



ПУЛЬМОНОЛОГИЯ PULMONOLOGY

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RESEARCH ARTICLE
НАУЧНАЯ СТАТЬЯ

Respiratory health evaluation of construction workers using questionnaire

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Abstract. Relevance. With growing economy and flourishing construction industries the comorbidities among construction workers are also raised. They are exposed to various dust, fumes, noxious gases and vapours making them susceptible to chronic airway diseases like Chronic Obstructive Lung Disease. *The aim of the study* was to evaluate the respiratory health status of construction workers in an unorganised sector. *Materials and Methods.* The data collected from National Capital of Delhi region in an unorganised sector of construction workers by using a Saint George Respiratory Questionnaire by the Institute of Occupational Health and Environmental research, Basaidarapur, Delhi, India. All the participant response was noted and the answers were evaluated to see respiratory health status of workers. Total 200 workers were evaluated. Total 182 males and 18 female participated in the study. *Results and Discussion.* 25% of workers reported poor health at the time of the survey, while only 4% of workers considered their health to be very good. Among the main complaints were indicated: cough, sputum production, shortness of breath, chest infections, attacks of wheezing. The overall mean of Saint George Respiratory Questionnaire core was 33.55. It increases with the working period in the construction field with 21.6% for <10years and 49.1 for >30years experienced workers, while workers with 11 to 20 years of experience, the score was 28.4. The Saint George Respiratory Questionnaire score was 35.1 in 21-30 years of experienced construction workers. *Conclusion.* As a result of the study, construction workers are found to be at high risk of various respiratory diseases and related disabilities. Participants in this study did not receive any

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treatment for respiratory problems at any clinic. This means the importance of occupational health education and the use of personal protective equipment and safe working conditions for construction workers.

Key words: construction worker, vapour, gas, dust, fumes, respiratory diseases, Saint George Respiratory Questionnaire

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Introduction

With growing economy and development of infrastructure, the construction industry is growing at rapid pace and co-morbidities among workers are also raised. Construction workers are consistently exposed to noxious gases, fumes, vapours and dust (VDGF). The cement generally used in construction is called as portland cement which contains many other chemicals apart from silica dust, one of the particulate responsible for the silicosis and a potential carcinogenic agent [1]. The construction workers are exposed to various solvents while painting and waterproofing. These vapours are not only neurotoxic but also cause airway abnormality apart from their malignant potential [2—4]. The exposure to solvent, welding fumes have variable effect from mild symptoms like rhinitis to autonomic dysfunction as well as respiratory airway disease [5, 6]. The welding fumes also contain gases like ozone, nitrogen oxide, carbon monoxide significantly affecting human health directly due to inhalation of gases and indirectly due to greenhouse effect of the emissions [7]. The construction workers constitute a group of workforce encompassing the construction labourers, painters, plasterers, welders, craftsman working with stone and bricks, tile installer, carpenter etc. Apart from the

VDGF exposure they are continuously exposed to heat, vibrations, and poor ventilation at workplace moreover, working in ergonomically unsuitable conditions makes them susceptible to musculoskeletal manifestations. The respiratory manifestations in construction workers ranges from small airway diseases, Chronic obstructive Lung Disease, Occupational asthma, interstitial lung diseases (ILD), bronchiectasis to malignancies like mesothelioma among roof installers exposed to asbestos dust [8—11]. The contribution of occupational diseases in the causation of chronic obstructive lung diseases (COPD) is approximately 15 % [12]. Despite advancement in technical aspects in construction industry, with introduction of automatic machines for painting, prefabricated construction with availability of personal protective equipment for the spectrum of construction professionals, the incidence of the morbidity is decreased but the other side of the story is the construction workers under umbrella of unorganised sector, where these modern technical amenities are sparse and this applies to the organised sector as well. The best way to prevent this is early detection and treatment.

The Saint Georges Respiratory Questionnaire (SGRQ) is for present health status of person with airway disease [13]. The prevalence of respiratory

symptoms was documented as high as 60 % in one study in construction workers [14]. The rationale behind the use of SGRQ questionnaire was to see the prevalence of respiratory complaints among construction workers in an unorganised sector. Since workers in unorganised sector have to depend on public health sector/private for their healthcare needs which is already overwhelmed with numbers. So the data pertaining to occupational induced respiratory disorders are sparse. To add to this is poor training pertaining to occupational health and time constraints makes healthcare worker at disadvantageous position.

Materials and Methods

This is a prospective observation study conducted between March 2019 to September 2019. The data was collected from construction worker by the Institute of Occupational Health and Environmental Research (IOHER), Basaidarapur, Delhi, India. All patients voluntary gave informed consent to participate in the study according to the Helsinki Declaration of the World Medical Association (WMA Declaration of Helsinki — Ethical Principles for Medical Research Involving Human Subjects, 2013) and personal data processing. The study was designed to assess the respiratory symptoms problem among construction workers who were exposing to various vapour, gas, dust and fumes at construction sites. The sample size of study was calculated with the help of online software. With confidence level of 90 % and confidence interval of 5 % in total populations of 700 construction workers in the study location, the calculated sample size was 196. We enrolled 240 consecutive workers for Saint George Respiratory Questionnaire (SGRQ). A Hindi Validated Saint George Respiratory Questionnaire (SGRQ) was used [15]. The SGRQ total score ranges from 0 to 100 and higher the score means more limitation in function.

The written consent from each worker for study participation was taken at the time of registration after explaining the detail of study and their willingness. Eleven patients refused for written consent were excluded from study. The study included construction workers with age of more than 18 years with history

of working in construction industry for at least 5 years i.e. participants were at least 23 year on the date of the study. There should also be history of exposure to vapour, gas, dust and fumes in combination or at least to one for 5 years. The workers with co-morbidities, which may have impaired the SGRQ score like Hypertension, Diabetes, Cardiovascular disease, chronic respiratory disease, thyroid disorders, obesity and persons with physical deformity were excluded from the study. All the participants had their primary education up to 5th standard hence all forms including SGRQ were filled by the participants only. Only briefing about the nature of questionnaire was explained to all the participants by one surveyor. In case, patient is unable to understand the question, it was explained to him/her in detail in Hindi by the questionnaire administrator.

Along with the SGRQ, all the enrolled workers demographic profile was also noted including age, sex, state they belong to, smoking habits, history of alcohol intake, tobacco intake, history of previous comorbidities, nature of job and duration of job, hours of duty/week and present place of stay. The enrolled worker also undergone for anthropometric data with Pulse, blood pressure along with systemic examination to rule out any asymmetry, deformity in alignment and posture.

Data collection

The Hindi translated and validated SGRQ questionnaire was given to all the participants. All the participants were from age between 23–65 years (age wise distribution: Fig.1). The nature of job of participants is depicted in Figure 2. The questionnaire was validated for 12 month recall period originally and it is then also validated for 3 months and 1 month's recall period [16].

Statistical analysis

The statistical analysis was done using SPSS software 21.0 and the level of confidence was set to 5 %. The response rate was recorded 100 %. Continuous data is presented as mean with standard deviation or median and inter-quartile range (due to extreme values) and categorical data is presented as percentages. Descriptive data is presented as bar diagram.

Results and discussion

Total 200 workers were enrolled and evaluated. Total 182 males and 18 female participated in study. More than half (55 %) of the participants were smoker. The mean age of participants, age group, total work experience, working hours with other demography is mentioned at Fig. 1 and Table 1. About 65 % of participants were living in the same construction site moreover their kitchen and living room was same.

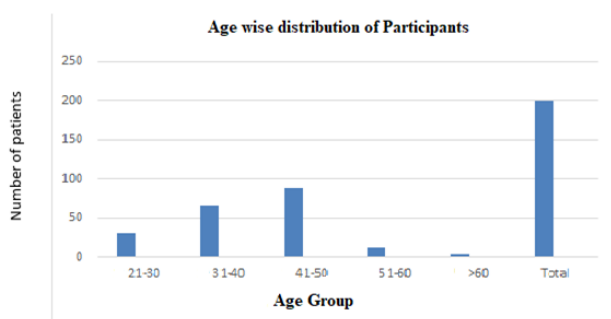


Fig. 1. Age wise distribution of participants

Table 1.

Demographic profile of the participants

Parameters	Mean ± SD/N%	Median	Min-Max
Age	40.53 ± 9.45	42	21–65
Male	182(91 %)	-	-
Female	18(9 %)	-	-
Duration of smoking	16.34 ± 7.98	16	2–30
Working experience	18.66 ± 8.67	20	0.5–35

The overall mean SGRQ score of all participants was 33.55. It increased with the period of working in the construction field with the score 21.6 for workers with <10 years' experience to 49.1 in workers with >30years of exposure to construction industry. As the duration of work experience increased, the SGRQ score was also increased. In workers with 11 to 20 years of experience as a construction worker, the score was 28.4. The SGRQ score was 35.1 in 21 to 30 years of exposure group of construction workers. Stratification

according to the job profile and SGRQ score is depicted in Fig. 2, Fig. 3 and Table 2.

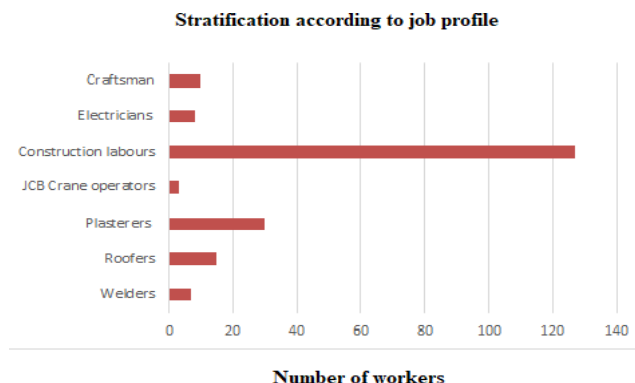


Fig. 2. Job profile of participants

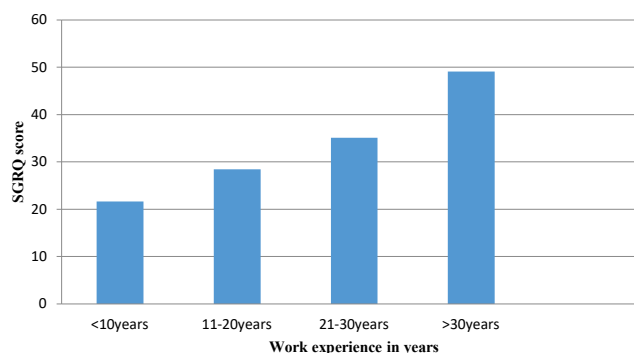


Fig. 3. SGRQ score of participants according to work experience

Table 2.

SGRQ Scores in relation with work experience

Work experience	≤10 years	11–20 years	21–30 years	≥31 years
SGRQ Scores	21.6	28.4	35.1	49.1

In the Part I of SGRQ questionnaire, 25 % of workers described themselves in the bad status of health at the time of the study, while only 4 % workers felt that they were at very good status of health. 34 % of workers complained of cough on most of the days in the preceding one month follow by 25 % had cough only when they had chest infections while 23 % did have cough on a few days a month and 18 % did not had cough at all. For phlegm complaints, 30 % of

workers were symptomatic on most of the days in a month and 28 % had phlegm complaints while had chest infections while 22 % had no such feature with 20 % had phlegm complaints on few days a week. Breathlessness was present in 22 % of workers on most of the days follow by 7 % workers during chest infection whereas 57 % of workers had no such symptoms while 14 % participants had breathlessness on few days in a week. The wheezing attacks was noted in 26 % of cases on most of the days, 25 % during chest infection and no such manifestation in preceding one month in 32 % of workers while 17 % had breathlessness on few days in a week. About 19 % of cases had 3 episode of chest related problems while 2 % had more than 3 episodes, 14 % had 2 episodes, 15 % had 1 episode of chest trouble while 50 % participants had no episodes of chest related problems. When it was about the worst attack of chest trouble, it was seen in 51 % of workers for less than 1 day, in 25 % of workers for 1 or 2 day, in 22 % for 3 days or more follow by 1 week or more in 2 % of individuals. Nearly 16 % subjects felt that every day was a good day in the last month while 41 % felt that every day was nearly good whereas 30 % experienced 3 or 4 good days, 9 % participants felt that they had 1 or 2 good days and 4 % felt no good days in the preceding month.

The limitation of our study is unavailability of pulmonary function tests reports of the participants.

The construction workers constitute a significant proportion of unorganised sector, which is the 2nd largest workforce in the world [17]. The morbidity among construction workers varies from psychological distress, musculoskeletal disorder, airway disease [18, 19]. The continuous exposure to hazardous vapours, gases, fumes and dust leads to airway abnormality moreover, the workers living in the same premises after working hours are exposed to local environmental pollution affecting their health on top of the working exposure effect, like in our case, 65 % of participants were living, where kitchen and living room was same.

The cement dust contains various chemicals like calcium oxide, silicon oxide, aluminium trioxide, ferric oxide, magnesium oxide and the role of these toxins in the causation of airway disease is well known [20,

21]. The construction labour gets exposed to the cement dust while unloading or emptying of cement bags apart from muscular sprains and strains while lifting these bags. The chemical in the cement has irritant and Pneumoconiotic properties [22]. The dust size of cement particle is 0.5–55 micron [23]. The particles of size less than 5 microns can reach the tertiary bronchus and alveoli and initiates inflammatory response. The bigger size particles get trapped in the airways and causes irritation and local inflammatory response manifesting as wheezing or chest heaviness as in our case, 15.56 % (n=14) non-smoker and 34.55 % (n=38) smoker were having wheezing on most of the days in the preceding month from the date of study [24].

The plasterers are involved in the plastering of wall to make finished surface. Their nature of work exposes them to physical, chemical hazards apart from injury due to ergonomically unsuitable working positions like working at heights. The Chemical hazards include the contact of cement with the skin causing dermatitis, eczema due to the chromates or dust induced lung disease [25]. The plaster of Paris (POP) and cement both acts as respiratory epithelium irritant and it may also contain less than 5 % of crystalline silica, which on overexposure cause silicosis and cases pertaining to silica dust exposure and its lung manifestation are well documented [26]. The Physical hazards are due to the working at extreme of temperatures or exposure to noise from the tools apart from the risk of musculoskeletal injuries from working at heights due to fall or slip. Apart from construction labour and plasterers, roofers also are exposed to cement dust and POP. Though asbestos roofs are scarce now but in maintenance of old constructed premises, roofers may get exposed. The manifestation of asbestosis ranges from Pleural plaques, pleural thickening, Interstitial lung disease (ILD) to malignancy [27].

Welders job profile is one of the challenging professions. It includes Pipe welding, window or door grill installation, duct installation. Welders are exposed to welding fumes apart from the local environmental pollution. Welding fumes exposure not only cause airway disease but also manifest with autonomic dysfunction [28, 29]. The gases emitting from welding

can cause pulmonary oedema and obstructive lung disease apart from greenhouse effects [30, 31].

Conclusion

The participants of this questionnaire-based study were not on any treatment from any clinic/hospital for their respiratory ailment. This signifies the reality of unorganised sectors encompassing the construction workers and the importance of occupational health education and use of personal protective equipment and safe working environment are immediate things to be addressed. The high SGRQ score in relation with total work experience have positive correlation. Our study also signifies incidence of respiratory symptoms in the construction workers, providing evidence of occupational contribution in the respiratory disease. The scenario like in our case could just be tip of iceberg and actual condition need to be investigated further.

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Оценка состояния респираторного тракта строителей с помощью анкетирования

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Аннотация. *Актуальность.* С ростом экономики и развитием отрасли строительства увеличивается количество сопутствующих заболеваний среди строительных рабочих: они подвергаются воздействию различной пыли, дыма, ядовитых газов и паров, что делает их восприимчивыми к хроническим заболеваниям дыхательных путей, таким как хроническая обструктивная болезнь легких. *Целью исследования была* оценка состояния респираторного здоровья рабочих-строителей в частном секторе. *Материалы и методы.* Данные, собранные в столичном регионе Дели в неорганизованном секторе строительных рабочих с помощью опросника респираторных заболеваний Святого Георгия, проведенного Институтом исследований в области гигиены труда и окружающей среды, Басайдарапур, Дели, Индия. Все ответы участников были записаны, и ответы были оценены, чтобы увидеть состояние респираторного здоровья рабочих. Всего было оценено 200 рабочих. Всего в исследовании приняли участие 182 мужчины и 18 женщин. *Результаты и обсуждение.* 25 % рабочих указали на плохое состояние здоровья на момент исследования, в то время как только 4 % рабочих считали, что состояние их здоровья очень хорошее. Среди основных жалоб указывались: кашель, выделение мокроты, одышка, инфекции грудной клетки, приступы свистящего дыхания. Общий средний балл опросника респираторных заболеваний Святого Георгия составил 33,55. Он увеличивается с периодом работы в строительной сфере с 21,6 % для <10 лет и 49,1 для >30-летних опытных рабочих, в то время как у рабочих со стажем от 11 до 20 лет показатель составил 28,4. Оценка опросника респираторных заболеваний Святого Георгия составила 35,1 у строителей со стажем 21—30 лет. *Выводы.* В результате исследования обнаружено, что строители подвергаются высокому риску различных заболеваний дыхательных путей и связанной с ними инвалидности. Участники данного исследования не получали никакого лечения респираторных заболеваний ни в одной клинике. Это означает важность просвещения по вопросам гигиены труда и использования средств индивидуальной защиты и безопасных условий труда строительных рабочих.

Ключевые слова: строитель, неорганизованный сектор, пар, газ, пыль, дым, респираторные заболевания, опросник респираторных заболеваний Святого Георгия

Вклад авторов. У.К. Оджда, О.К. Чоудхари — разработка дизайна исследования; С. Спалгаис, А. Ранджан, О.К. Чоудхари — сбор данных; У.К. Оджда, С. Спалгаис, А. Ranjan, О.К. Чоудхари — анализ и интерпретация результатов; У.К. Оджда, С. Спалгаис, А. Ранджан, О.К. Чоудхари — написание черновика рукописи. Все авторы рассмотрели проект и одобрили окончательный вариант рукописи.

Информация о конфликте интересов. Авторы объявили, что нет никаких конфликтов интересов.

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