Journal of Respiratory Medicine

Case Report Open Access

# Respiratory Morbidity Definitions of the Outcome Variables

**Francesco B***

*Department of Medical and Surgical Sciences, Institute of Neurology, Catanzaro, Italy*

**Abstract**

The monetary compensation for work related diseases and deaths have increased twenty threefold from 1961 to 1997. COPD and asthma represented 87 percentage and 5 percentage of work related non-malignant respiratory disease mortality in the country and a population attributable fraction of 14 percentages and 5 percentages respectively.

**Keywords:** Poultry sectors; Healthy years; Global health; Production sites; Volume needed; Nasal cavity

## Introduction

The pattern of occupational morbidity also differs from the global scenario. In contrast to musculoskeletal diseases being the top on the global burden, occupational lung diseases form the majority of the work related morbidity in India. This is mainly in the form of occupational asthma and COPD followed by occupational cancers, cardiovascular diseases, reproductive disorders, neurotoxicity; noise induced hearing loss, skin and psychological disorder [1]. The risk factors for non-malignant respiratory diseases among the workers in India are mostly in the form of exposure to particulates or dusts. It is also evident that dust related exposure is the main underlying factor for silicosis, asbestosis, agricultural and poultry-sectors. Silicosis prevalence is 6.2 to 54.6 percentage, asbestosis 3 to 21 percentages and bysinosis 28-47 percentage across the dusty occupations. There is sex based difference noted, Males had five times greater loss of healthy years and deaths compared to females. However this difference may be attributed to the gender based division of work – women mainly doing domestic chores or home based occupations but men in outdoor occupations and also riskier jobs. The major male work force is in formal sector and females in unorganised informal sector for which accurate data or monitoring is not available [2]. This requires further exploration. Occupational Health in India The occupational health which was long ignored in India was one of the components of the National Health Policy 1983 and also included in National Health Policy 2002. But very few steps were taken to mitigate the effect of occupational disease through proper programme. Hence the National Programme for Control & Treatment of Occupational Diseases was launched in 1998-99, with WHO Global occupational health for all strategies and activities in the action plan. It was followed by a National Policy on Safety, Health and Environment at Work Place guideline issued by Ministry of Labour. There has been major research in the dusty occupations in India since then, in agriculture, poultry, asbestos industry, quarry, mining and few in construction. However the cement industry in India is the backbone of the construction sector, which is the second largest employer after agriculture [3].

## Methodology

The exposure to dust levels is very low in the construction sites, compared to cement production sites. But due to reasons not known, the cement sector has been totally ignored in research. India is the world's second largest producer of cement after China. Indian cement industry has outpaced the growth rates of other prominent industries [4]. The recent decadal development of special economic zones, rising demand from the housing sector, increased activity in infrastructure spending, continuous industrial expansion, highways and road development increased the volume needed. The cement production in the country is projected to grow at an annual growth rate of around 12% during 2011-12 to2013-14 to reach 303 Million Metric Tons. The cement-manufacturing sector has about 140 Major and 352 smaller plants, mostly concentrated in the south. The majority of production is by private sector companies and the share of public/Government sector is only marginal at six percentages. Most of these units are concentrated in the south [5]. Tamilnadu, one of the southern states is fifth largest producer among all states. This distribution is reflective of the availability of limestone which is the raw material for production and proximity to coal mines which is the energy source and another raw material [6]. The industry employs 1, 35,000 workers in major units excluding the smaller units. The contractual, non-regular employees are not included above whose numbers may far exceed regular employees. They might be subject to rigors of under wages, overwork schedule and other socio-economic inequities. The trend of urban migration for employment in this industry is also noteworthy. It is attributed to government sector ceasing its recruitment and downsizing the workforce [7]. The entry of foreign companies since the 2000 and their slow monopoly of the industry in the northern states have further worsened the scenario with many uncertainties for the workers. The outsourcing helps the foreign companies in procuring cheap labour at 1/30th wages paid in their countries [8]. The recent developments in Chhattisgarh are evidence to these. Despite the legal norms and verdicts, justice to the workers is delayed or denied. The externalities of the cement industry to the larger ecosystem have been subject of review and research in the country that have proved the pollution of neighbouring-environment and adverse health outcomes in the nearby communities as shown in (Figure 1). But the studies looking at workplace and workforce related morbidities of the cement producing units in India have not been done. This is revealed by the unavailability of the literature after extensive searches. However there are sufficient studies done in developing countries like United Arab Emirates, Iran, Saudi Arabia, African and Latin American nations that have proved the whole spectrum of illnesses in cement industrial workers. The primary organ affected is the respiratory system which is very conclusive from researches done so far. It is much needed to study the respiratory morbidity among the Indian cement industrial

***Corresponding author:** Francesco Bono, Department of Medical and Surgical Sciences, Institute of Neurology, Catanzaro, Italy, Email: Francesco@gmail.com

**Received:** 27-Jun-2023, Manuscript No. JRM-23-108273; **Editor assigned:** 30-Jun-2023, PreQC No. JRM-23-108273(PQ); **Reviewed:** 14-Jul-2023, QC No. JRM-23-108273; **Revised:** 19-Jul-2023, Manuscript No. JRM-23-108273 (R); **Published:** 26-Jul-2023, DOI: 10.4172/jrm.1000169

**Citation:** Bono F (2023) Respiratory Morbidity Definitions of the Outcome Variables. J Respir Med 5: 169.

**Figure 1:** Neighbouring-environment and adverse health outcomes.

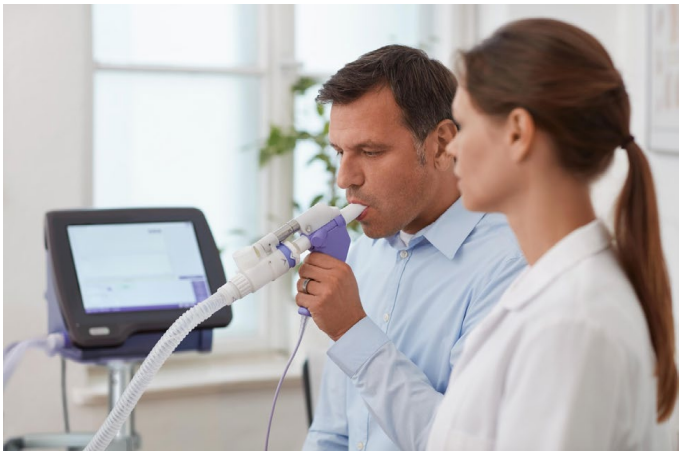

**Figure 2:** Inhalation through nasal or oral cavity.

workers exposed to dust in the backdrop of the various socio- economic-political situations existing here, which have been briefly discussed in this background section. The following mechanisms aid in dealing with dust entry in human body and respiratory tract in particular. Even then 35 to 42 per cent of fine dust reaches the lungs in nose breathing and as much as 80 percentages in mouth breathing.

## Discussion

The capture and impingement in tough mucus and sub mucosal tissues, by which dust is removed in spitting, coughing, sneezing and assisted by the action of the ciliated epithelium [9]. The activity of phagocytes composed of leucocytes, endothelial cells, alveolar cells and plasma cells. The pigmentation of colorless dusts in the lung tissues which are more readily eliminated. The lymph spaces with their valvular arrangements and filtering lymph-nodes drain eventually through the bronchial walls and discharging the particles into the bronchial secretions to be expectorated. The anti-bodies against organisms. Tissue cell proliferations, fibrosis and calcification including fixation of the diaphragm and adherent pleurisy are the chronic dust response changes [10]. In short term the cement dust causes increased bronchial muscle tone and bronco-constriction due to irritant effect and at molecular level this is proved by the basic reaction at mucosal levels with high PH values. In the chronic exposure there is impairment of gaseous exchange leading to respiratory acidosis and raised bicarbonate levels [11]. Exposure is the concentration or amount of a particular agent that reaches a target organism, system, or subpopulation in a specific frequency for a defined duration. Exposure assessment is the evaluation of this exposure, of an organism, system, or subpopulation to an agent. Inhalation is the main route of entry for cement dust either through nasal or oral cavity as shown in (Figure 2). This is dependent on the particle aerodynamic diameter, air movement round the body, and breathing rate [12]. The inhaled particles may then either be deposited or exhaled again, depending on a whole range of physiological and particle-related factors. The five deposition mechanisms are sedimentation, inertial impaction, diffusion, interception, and electrostatic deposition. Sedimentation and impaction are the most important mechanisms. Skin and mucosal contact is the next common route of entry because of the chemical property of the cement to get absorbed from dermal and mucosal in to the systemic circulation and reaches lungs. Wet cement is absorbed highly. The local skin reactions are also additional effect [13]. Conjunctively absorption is commonly due to lack of protective eye wear during work resulting in conjunctivitis and ulcerations. When poor hygiene allows eating, drinking or smoking in contaminated or dusty workplaces, many inhaled particles are also swallowed and ingested, but for control and measurement purposes these are usually considered with the inhalation route. Higher the exposure to cement dust greater will be the magnitude of adverse health effect caused by it. It follows a typical sigmoid or S shaped curve for cement dust. The profound adverse effects are noted in the respiratory tract, followed by gastrointestinal and skin [14]. Hence chronicity or cumulative toxicity is an important factor. To minimize the effects various industrial and occupational hygiene bodies have specified the minimum allowed exposure limits for the cement dust. These Occupational Exposure Limits are a key element in risk management and are often incorporated in legal standards. The exposure is not uniform across different sections of same industry and also among different workers of the same section. The exposure variations within the various units of the factory are called inter unit variability. The person to person exposure variation in same unit or different units is called interpersonal variability depending on practices adopted by every worker. These facts are often overlooked by the researches that measure exposure as a single entity. Several studies have looked in detail into the occupational morbidities among workers in the cement industry. The adverse health outcomes described has been primarily respiratory followed by skin, hearing loss, gastro-intestinal, eyes, oral and injuries. The respiratory morbidity included irritation and inflammatory lung diseases like rhinitis, laryngitis, tracheas, bronchitis, pneumonitis, pulmonary oedema, chronic bronchitis, and chronic emphysema. The allergic responses are occupational asthma and extrinsic-allergicalveolitis. The pneumoconiosis diseases are interstitial and fibrotic lung diseases of which silicosis is important though rarer. The association of cement dust with respiratory impairment is proved by weakness in ventilator findings on spirometer and directly by EMG.

## Conclusion

The most controversial issue concerns whether only immunologically-mediated asthma should be considered to be occupational asthma or whether asthma arising as result of workplace exposure to irritants, or exacerbation of pre-existing asthma by work place irritants, should also be considered in the definition.

### Acknowledgement

None

### Conflict of Interest

None

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