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Childhood maltreatment and lung function: Findings from the general population

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This general population study calls into question the well-documented link between childhood maltreatment and obstructive pulmonary diseases by indicating that spirometrically assessed lung function is not related to any type of childhood abuse or neglect.

Abstract

Objective: Cumulative evidence indicates that childhood maltreatment (CM) is linked to self-reported asthma and chronic obstructive pulmonary disease. However, the relation between CM and objective measures of lung function as determined by spirometry has not yet been assessed. **Methods:** Medical histories and spirometric lung function were taken in 1386 adults from the general population. Participants also completed the Childhood Trauma Questionnaire for the assessment of emotional, physical and sexual abuse as well as emotional and physical neglect. **Results:** 25.3% of the participants reported at least one type of CM. Among them, use of medication for obstructive airway diseases as well as typical signs and symptoms of airflow limitation were significantly more frequent than in the group without exposure to CM. Although participants with CM had numerically lower values for FEV1, FVC and PEF than those without, these differences were non-significant when accounting for relevant covariates like age, sex, height and smoking. Likewise, there were no differences in the FEV1/ FVC ratio nor in the frequency of airflow limitation regardless of its definition. No specific type of CM was related to spirometrically determined parameters of lung function. **Conclusions:** Our findings call into question the association of CM with obstructive lung diseases as indicated by prior research relying on self-reported diagnoses. We consider several explanations for these discrepancies.

Key words:

Childhood maltreatment, asthma, chronic obstructive pulmonary disease (COPD), lung function, airflow limitation, pulmonary function testing

Introduction

A growing body of research suggests an association between exposure to childhood maltreatment (CM) such as child abuse or neglect and adult respiratory disease characterized by airway obstruction, i.e. asthma [1, 2] and chronic obstructive pulmonary disease (COPD) [3-5]. For instance, the Adverse Childhood Experiences (ACE) Study enrolling 15,472 adults reported a graded relation between the numbers of childhood adversities (ACE score) and the risk of self-reported COPD [6]. Those with an ACE score of five or higher had 2.6 times increased age-adjusted odds of COPD compared to individuals with a score of 0, and these odds only dropped to 2.1 when age, gender, race/ethnicity, education, diabetes, obesity, and smoking were controlled for . Similarly, cross-sectionally collected data from ten countries participating in the World Mental Health Surveys initiative demonstrated a graded relation between the numbers of ACEs and adult asthma [7]. However, childhood physical abuse (CPA) was the only CM type associated with the onset of asthma, and increased its risk by 92%, even when smoking was accounted for [7].

Several independent general population studies have confirmed the association between CM and adult respiratory disease [2-5, 8]. Additionally, this link was also found in community dwelling Hispanics/Latinos [9] and African American women [10], among pregnant Peruvian women [11] as well as adults aged 50 years and over [12]. More importantly, two longitudinal studies [10, 13] have prospectively analyzed the association between CM and lung disease. In a large cohort of African American women (N = 28,456) the experience of any type of childhood abuse significantly increased the subsequent risk of incident adult-onset asthma by 24%, but the relative risk was higher for childhood physical abuse (CPA) than for childhood sexual abuse (CSA) [10]. Another longitudinal study using a prospective cohort design matched children aged 0 to 11 years with documented cases of CPA, CSA and neglect with non-maltreated children, and compared their medical status examination including peak airflow after a 30-year follow-up [13]. While neither CPA nor CSA emerged as significant predictors of poor peak airflow, neglect increased the risk [13].

In sum, consistent evidence indicates an association lung diseases characterized by airflow limitation and CM, which was assessed by retrospective self-report in the majority of studies [1-12]. However, important issues remain unresolved to date. First, the vast majority of the aforementioned studies relied on self-reported diagnoses of asthma or COPD, respectively, possibly introducing information bias. Only the investigation by Widom and co-workers [13] used objective measures of lung function, i.e. peak airflow. Moreover, the differential impact of the various types of CM (i.e. sexual, physical, emotional abuse as well as physical and emotional neglect) on lung disease is still a matter of debate. In some investigations neglect, but not abuse was related to COPD [13], whereas other studies demonstrated the importance of abuse in the CM-respiratory disease link [6, 8, 9, 11].

In light of these findings, the objective of our general population study was to assess the association between CM, self-reported asthma-like symptoms and objective measures of lung function, i.e. forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and their ratio, and peak expiratory flow (PEF), and to analyze which types of CM, if any, are differentially related to these measures of lung function.

Methods

Procedure and Subjects

Data from the Study of Health in Pomerania (SHIP), an ongoing population-based project in northeast Germany were used [14, 15]. A sample from the adult population was drawn from population registries considering the inclusion criteria of German citizenship, residency in West Pomerania and age between 20 and 79 years. Data collection of the baseline study (SHIP-0) was performed between October 1997 and May 2001. Follow-up examinations (SHIP-1 and 2) were conducted every five years after baseline [15]. Additionally and parallel to SHIP-2, the “Life-Events and Gene–Environment Interaction in Depression” (LEGEND) study used the initial SHIP-0 baseline population to collect data on mental health and psychosocial risk factors [15, 16]. All participants gave written informed consent. SHIP and LEGEND were approved by the local Institutional Review Board and conformed to the principles of the Declaration of Helsinki.

The baseline study (SHIP-0) included a total of 4308 individuals (2193 women, 68.8% of all 6265 sampled subjects). The detailed objectives and design of SHIP are published elsewhere [14, 15]. In brief, data were collected in two medical centres specifically established for this study. Participants were offered free transportation to the examination centres and back home, a meal and 15 Euros as incentives. The data collection comprised four parts: a health- and risk factor-related self-report questionnaire, an oral health examination, a medical examination, and a computer-assisted health-related interview. The latter was conducted by trained interviewers; additionally, there was a continuous quality monitoring [14, 15].

The present study used data from both the first five-year follow-up investigation (SHIP-I) performed between December 2002 and December 2006 and LEGEND carried out between June 2007 until August 2010, i.e. a cross-sectional study nested in a long-term community-based cohort study. For SHIP-I, there were 130 passive non-responders due to migration, and 231 deceased subjects. Of the remaining 3947 eligible persons, 647 were active non-responders. Thus, a total of 3300 participants of the original study were followed up (83.6% response). The non-responders were significantly older, more often single, less educated, and unemployed [17]. Pulmonary function testing was offered to any subject volunteering in SHIP-I, and was finally carried out on a random subsample comprising 1809 volunteering subjects [18, 19]. Those performing spirometry were younger, less often separated, divorced or widowed, had a higher educational level, and were less often current smokers, than non-performers (results not presented in detail). Of the 1809 participants with spirometry data, 26 subjects (1.4%) had to be excluded due to cognitive impairment as defined by a Mini Mental State Examination (MMSE) score of 23 or below, and 9 (0.5%) had incomplete pulmonary function testing data. Of the remaining 1777 subjects, 1415 also took part in LEGEND. Due to missing data on the variables of interest, 29 participants (2.0%) had to be excluded resulting in a net sample of 1386 adults living in the community analyzed in the present study.

Medical History of Lung Disease and Pulmonary Function Testing

Personal medical history was assessed by a computer-assisted personal interview including several questions about respiratory signs and symptoms in the last 12 months prior to the interview, derived from the interview applied within the European Community Respiratory Health Survey [20]. Respondents were also asked if they had ever suffered from a physician-diagnosed chronic bronchitis or asthma in their life. Current medication was recorded according to the Anatomical Therapeutic Chemical (ATC) classification and drugs of interest (ATC code R03) were treated as binary variables (no use = 0 vs. use = 1). Participants also underwent routine medical examination including anthropometric measurements. Because only current, but not former smoking has an impact on lung function parameters [21], smoking status was classified as never or former smoking (= 0), or current smoking (= 1). Marital status was subdivided into three categories: never married (= 0), married (= 1), and divorced, separated or widowed (= 2). Corresponding to the German school system, the educational level of participants was assigned to one of the following three categories: 10 years or less/ elementary school (= 0), 10 years/ junior high (= 1), and 11 years or more/ high school (= 2).

Pulmonary function testing was conducted using a bodyplethysmograph equipped with a pneumotachograph (VIASYS Healthcare, JAEGER, Hoechberg, Germany) that meets the American Thoracic Society criteria [22]. The volume signal of the equipment was calibrated with a 3.0 litre syringe connected to the pneumotachograph in accordance with the manufacturer's recommendations, and this was performed at least once on each testing day. Barometric pressure, temperature and relative humidity were registered every morning. Calibration of the volume was examined under Ambient Temperature Pressure conditions and the integrated volumes were Body Temperature Pressure Saturated corrected [22]. The participants performed at least three lung function maneuvers in order to obtain a minimum of two acceptable and reproducible values [23]. Immediate on-screen error codes indicating the major acceptability (including start, minimal duration and end of test) and reproducibility criteria supported the attempt for standardized procedures. Prior to the tests, the required maneuvers were demonstrated by the operator and the individuals were encouraged and supervised throughout the performance of the tests. The best results for FVC, FEV1 and PEF were taken. We also calculated percentage of predicted values of FEV1 and FVC based on the equations of the Global Lung Initiative 2012 (GLI) [24]. Airflow limitation was defined both as fixed ratio of FEV1/ FVC < 70% and as FEV1/FVC % < the lower limits of normal (LLN) derived from prediction equations of the GLI [24].

Psychological Assessment

Childhood maltreatment was assessed by means of the Childhood Trauma Questionnaire (CTQ) [25, 26] within the LEGEND study. This self-report measure asks about histories of childhood trauma before the age of 18 years including emotional, sexual and physical abuse as well as emotional and physical neglect. Each of these types is captured by five items endorsed on a 5-point Likert scale with higher scores indicating a higher degree of CM. In addition to a dimensional scoring procedure, the manual provides threshold values to determine the severity of abuse and neglect (none, mild, moderate and severe). Dichotomized variables (none to mild versus moderate to severe) were created for each trauma type. From these, a composite variable was computed indicating exposure to moderate to severe maltreatment in at least one trauma type (CM+) vs. no or mild exposure (CM-). In independent studies the CTQ and its German version were reported to show good reliability and validity in both clinical and non-clinical samples [27, 28]. Furthermore, the five-factor model (i.e. the five subscales reflecting the different types of childhood trauma) was empirically confirmed [29].

Cognitive functioning was determined by the MMSE [30] before administering the other measures. MMSE scores of 23 or below were considered to indicate cognitive impairment, and participants not exceeding this cut-off were excluded.

Statistical Analysis

For comparisons of study population characteristics between participants with and without histories of CM (i.e. CM+ vs. CM-), we applied analyses of variance for continuous and χ^2-test for categorical variables. To determine the relation of CM with self-reported respiratory signs and symptoms, we performed logistic regression analyses of the latter variables (present vs. absent) as dependent variables; sex, age, height, marital status, educational level, and smoking were taken into account as relevant covariates. Results from pulmonary function testing were compared between CM+ and CM- participants using linear and logistic regression analyses; sex, age, height, marital status, educational level, and smoking were controlled for. When analyzing percentage of predicted values of FEV1 and FVC, sex, age, and height were not considered as covariates. We report the unstandardized regression coefficient B and the associated 95% confidence interval. Additionally, we calculated the corresponding effect sizes d and their 95% confidence intervals. Stepwise multivariate regression analyses were run to analyze the differential impact of CM type on lung function parameters with FEV1, FVC, PEF, and FEV1/ FVC as dependent variables. Age, sex, height, marital status, educational level, smoking, self-reported asthma/ bronchitis, medication (ATC code R03) were included as predictor variables in the 1st step. The dimensional CTQ subscales reflecting the different CM types were simultaneously included as additional predictors in the 2nd step. There was no evidence of collinearity between the predictor variables as indicated by variance inflation factors (VIF), which were below 5 in all cases. Significance level was set at $p < .05$. All analyses were computed using the 'Statistical Package for the Social Sciences' (SPSS, version 27.0, IBM, Armonk, NY, USA).

Results

The study population comprised 719 women (51.9%) and 667 men (48.1%) with a mean age of 51.2 years (SD = 13.1; range: 25 – 84 years). Of the 1386 community residents included in the present study, 350 subjects (25.3%) reported exposure to at least one type of CM. As illustrated by Table 1, comparisons between participants reporting CM (CM+) and those without histories of CM (CM-) revealed significant differences with respect to age, educational level, and height. There were no differences in the distributions of gender, marital as well as smoking status.

Accounting for age, sex, height, marital status, educational level, and smoking, CM positive subjects had significantly increased odds for medication use for obstructive airway diseases, wheeze without having a cold, woken with chest tightness, and asthma attacks compared to those without experiences of CM (Table 2). While the CM-asthma/ chronic bronchitis association just missed significance ($p = .069$), the respiratory signs and symptoms of woken with shortness of breath as well as woken by an attack of coughing were not related to CM.

Although participants reporting CM had numerically lower absolute values for FEV1, FVC and PEF than those without exposure to CM, linear regression analyses accounting for relevant covariates did not reveal any significant relation between CM and these parameters (Table 3). Similarly, neither the FEV1/ FVC ratio nor the percentages of predicted values of FEV1 or FVC based on the GLI equations were associated with CM. The odds of airflow limitation were not higher in participants with CM compared to those without exposure regardless of its definition.

To determine the differential associations of CM types with lung function independent of other determinants, we performed stepwise linear regressions with absolute values of FEV1, FVC, PEF, and the ratio of FEV1/ FVC as dependent variables (Table 4). While FEV1, FVC and PEF were significantly predicted by age, sex, height, marital status, educational level, smoking status, self-reported asthma/ bronchitis as well as the use of medication (ΔR^2 ranging between 61.4% and 73.3%), the simultaneous inclusion of the CTQ subscales did not contribute to a relevant increase in variance. Of note, the inverse association of physical neglect with PEF just reached significance. None of the other CM types was related to FEV1, FVC or PEF. Similarly, the ratio of FEV1/ FVC was not significantly predicted by any CM type. Using the percentages of predicted values for FEV1 and FVC according to the GLI equations as dependent variables revealed that neither CM in general nor any of its types was associated with these lung function parameters (see Table S1 in the supplementary material).

Discussion

To the best of our knowledge, this is the first general population study relating CM to signs and symptoms of obstructive lung disease as well as to spirometrically assessed parameters of pulmonary function, thus extending prior research suggesting associations between CM and self-reported respiratory diseases characterized by airway obstruction [1-12]. In good keeping with these investigations, our findings suggest significantly higher frequencies of self-reported asthma/ chronic bronchitis and use of drugs for obstructive airway diseases (ATC core R03) in community dwelling adults with exposure to at least one type of CM compared to those without. Moreover, three of five respiratory signs and symptoms were associated with CM, and these associations remained significant when relevant covariates were accounted for underscoring the validity of the link between CM and obstructive respiratory diseases. However, although lung function parameters were numerically lower in participants reporting CM compared to those without, these differences were not significant when accounting for sex, height, and smoking. Likewise, neither the percentage of predicted values of FEV1 and FVC nor the frequency of airflow limitation regardless of its definition differed between the two groups. Similarly, a longitudinal study reported that peak airflow was significantly lower in participants with documented abuse and neglect in childhood compared to the control group [13]. However, poor peak airflow in adulthood was solely predicted by neglect but neither by sexual nor by physical [13]. In contrast, our cross-sectional results do not suggest that any type of CM is associated with spirometrically assessed lung function indicators of airway obstruction in a relevant matter. Although physical neglect emerged as significant negative predictor of PEF, this finding has to be interpreted with caution for two reasons. First, the inclusion of CM types into the regression equation did not contribute to a significant increase in explained variance beyond other relevant predictors like age, sex, height, and smoking. Second, this association just reached significance ($p = .029$), and was not found with respect to FEV1, which is usually considered the most sensitive measure of airflow obstruction.

Of note, while a large body of investigations clearly shows a link between CM and self-reported obstructive lung diseases, our approach and another study [13] using objective lung function parameters do not confirm this association. This inconsistency deserves some consideration, particularly as our non-significant results cannot be attributed to insufficient statistical power. The 95% confidence intervals of the effect sizes relating to our main findings indicate that our study was adequately powered to detect small effects. It might be argued that an adequate anti-obstructive medication in CM positive participants with obstructive lung diseases resulted in largely normal spirometry findings. However, it was not recorded whether participants were under anti-obstructive medication when performing lung function testing. Moreover, while COPD is reflected by alterations in spirometry, this does not necessarily apply to asthma. Thus, the link between CM and asthma may still hold true, even if there are no associations with lung function indices. Consistent with this line of reasoning, it has to be kept in mind that the diagnostic value of symptoms, signs, and functional measures are not equivalent, as they differentially contribute to establishing the diagnosis of COPD and asthma, respectively.

An alternative explanation refers to individual differences in self-presentation styles impacting accuracy in retrospective symptom reporting which is of primary importance in health-related research [31]. Several factors have been identified to influence the amount of bias in symptom reporting, e.g. sensory-perceptual or affective-motivational aspects [31, 32]. In obstructive lung disease, mood-dependent attentional processing has been shown to play a decisive role in symptom perception and reporting [33, 34]. This affect-induced self-reported health bias [35] may result in both under- and overreporting [33]. Likewise, symptom overreporting is a controversial issue in traumatic stress research, and it has been argued that it obscures the dose-response relation between trauma severity and symptoms [36]. Although it is unknown whether or not adult victims of CM are more liable to symptom overreporting than adults without exposure to CM, it may well be that the association between childhood traumatic experiences and self-reported obstructive lung disease can partially be attributed to mood-dependent health bias and symptom overreporting. Further research is warranted to clarify these issues.

Although our study holds some strengths including the population-based design, the assessment of lung function with spirometry, and the exclusion of cognitively impaired subjects likely unable to engage in self-report measures and lung function testing, some methodological limitations need to be discussed. First, the cross-sectional design does not allow any causal inferences. Second, our general population sample cannot be considered representative for two reasons: The follow-up sample differed from the representative baseline SHIP-0 sample, and pulmonary function testing was carried out on a random subsample of volunteers [37]. As a result of this selection bias, airflow limitation was less prevalent in our study compared to findings of other general population studies regardless of the applied criteria [38, 39]. However, the rate of CM positive participants of 25.3% found in our sample is of similar magnitude as the 31.0% reported in an independent German representative general population study using exactly the same method for the assessment of CM [40]. Furthermore, the disregard of environmental factors possibly contributing to COPD and asthma, respectively, represents another shortcoming of our study. Finally, the exclusive reliance on self-report to capture CM may compromise validity, and its retrospective assessment has possibly introduced a recall bias. However, comparison between data on adverse childhood experiences based either on a longitudinal cohort study or on a retrospective approach did not show any bias in the retrospective assessment [41].

In sum, our cross-sectional approach in concert with a prospective study [13] using objective parameters of lung function call into question that CM is related to obstructive lung diseases as indicated by prior research relying on self-reported diagnoses. Neither self-reported diagnosis of obstructive pulmonary disease nor spirometrically assessed lung function seem sufficient to determine caseness, and future attempts to resolve these discrepancies are needed as well as validated diagnostic coding procedures.

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Statement of interest:

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Table 1. Sociodemographic and clinical characteristics of the study population

	Total sample (n = 1386)	**CM+** (n = 350)	**CM-** (n = 1036)	**Statistics** χ^2 / F	**p ≤**
Women, %	51.9	50.9	52.2	0.195	.659
Age, years	51.2 ± 13.1	53.2 ± 12.5	50.5 ± 13.2	11.354	.001
Marital status, %				4.785	.091
Never married	14.3	14.0	14.4		
Married	71.0	67.7	72.1		
Separated, divorced, widowed	14.7	18.3	13.5		
School education, %				28.628	.001
≤ 9 years	28.1	38.9	24.4		
10 years	50.1	44.9	51.8		
≥ 11 years	21.9	16.3	23.7		
Smoking status, %				0.018	.894
Never or former	76.3	76.0	76.4		
Current	23.7	24.0	23.6		
Height, cm	169.9 ± 9.0	169.0 ± 8.6	170.2 ± 9.1	5.072	.024

Table 2. Comparison of physician diagnosed asthma/chronic bronchitis, medication use, and self-reported signs and symptoms[#] of obstructive lung disease between participants with (CM+) and without (CM-) histories of childhood maltreatment

	CM+ (n = 350)	**CM-** (n = 1036)	**Statistics** AOR (95% CI)
Asthma/ chronic bronchitis (%)	7.7	4.6	1.59 (0.97-2.62)
Medication $_{\text{(ATC code R03)}}$ (%)	6.0	3.3	1.90 (1.08-3.34)*
Wheeze without having a cold (%)	6.3	2.4	2.62 (1.43-4.82)**
Woken with chest tightness (%)	7.4	4.2	1.88 (1.12-3.14)*
Woken with shortness of breath (%)	3.4	2.0	1.70 (0.82-3.54)
Woken by an attack of coughing (%)	9.9	6.7	1.39 (0.90-2.16)
Asthma attack (%)	2.3	0.6	4.07 (1.35-12.23)*

[#] within the last 12 months prior to the interview

AOR: adjusted odds ratio; CI: confidence interval, ATC: Anatomical Therapeutic Chemical classification

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Table 3. Comparison of pulmonary function testing between participants with (CM+) and without (CM-) histories of childhood maltreatment

	CM+	**CM-**	**Statistics**			**ES**	
	(n = 350)	(n = 1036)	B	95% CI	p	d	95% CI
FEV1, l	3.20 ± 0.85	3.38 ± 0.88	-.048	-.11/.01	.108	-.06	-.18/.07
FVC, l	3.78 ± 0.98	3.98 ± 1.02	-.052	-.12/.01	.119	-.05	-.17/.07
PEF, l/ min	7.17 ± 2.04	7.50 ± 2.04	-.122	-.28/.04	.128	-.06	-.18/.06
FEV1/ FVC, %	84.8 ± 6.4	85.1 ± 6.0	-.060	-.80/.68	.873	-.01	-.13/.11
FEV1, % pred (GLI)	100.7 ± 15.1	102.4 ± 14.2	-1.465	-3.23/.30	.103	-.10	-.22/.02
FVC, % pred (GLI)	94.2 ± 13.0	95.9 ± 12.6	-1.452	-3.00/.10	.067	-.11	-.24/.01
			AOR	95% CI	p		
AL (fixed ratio), %	1.4	1.6	0.80	0.29;2.21	.664		
AL (GLI-LLN), %	1.4	1.0	1.43	0.48;4.30	.526		

FEV1: forced expiratory volume in one second; FVC: forced vital capacity; PEF: peak expiratory flow; FEV1, % pred (GLI): % of predicted FEV1 values according to the GLI equation; FVC, % pred (GLI): % predicted FVC values according to the GLI equation; AL (fixed ratio): airflow limitation as defined by the fixed ratio of FEV1/ FVC < 70%; GLI-LLN: Global Lung Function Initiative lower limit of normal; AL (GLI-LLN): airflow limitation as defined by FEV1/ FVC values below the 5^{th} percentile according to the equations of the Global Lung Function Initiative

B: unstandardized regression coefficient; AOR: adjusted odds ratio; CI: confidence interval; ES: data on effect sizes; d: point estimate of effect size

Table 4. Differential association between absolute values of FEV1, FVC, PEF, FEV1/ FVC and types of childhood maltreatment (stepwise linear regression analyses)

	FEV1, l		**FVC, l**		**PEF, l/ min**		**FEV1/ FVC**	
	ΔR^2	**B (95% CI)**	**ΔR^2**	**B (95% CI)**	**ΔR^2**	**B (95% CI)**	**ΔR^2**	**B (95% CI)**
Step 1	.715***		.733***		.614***		.081***	
Step 2	.001		.001		.002		.002	
Sexual abuse		-.008 (-.03/.01)		-.005(-.03/.02)		-.020 (-.07/.03)		-.086 (-.32/.14)
Physical abuse		.001 (-.02/.02)		.003-.02/.02)		.028 (-.02/.07)		-.056 (-.27/.15)
Emotional abuse		-.003 (-.02/.01)		-.007 (.02/.01)		-.005 (-.04/.03)		.117 (-.06/.30)
Physical neglect		-.012 (-.03/.00)		-.012 (-.03/.00)		-.038 (-.07/.00)*		-.060 (-.22/.10)
Emotional neglect		.003 (-.01/.01)		.002 (-.01/.01)		-.001 (-.02/.02)		.028 (-.07/.13)

FEV1: forced expiratory volume in one second; FVC: forced vital capacity; PEF: peak expiratory flow; B: unstandardized regression coefficient; CI: confidence interval

Step 1: Inclusion of age, sex, height, marital status, educational level, smoking, self-reported asthma/ bronchitis, medication (ATC code R03); Step 2: Additional inclusion of the CTQ subscales

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$

Table S1. Differential association between percentage of predicted values (GLI) of FEV1 and of FVC and types of childhood maltreatment (stepwise linear regression analyses)

	FEV1, % pred (GLI)		**FVC, % pred (GLI)**	
	ΔR^2	**B (95% CI)**	**ΔR^2**	**B (95% CI)**
Step 1	.044***		.021***	
Step 2	.004		.004	
Sexual abuse		-.024 (-.79/.30)6		-.096 (-.58/.39)
Physical abuse		.001 (-.50/.49)		.002 (-.44/.44)
Emotional abuse		-.088 (-.51/.33)		-.070 (-.44/.30)
Physical neglect		-.350 (-.72/.02)		-.321 (-.65/.01)
Emotional neglect		.108 (-.13/.34)		.046 (-.16/.25)

FEV1: forced expiratory volume in one second; FVC: forced vital capacity; B: unstandardized regression coefficient; CI: confidence interval

Step 1: Inclusion of marital status, educational level, smoking, self-reported asthma/ bronchitis, medication (ATC code R03); Step 2: Additional inclusion of the dimensional CTQ subscales

* $p \leq .05$ ** $p \leq .01$ *** $p \leq .001$