

Research Article

Morbidities among Shipbuilding Workers in Goa: A Retrospective Record-Based Study

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A B S T R A C T

Background: Shipbuilding industry is among the heaviest and most hazardous production industries. The workers are exposed to various chemicals and physical hazards. Chronic illnesses are important among long term shipyard workers. The current study was performed to assess selected morbidities among shipbuilding workers in Goa and to suggest suitable measures to minimize the hazards.

Methods: A retrospective record-based cross-sectional study was conducted over a period of two months from November to December 2018. The data of 791 workers was obtained from OHS centre catering to the shipbuilding industries in North-Goa which conducted periodic medical check-ups of the shipbuilding workers. The data included socio-demographic details and details regarding selected morbidities among shipbuilding workers.

Result: The records of 791 workers working in shipbuilding industry was analysed. A high number of workers i.e. 216 (23.3%) were overweight. As high as 196 (24.8%) workers were hypertensive, 101 (12.8%) had diabetes, 76 (9.6%) had dyslipidaemia while 3 (0.4%) were anaemic. 40 (5.1%) had restrictive lung disease, while 9 (1.1%) had obstructive lung disease. Assessment of Audiometry reports revealed that 190 (24%) workers had mild hearing loss, 33 (4.2%) had moderate hearing loss and 14 (1.8%) had severe hearing loss.

Conclusions: Shipbuilding workers suffer from several health problems, notably, hearing impairment, visual impairment, lung conditions impairing pulmonary functions as well as lifestyle diseases like diabetes, hypertension, overweight and dyslipidaemia. Periodic medical examinations are needed for timely detection and appropriate treatment of these health conditions among the shipbuilding workers.

Keywords: Occupational Health, Non-Communicable Diseases, Visual Impairment, Hearing Impairment

Introduction

Shipbuilding industry is among the heaviest and most hazardous production industries all over the world. There is major manpower required to process production in shipyard industry, which involves different groups of workers like welders, carpenters, electricians, painters, fabricators, electroplaters, manual labourers, supervisors, loaders, still workers, etc. Their activities expose the worker to various health hazards as majority of their activities have to be carried out at heights, or in closed confined spaces along with the added risk of exposure to chemicals and metal fumes.

Shipyards workers are involved in the manufacture, repair, maintenance, and dismantling of boats and ships. The work involves activities such as welding and cutting steel, machining, plumbing, electrical work, rigging, painting, cleaning and removal of paint and other coverings, clean-up of chemical and fuel residues.¹ Workers are exposed to various chemicals (dust, asbestos, spraymist from paint, coating, solvents, thinners, metal fumes from chromate paints, oils, greases) and physical hazards (noise exposure, extreme temperatures, vibration, awkward body positions, and the risk of musculoskeletal injuries).

Chronic illnesses are important among long term shipyard workers. Of particular concern are the respiratory illnesses caused by smoke and fume inhalation and exposure to heavy metals, such as lead. Excess cancer morbidity has been detected in among shipyard workers, especially cancers of the respiratory system, with welders appearing to be at particular risk.^{2,3} These workers are predisposed to various respiratory problems, cardiovascular disorders, ocular problems, noise induced hearing loss, etc. Our study was performed with an aim of assessing selected morbidities among shipbuilding workers in Goa and to suggest suitable recommendations to minimize the hazards, reduce morbidities and enhance productivity.

Methods

Our retrospective record-based cross-sectional study was conducted over a period of two months from November to December 2018. The study was commenced after obtaining approval from the Institutional Ethics Committee of Goa Medical College.

Records of 791 workers were collected from an Occupational Health Service (OHS) centre which is associated with the various shipbuilding firms in North-Goa. This OHS centre conducted periodic medical check-ups of the shipbuilding workers of various categories. The data included socio-demographic details of the workers and details of periodic medical check-up including anthropometry (height, weight), blood pressure measurements, routine blood investigation

reports (haemoglobin, fasting blood glucose, post-prandial blood glucose, lipid profile), vision testing (far vision, near vision and colour vision), ECG reports, Lung Function Tests, chest X-ray findings and audiometry readings.

The data was entered and analysed in SPSS Version 22. The results were presented using tables and figures along with charts and figures. Chi-square test was used to assess association between qualitative variables.

The study variables were classified as follows:

1. Hypertension: History of hypertension or Systolic BP > 140 mmHg and/or diastolic BP > 90 mmHg.⁴
2. Diabetes: History of Diabetes or Fasting blood glucose \geq 126 mg/dl and/or post-prandial blood glucose \geq 200 mg/dl.⁵ general treatment goals and guidelines, and tools to evaluate quality of care. Members of the ADA Professional Practice Committee, a multidisciplinary expert committee, are responsible for updating the Standards of Care annually, or more frequently as warranted. For a detailed description of ADA standards, statements, and reports, as well as the evidence-grading system for ADA's clinical practice recommendations, please refer to the Standards of Care Introduction. Readers who wish to comment on the Standards of Care are invited to do so at professional.diabetes.org/SOC." "DOI": "10.2337/dc19-S002", "ISSN": "0149-5992, 1935-5548", "note": "PMID: 30559228", "title-short": "2. Classification and Diagnosis of Diabetes", "language": "en", "issued": {"date-parts": [{"2019", 1, 1}]}, "schema": "https://github.com/citation-style-language/schema/raw/master/csl-citation.json".
3. BMI: <18.5 kg/m² as underweight, 18.5 – 24.9 kg/m² as Normal, 25 – 29.9 kg/m² as overweight and \geq 30 kg/m² as obese.⁶
4. Dyslipidaemia as Triglycerides > 150 mg/dl and/or Total Cholesterol > 200 mg/dl and/or LDL > 130 mg/dl and/or HDL < 40.⁷
- Audiometry results were interpreted as follows based on WHO Grades of hearing impairment.⁸
5. Hearing levels of 26-40 dB as mild, 41-60 dB as moderate, 61-80 dB as severe and >80 dB as profound hearing impairment.
6. A working definition was used for visual status:
 - Far vision (Snellen chart): Normal \geq 6/6 in both eyes, Satisfactory 6/9 – 6/12 in worse eye, Poor < 6/12 in worse eye.
 - Near Vision (Roman text type): Normal \geq N6, Satisfactory N8 – N12, Poor < N12.
 - Colour Vision: Ishihara chart was used and interpreted as defective if the study participant could not correctly identify at least 12 of the 14 red/green plates.

Result

Upon analysis of records of 791 shipbuilding workers, it was observed that majority of them i.e. 773 (97.7%) were males while 18 (2.3%) were females. Most workers i.e. 591 (74.7%) belonged to the age group of 40 – 49 years while 165 (20.9%) were 50-59 years of age (Table 1). Table 2 shows the various employment categories of the workers. A majority of them i.e. 189 (23.9%) were working as electroplaters, followed by 139 (17.6%) who belonged to fitting and engineering group.

Table 1. Age-wise distribution of the shipbuilding workers

Age group	Frequency	Percentage
20 - 29 years	2	0.2
30 - 39 years	30	3.1
40 - 49 years	743	76.2
50 - 59 years	197	20.2
60 - 69 years	2	0.2
70 - 79 years	1	0.1
Total	975	100.0

Table 2. Distribution of the shipbuilding workers based on employment categories

Employment Type	Frequency	Percentage
Administration	115	14.5
Canteen staff	34	4.3
Design	30	3.8
Electrical and Powerhouse staff	92	11.6
Welding	85	10.7
Fitting and Engineering	139	17.6
Plant maintenance	63	8.0
Shipwright and repair	44	5.6
Electroplating	189	23.9
Total	791	100.0

Table 3, shows the health profile of the workers. As per WHO classification of obesity, a high number of workers i.e. 216 (23.3%) were overweight. 46 (5.8%) were underweight, while 14 (1.8%) were obese.

Blood pressure assessment revealed that as much as 196 (24.8%) of the workers were hypertensive. The records also comprised of latest routine blood investigations of the workers. It was seen that 101 (12.8%) had diabetes, 76 (9.6%) had dyslipidaemia while 3 (0.4%) were anaemic. Assessment of ECG reports revealed that 146 (18.5%) of them had an abnormal ECG finding. The chest X-ray

reporting of the workers revealed the 44 (5.6%) of the them had an abnormal chest x-ray reports.

The records also revealed information on the Lung Function Tests of the workers. It was seen that 40 (5.1%) had restrictive lung disease, 9 (1.1%) had obstructive lung disease while 2 (0.3) had both restrictive as well as obstructive lung disease. Assessment of Audiometry reports revealed that 190 (24%) workers had mild hearing loss, 33 (4.2%) had moderate hearing loss and 14 (1.8%) had severe hearing loss.

Table 3. Health profile of the shipbuilding workers

Health Indicator	Frequency	Percentage
Body Mass Index		
Underweight	46	5.8
Normal	515	65.1
Overweight	216	27.3
Obese	14	1.8
Blood Pressure		
Normotensive	595	75.2
Hypertensive	196	24.8
Blood Investigations		
Normal	599	75.7
Diabetes	101	12.8
Dyslipidemia	76	9.6
Anemia	3	0.4
Diabetes and Dyslipidemia	11	1.4
Diabetes and Anemia	1	0.1
ECG		
Normal	645	81.5
Abnormal	146	18.5
Chest X-ray		
Normal	747	94.4
Abnormal	44	5.6
Lung Function Test		
Normal	740	93.6
Restrictive	40	5.1
Obstructive	9	1.1
Both	2	0.3
Audiometry		
No hearing impairment	554	70
Slight impairment	190	24
Moderate impairment	33	4.2
Severe impairment	14	1.8
Profound impairment	0	0

Table 4. Assessment of vision of the shipbuilding workers

	Frequency	Percentage
Far Vision		
Normal	429	54.2
Satisfactory	326	41.2
Poor	36	4.6
Near Vision		
Normal	330	41.7
Satisfactory	403	51
Poor	58	7.3
Colour Vision		
Normal	775	98
Defective	16	2

Table 4, shows the assessment of vision of the workers. 36 (4.6%) had poor far vision, 58 (7.3%) had poor near vision and 16 (2%) had defective colour vision.

Discussion

Our study findings reveal that shipbuilding workers in Goa suffered several health problems. A majority of the workers were males as the shipbuilding industry is a heavy industry mainly employing males as compared to females. A high proportion of workers were employed as welders and electroplaters who mostly carry out their work in confined space, which exposes them to several health hazards.⁹ Welding can produce metal fumes responsible for metal fume fever, bronchial asthma, chronic obstructive airway disease, pneumoconiosis, and lung cancer.¹⁰ Also, of importance in this industry are falls, which are a leading cause of shipyard fatalities.¹¹ A significant number of employees worked in the field under fitting & engineering as well as shipwright & repair which involves working at heights using elevation equipment like ladders and scaffolds. These workers are prone to falls and injuries which may be fatal. Yilmaz A et al in a study among shipyard workers in turkey reported that fall from height was the leading cause of fatal occupational accidents.¹²

Assessment of BMI revealed that a high number i.e. 216 (23.3%) of the workers were overweight, while 14 (1.8%) were obese. A cross-sectional study done by VR Lokhande among shipyard workers in Mumbai revealed that 48% of them were overweight with BMI 25 - 29.9 kg/m², while 5% were obese with BMI ≥30 kg/m².¹³ A study done by A Koulouri et al among people working in ship building industry showed 7% of workers having hypertension.¹⁴ In contrast, our study revealed that a high number i.e. 236 (24.2%) of the workers were hypertensive.

The prevalence of diabetes in general population of Goa as

reported in a study done by Vaz NC et al is 10.3%.¹⁵ As per the National Health Profile 2018 report published by MoHFW, GOI, of the total number of patients screened for diabetes in Goa, 12.47% were diagnosed as having diabetes.¹⁶ A similar finding was obtained among shipbuilding workers in Goa with a prevalence of 12.8%.

In this study, it was observed that 40 (5.1%) had restrictive lung disease, 9 (1.1%) had obstructive lung disease while 2 (0.3) had both restrictive as well as obstructive lung disease. There was no significant association between welders and abnormal pulmonary function tests. A study done by Bradshaw LM et al in New Zealand assessing pulmonary functions among welders revealed that there was a significant association between chronic bronchitis and cumulative exposure to welding fumes of ≥10 years. These workers with chronic bronchitis also had significantly lower measures of baseline PEF (p=0.008) and FEV/ FVC ratio (p=0.001) than workers without chronic bronchitis.¹⁷

In a study done by Bhumika N et al in Goa, 7.6% of the shipbuilding workers suffered from hearing loss.¹⁸ In contrast, our study revealed that as much as 30.1% of the workers had mild to severe hearing loss. A similar finding was obtained by Alexopoulos EC et al in Greece among shipyard workers, with 27.1% of the workers having hearing impairment.¹⁹ With a higher incidence in the heavy industry.
Objectives of the Study:
 The aim of this study is to investigate the prevalence of NIHL in Greece and explore its correlations with other job and individual-related factors.
Materials and Methods:
 Questionnaires were administered, and audiograms were conducted to 757 employees of a shipyard company in Greece, both white- and blue-collar, during the period 2006-2009. A modification of the 1979' equation of the American Academy of Otolaryngology was used to calculate hearing loss. Statistical analysis was conducted by means of the SPSS v. 17.
Results:
 A 27.1% of the employees were hearing handicap. Hearing loss was correlated with age, past medical history of ear disease (Meniere's disease, acoustic neuroma, otosclerosis).

Our study revealed that a high proportion of the workers had visual impairment. As majority i.e. 274 (34.6%) were welders and electroplaters, they are exposed to bright flashes of light which is aggravated if the workers do not use appropriate Personal Protective Equipment. A study done by Sithole HL in South Africa among welders reported that Reduced distance vision was reported by 32% of the welders, 14% reported reduced vision at near; 43% reported double vision and 11% reported colour vision anomaly.²⁰ Pinhole, ophthalmoscopy, external assessment of the adnexa and Amsler grid were used to determine their oculo-visual status. One hundred and fifty welders were included in the study and their ages ranged from 18 to

65 years with a mean of 39±14.9 years. Reduced distance vision was reported by 32% of the welders, 14% reported reduced vision at near; 43% reported double vision and 11% reported colour vision anomaly. Forty seven percent of the welders had VA less than 6/ 6 at distance and 8% could only read 1M or larger print at near. Following the pinhole test, there was no improvement in 7% of the welders who had VA less than 6/ 6, indicating a possibility of pathological conditions. Amsler grid showed that 6% of the welders had possible macular disorders. Ophthalmoscopy and external observations revealed that 7% of the welders had cup disc ratio (H/ V). Another study done by Heydarian S et al in Iran among welders showed prevalence of dyschromatopsia of 15% which was statistically higher than that of non-welders group.²¹

Conclusion

Shipbuilding workers suffer from a number of health problems, notably, hearing impairment, visual impairment, lung conditions impairing pulmonary functions as well as lifestyle diseases like diabetes, hypertension, overweight and dyslipidaemia. Regular hearing tests with audiometry will be useful as most of these workers are exposed to high levels of noise for most part of the shift. Whereas, regular vision testing is essential for early detection of visual impairment, especially among welders and electroplaters. Periodic medical examinations are needed for timely detection and appropriate treatment of these chronic health conditions among the shipbuilding workers. This, along with health education to the workers are essential to reduce work absenteeism, morbidity as well as mortality among these shipbuilding workers and enhance productivity. Further studies are needed to assess association of these conditions with various exposures and risk factors in this industry. Also, regular inspection of the work place for health hazards will go a long way in improving the health status of shipbuilding workers.

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Conflict of Interest: None

References

1. CDC - NIOSH Program Portfolio: Center for Maritime Safety and Health Studies: Shipyards [Internet]. [cited 2019 May 26]. Available from: <https://www.cdc.gov/niosh/programs/cms/shipyards.html>.
2. Blot WJ, Morris LE, Stroube R et al. Lung and Laryngeal Cancers in Relation to Shipyard Employment in Coastal Virginia. *JNCI J Natl Cancer Inst* 1980; 65(3): 571-575.
3. Edge JR. Incidence of bronchial carcinoma in shipyard workers with pleural plaques. *Ann N Y Acad Sci* 1979; 330(1): 289-294.
4. Williams B, Mancia G, Spiering W et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension. *Eur Heart J* 2018; 39(33): 3021-3104.
5. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes - 2019. *Am Diabetes Assoc*; 42(Supplement 1): S13-28.
6. World Health Organization. Obesity and overweight. Geneva, Switzerland: WHO; 2018 [Internet]. [cited 2019 Jun 5]. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>.
7. Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) Final Report. *Circulation* 2002; 106(25): 3143-3143.
8. World Health Organization. Prevention of Blindness and Deafness: Grades of hearing impairment. Geneva, Switzerland: WHO; 2019 [Internet]. [cited 2019 May 30]. Available from: http://www.who.int/deafness/hearing_impairment_grades/en/.
9. Stellman JM. Encyclopaedia of occupational health and safety. Vol. 1. International Labour Organization; 1998.
10. Wittczak T, Walusiak J, Pałczyński C. Welding-related respiratory diseases. *Med Pr* 2009; 60(3): 201-208.
11. Celebi U, Ekinci S, alarçin F et al. The Risk of Occupational Safety and Health in Shipbuilding Industry in Turkey. In: Proceedings of the 3rd Int. Conf. *Maritime and Naval Science and Engineering* 2010; 178-184.
12. Yilmaz AI, Yilmaz F, Celebi U. Analysis of Shipyard Accidents in Turkey. *Br J Appl Sci Technol* 2015; 5(5): 472-481.
13. Lokhande V. Health profile of workers in a ship building and repair industry. *Indian J Occup Environ Med* 2014; 18(2): 89.
14. Koulouri A, Roupa Z, Sarafis P et al. Assessment of Health Level and Socio-Economic Characteristics of People Working in the Shipbuilding Industry: A Control Group Study. *Glob J Health Sci* 2015; 7(2): 154-161.
15. Vaz NC, Ferreira AM, Kulkarni MS et al. Prevalence of diabetic complications in rural Goa, India. *Indian J Community Med* 2011; 36(4): 283.
16. National Health Profile 2018. Central Bureau of Health Intelligence, Directorate General of Health Services, Ministry of Health and Family Welfare, Government of India; New Delhi. (13th Issue). Available from: <http://www.cbhidghs.nic.in/WriteReadData/l892s/Before%20Chapter1.pdf>.

17. Bradshaw LM, Fishwick D, Slater T et al. Chronic bronchitis, work related respiratory symptoms, and pulmonary function in welders in New Zealand. *Occup Environ Med* 1998; 55(3): 150-154.
18. Bhumika N, Prabhu G, Ferreira A et al. Noise-Induced Hearing Loss Still a Problem in Shipbuilders: A Cross-Sectional Study in Goa, India. *Ann Med Health Sci Res* 2013; 3(1): 1-6.
19. Alexopoulos EC, Tsouvaltziidou T. Hearing loss in shipyard employees. *Indian J Occup Environ Med* 2015; 19(1): 14-18.
20. Sithole HL, Oduntan OA, Oriowo MO. Oculo-visual status of the welders in the Capricorn District of the Limpopo Province of South Africa. *Afr Vis Eye Health* 2009; 68.
21. Heydarian S, Mahjoob M, Gholami A et al. Prevalence of color vision deficiency among arc welders. *J Optom* 2017; 10(2): 130-134.