

Teaching - an Occupational Hazard for Respiratory Insult contributing to the burden of respiratory diseases in the society

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Introduction

According to the Global burden of Disease Studies in 2015, COPD and asthma ranked among the top 20 conditions causing disability globally and were ranked 8th and 23rd, respectively, as causes of disease burden when measured by disability-adjusted life years⁽¹⁾
Lung India carries a study on cost of asthma treatment in a private healthcare facility in South India, where the annual cost of asthma treatment has been calculated to be 18,737 INR. The economic burden of asthma can be decreased with access to preventive care, early treatment, and use of primary care health providers instead of emergency departments⁽²⁾
The cause for the rise in asthma incidence may be attributed to many factors like environment, occupation, lifestyle, etc. Traditional teaching with chalk and black board is still used in many schools and colleges in developing countries like India. Teachers are exposed to chalk dust in the class rooms as they are in close proximity to the black board⁽¹⁾. Chalk dust is a major source of particulate matter in the class rooms⁽³⁾
Chalk dust particles size decide the responsive reaction in the respiratory tract and the damage⁽⁴⁾
>10-15µm in diameter – settle in Upper airway, stimulates sensory nerve reflexes cause inflammation, mucus production, cough and sneezing in an effort to clear the lungs of the particles⁽⁵⁾ <10 µm in size are deposited in the alveoli⁽⁶⁾

Our aim of doing this project was to capture the cohort contributed by occupational exposure to chalk for respiratory damage (Respiratory diseases) and to suggest the preventive methods to reduce this contribution to the GBD due to respiratory illnesses.

Conclusion

In this study we found that teachers are exposed to chalk dust as an occupational hazard. The chalk dust contains many of the heavy metals predominantly Aluminium which is a potent respiratory irritant. **Aluminium was in excess quantity in color chalk**. The recently introduced **Dustless chalk is not the solution as is evident by the aluminium present (248.7 mg/kg) in them is more than the traditional chalk (242.9 mg/kg)**

Teachers mostly use either public transport or private vehicles like scooter that **exposed them to environmental pollutants of the air** which is high in countries like India because of vehicular emissions. **Hence there is a dual exposures (Both occupational & environmental).**

Small airway damage (as captured by the FEV1 25-75) was high in our study population. The odds of developing airway damage was more if the teachers had more exposure (OR =12.9) if they suffer from "Atopy" (OR=2.82)/ co-morbid conditions (OR= 1.19) / and if they are Obese (OR=1.3).

If we wanted to reduce the cohort of teachers contributing to the burden of asthma and COPD (in future) we should have controls in place for reducing the chalk exposures. **Hence we have to replace white board & chalk by digital boards or we must ask the teachers to use PPE like face masks (N95) as a last resort.**

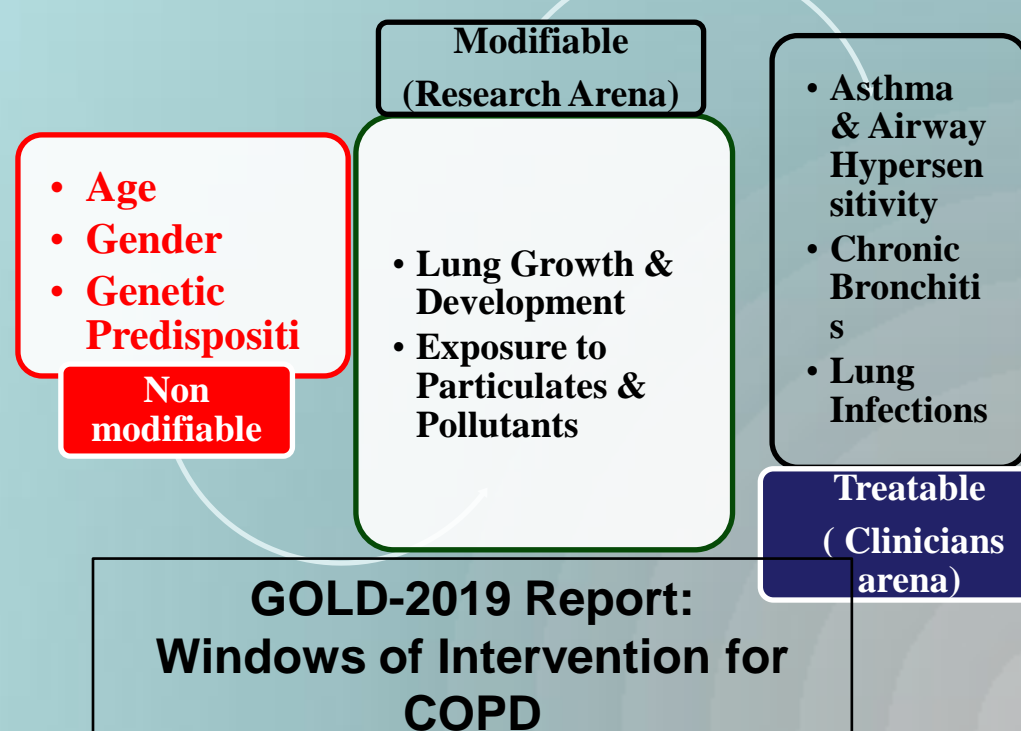
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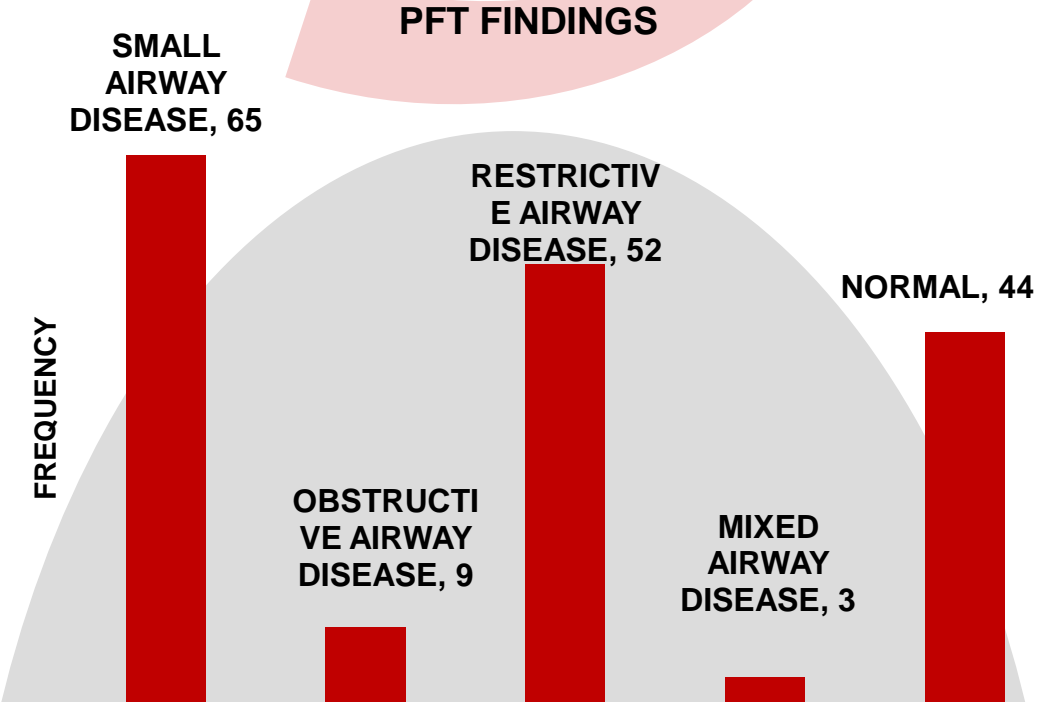
Materials & Methods

1. School teachers from 4 different schools (3 urban and 1 rural) were recruited. All the teachers working in these schools were taken into the study. After explaining the purpose of evaluation they were administered the modified MRC Respiratory questionnaire to capture the experience in teaching / number of hours of teaching per day/ mode of travel to school/ H/O Atopy in the family.
2. They were clinically examined by a physician to find the status of the lungs and other systems.
3. Spirometry was performed as per ATS/ERS PROTOCOL for SPIROMETRY 1988 using "easy on- PC spirometer nnd Medizintechnik AGZurich,Switzerland" that uses ultrasonic sensor.
4. Blood was drawn for Absolute Eosinophil Count analysis.
5. Chalk pieces were collected from the schools –for Chemical Analysis
6. Results were analyzed using R statistical package

Justification for the study



Results



Results

Table 2. CHALK ANALYSIS REPORT

TEST REPORT	Dustless Chalk White	White chalk	Colour Chalk Dr. Mishal Divya Sri Sai scan
Sample NO.	EN19030009-01	EN19030009-02	EN19030009-03
Unit	mg/kg	mg/kg	mg/kg
Boron as B	1.6	7.52	5.36
Aluminium as Al	248.77	242.97	483.26
Vanadium as V	3.35	1.1	1.48
Chromium as Cr	1.10	2.33	1.92
Manganese as Mn	57.93	51.76	18.85
Iron as Fe	1161.57	456.73	534.74
Cobalt as Co	0.65	0.99	0.48
Nickel as Ni	7.23	5.57	6.64
Copper as Cu	1.06	2.29	5.05
Zinc as Zn	4.16	BDL(DL:0.01)	7.74
Arsenic as As	0.68	0.42	0.54
Selenium as Se	0.02	BDL(DL:0.01)	BDL(DL:0.01)
Molybdenum as Mo	BDL(DL:0.01)	0.20	0.45
Cadmium as Cd	0.01	0.02	0.02
Tin as Sn	BDL(DL:0.01)	BDL(DL:0.01)	0.02
Mercury as Hg	BDL(DL:0.01)	BDL(DL:0.01)	BDL(DL:0.01)
Lead as Pb	1.33	0.54	2.84

Table 1. Descriptive statistics

	Age	BMI	Eosinophils	Experience	Working hours	FET	%Pred.FVC	% Pred. FEV1	% Pred. FV1/FVC	%PRED.FEF25-75
Mean	41.46	26.518	224.59	11.918	3.739	5.358	84.88	80.843	97.236	68.684
Median	42	25.99	200	11	4	5.5	84	81	99	66
SD	10.73	4.467	200.179	8.723	1.77	2.163	19.36	16.047	11.885	29.807
Range - lowest	22	16.384	0	0	1	0.93	1.6	34	50	7
highest	78	46.617	1160	40	8	14.17	160	127	125	147
Quantiles-0%	22	16.384	0	0	1	0.93	1.6	34	50	7
Quantiles-25%	33	23.875	70	5	2	4.09	74	71	93	48
Quantiles-50%	42	25.99	200	11	4	5.5	84	81	99	66
Quantiles-75%	49	29.296	320	17	5	6.3	95	93	103	90
Quantiles-100%	78	46.617	1160	40	8	14.7	160	127	125	147

	PFT findings		OR
	Normal	Abnormal	
Age	<= 30 yrs	7	0.79
	> 30 yrs	37	
BMI	18.5-24.9	17	1.3
	<18.5, >=25	27	
ATOPY	0	39	2.82
	1	5	
FamASTHM	0	40	0.83
	1	4	
PerASTHM	0	36	0.61
	1	8	
COMORBIDITIES	0	40	1.19
	1	4	
EOSINOPHILS	0	11	0.75
	1	2	
TRAVEL BY	0	10	3.13
	1	34	
NUMBER OF YEARS	<=15	29	0.71
	>15	15	
HOURS PER DAY	<=5	43	12.9
	>5	1	

Table 3. PEARSON CORRELATION TEST

	AGE	BMI	NO. OF YRS	HRS PER DAY	EOSINOPHILS	COMORBIDITIES
P VALUE	0.258	0.239	0.366	0.621	0.534	0.632
T VALUE	-1.071	-1.18	-0.906	-0.494	-0.623	-0.478
CORRELATION	-0.081	-0.089	-0.069	-0.037	-0.054	-0.036
P VALUE	0.019	0.909	0.939	0.454	0.597	0.751
T VALUE	2.364	-0.114	-0.076	-0.75	-0.529	-0.317
CORRELATION	0.177	-0.008	-0.005	-0.057	-0.046	-0.024
P VALUE	0.645	0.002	0.139	0.056	0.246	0.48
T VALUE	0.46	-0.971	-1.483	-1.92	-1.165	-0.706
CORRELATION	0.035	-0.074	-0.113	-0.145	-0.101	-0.054
P VALUE	0.646	0.746	0.061	0.084	0.19	0.151
T VALUE	0.459	0.323	-1.882	-1.734	-1.316	-1.439
CORRELATION	0.035	0.024	-0.143	-0.132	-0.115	-0.11