experts in the field [35, 36]. To improve the measure of mindfulness, we have included a different scale of mindfulness, the Five

Table 2. Five logistic regressions of persistent dry cough, wheezing, and asthma diagnosis.

	Ever been diagnosed as asthma	Ever had persistent dry cough	Ever had wheezing	Persistent dry cough among non-asthmatic	Had wheezing among non-asthmatic
Mindfulness-MAAS score	0.662* [0.452,0.969]	0.658* [0.545,0.795]	0.747* [0.569,0.981]	0.663* [0.544,0.807]	0.710* [0.515,0.980]
Ever smoked	0.959 [0.480,1.916]	1.135 [0.823,1.567]	1.572* [1.010,2.446]	1.133 [0.811,1.583]	1.923* [1.157,3.195]
Gender (Male)	2.002* [1.099,3.646]	0.853 [0.637,1.141]	1.322 [0.873,2.003]	0.827 [0.610,1.121]	1.210 [0.740,1.979]
Urban house hold registration	2.607 [0.779,8.718]	1.756* [1.158,2.662]	2.306* [1.135,4.685]	1.777* [1.151,2.743]	1.592 [0.766,3.306]
Serious smog in hometown	1.063 [0.563,2.009]	1.080 [0.812,1.437]	1.183 [0.778,1.799]	1.072 [0.776,1.481]	1.104 [0.670,1.818]
Age	0.692* [0.508,0.944]	0.841 [0.706,1.003]	1.036 [0.804,1.335]	0.856 [0.698,1.050]	1.138 [0.837,1.548]
N	1392	1392	1392	1345	1345

Exponentiated coefficients; 95% confidence intervals in brackets.

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

Facet Mindfulness Questionnaire (FFMQ [37–41]), in our follow-up questionnaires of this study. Nevertheless, it is encouraging to see that one-unit increase of MAAS score in our study has consistently negative associations with all three asthma outcomes, and this negative association remains significant when we limit the sample to those who reported no prior asthma diagnosis. The values of these ORs range between 0.658 and 0.747, signaling a possible clinical relevance, especially if this association can be revealed by future studies as causal. It will be worthwhile to retest the association between asthma outcomes and trait mindfulness with our follow-up data, which has alternative measures of mindfulness, longitudinal data structure, and objective measures of asthma diagnosis and symptoms.

Given the cross-sectional and observational nature of our data, we cannot assert with certainty that mindfulness lowered the incidence of asthma or alleviated asthma symptoms. As we plan for a longitudinal follow-up with these college freshmen in SUFE, we are aware that experimental designs with participants randomized to the mindfulness intervention are needed to examine the causal link between mindfulness and asthma symptoms. An experimental design with mindfulness intervention will not only offer better evidence for the link between mindfulness and health behavior but also have stronger public health relevance if the results support a causal mechanism: we might be able to use mindfulness intervention as a way to promote the health of college students with asthma.

Given the nature of our cross-sectional study, there remain alternative hypotheses to explain the positive link between trait mindfulness and asthma. Chronic stress in life could affect both asthma and trait mindfulness, a hypothesis we expect to explore in the follow-up questionnaire with the longitudinal data and the inclusion of stress measures. The “reverse causality” hypothesis might also worth exploring: severe asthma symptoms affect mental health and affect mindful attention and awareness in daily life. This “reverse causality” hypothesis could be addressed in experimental designs where asthma patients are treated and their trait mindfulness is followed over time.

Finally, our measurement of both asthma diagnosis and symptoms is based upon the respondent’s self-report, so is our measurement of the smog frequency in their hometowns. Our study is therefore subject to self-report bias or recall bias in these measures [42]. The follow-up surveys of our planned longitudinal study would evaluate subjects’ asthma-related outcomes with objective measures. These objective measures will include pulmonary function tests, use of asthma rescue medications, and emergency department visits and hospitalizations for

asthma. Using these specific and objective measures can also address the issue that the asthma-related symptoms we use in our study are not unique to asthma for this age group (e.g., pediatric COPD [43]). We look forward to obtaining these asthma-related measures in our follow-up surveys to reexamine the associations we tested in this study.

In conclusion, we found in this study significant associations between mindfulness and asthma: first-year college students with a higher level of mindfulness were less likely to have asthma diagnosis and symptoms. While further research is needed to explore the causal mechanisms of such associations, our result from a large sample of people aged 18–20 suggests that mindfulness training might be promising in asthma control among college students.

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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