



Original Article

Occupational Hazards and Safety Measures Amongst the Paint Factory Workers in Lagos, Nigeria



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ABSTRACT

Background: The manufacture of paint involves a variety of processes that present with medical hazards. Safety initiatives are hence introduced to limit hazard exposures and promote workplace safety. This aim of this study is to assess the use of available control measures/initiatives in selected paint factories in Lagos West Senatorial District, Nigeria.

Methods: A total of 400 randomly selected paint factory workers were involved in the study. A well-structured World Health Organization standard questionnaire was designed and distributed to the workers to elicit information on awareness to occupational hazards, use of personal protective devices, and commonly experienced adverse symptoms. Urine samples were obtained from 50 workers randomly selected from these 400 participants, and the concentrations of the heavy metals (lead, cadmium, arsenic, and chromium) were determined using atomic absorption spectroscopy.

Results: The results show that 72.5% of the respondents are aware of the hazards associated with their jobs; 30% have had formal training on hazards and safety measures; 40% do not use personal protective devices, and 90% of the respondents reported symptoms relating to hazard exposure. There was a statistically significant ($p < 0.05$) increase in the mean heavy metal concentrations in the urine samples obtained from paint factory workers as compared with nonfactory workers.

Conclusion: The need to develop effective frameworks that will initiate the integration and ensure implementation of safety regulations in paint factories is evident. Where these exist, there is a need to promote adherence to these practice guidelines.

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1. Introduction

Work has its positive health-promoting effects, as the financial dividend provides the worker with the basic necessities of life [1]. The aforementioned translates into healthy well-being, job satisfaction, and ultimately, higher productivity. There is, however, a reciprocal and interactive relationship between the workers and the work environment [2]. The knowledge of these interactions between work and health is fundamental in understanding and practicing occupational health and safety [3], but the importance of safety at the workplace is often overlooked [4].

Occupational hazard is the risk, harm, or danger that an individual is exposed to at the workplace, whereas occupational diseases result from such exposures to the individual [5,6]. Although these occupational diseases appear to occur less frequently than other major debilitating diseases, there is evidence that they affect a considerable number of people, particularly in rapidly industrializing countries (e.g., Nigeria), hence indirectly impacting on the economy [7]. During work periods, workers are faced with a variety of hazards almost as numerous as the different types of work, including chemicals, biological agents, physical factors, and adverse ergonomic conditions. These are responsible for a variety of health consequences [4].

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Chemical substances, and their derivatives, are widely used in many sectors including industry, agriculture, mining, water purification, public health—particularly disease eradication—and infrastructure development. Their utilization has brought immense benefits to mankind. However, the production, storage, transportation, and removal of these substances can pose risks to people and the environment, and at the same time it has had negative impacts on human health and safety [8].

Solvents used in the paint industry for example have been shown in numerous studies to be the cause for negative health symptoms that include the central and peripheral nervous system as well as other organ systems. Various studies, as shown in Table 1, reveal the neurobehavioral effects of organic solvents in paints on paint factory workers/painters. The studies show exposure related negative effects, most commonly on tests of psychomotor function and short-term memory.

Also, some chemicals (organic and inorganic) used in paint industries contain heavy metals with known risks. Usually, the manufacture of paints involves a wide variety of raw materials that contain heavy metals such as lead, cadmium, and chromium pigments, and fungicides such as mercuric oxide [15] in the production process, which can present with medical hazards, some of which are easily recognized and others that may remain undetected for many years [16–18]. Lead and mercury, for example, have a serious and irreversible impact on the mental development of children [8]. Exposure to heavy metals has been shown to be associated with middle-term and long-term health risks such as abdominal pain and illness to the human fetus (causing abortion and/or preterm labor). Adults may also experience high blood pressure, fatigue, kidney, and brain disturbances [19]. Chronic exposure to heavy metals may also lead to skin eruptions, intestinal ulcer, and different types of cancers [20].

To control these medical hazards, particularly in relation to heavy metals, there are coordinated safety initiatives introduced to limit heavy metal exposures in the paint industry thereby preventing negative health effects. These measures include redesigning processes to place a barrier between workers and the hazard; adopting standard operating procedures or safe work practices; providing appropriate training, instruction, or information to reduce the potential for harm and/or adverse health effects to person(s); and implementing the use of personal protective devices (PPDs) such as gloves, glasses, aprons, safety footwear, and dust masks designed to reduce exposure to the hazard. PPDs are usually the last line of defense and usually used in conjunction with one or more of the other control measures [21].

The consequences of not following these practice guidelines can be fatal as control of these hazards is the key to reducing the risk of injury and illness among workers in this industry [18].

Our intention was to assess the awareness of workers on the occupational hazards present at work and the safety measures necessary in paint production factories. The study was also intended to highlight the common negative health symptoms

experienced by paint factory workers. Another objective was to quantify the heavy metal concentrations in the urine of some selected paint factory workers.

2. Materials and methods

The study was designed to assess the occupational safety and concentration of heavy metals in the urine samples obtained from paint factory workers in Lagos West Senatorial District, Nigeria. The paint factory workers studied were factory production workers who were involved in the process of mixing raw materials and paint production, packaging of manufactured paints, and loading of paints into vehicles for appropriate distribution and marketing. A properly structured questionnaire adapted from the World Health Organization was used as a tool for data collection [5]. This study was undertaken for a period of 2 months.

2.1. Sample size determination and participant selection

A total of 400 consenting respondents were included in this study. This sample size has been found to be adequate for such a cross-sectional study [22]. The inclusion criteria called for factory workers in paint production factories in Lagos West Senatorial District. The estimated number of paint manufacturing establishments in Nigeria is 510, of which 228 are located within the three senatorial districts of Lagos. A total of 40 paint manufacturing factories were randomly (systematically with $n = 5$ factories) selected and used for this study. Ten factory workers were then randomly selected from each paint manufacturing establishment, making a total of 400 respondents.

2.2. Data collection

A self-administered well-structured standard questionnaire was designed and distributed to factory workers with the assistance of the factory supervisor for the purpose of gathering information from the respondents. The questionnaire elicited information on personal data, awareness of occupational hazards, and use of PPDs. The management personnel of the various paint manufacturers were adequately informed and were aware of the purpose of the study. They were also made to understand that participation in the study was voluntary and strict confidentiality was to be maintained.

2.3. Biological specimen collection and analysis of heavy metals

Fifty consenting factory workers were randomly selected from the 400 factory workers for urine heavy metals determination assay. The selected participants (paint factory workers) were age matched with the control participants (nonpaint factory workers) who were selected randomly from consenting students in the Department of Chemistry, University of Lagos, Lagos, Nigeria.

Table 1
Neurobehavioral effects of organic solvents in paints on paint factory workers/painters

Study	Exposed group (N)	Visual performance/motor deficit	Memory deficit	Behavioral symptoms
Bleeker et al (1991)[9]	Paint factory workers (187)	+	+	–
Maizlish et al (1987)[10]	Spray painters (124)	–	+	–
Fiddler et al (1987)[11]	Painters (101)			+
Cherry (1985)[12]	Painters (44)	+	+	+
Baker et al (1988)[13]	Painters (186)	+	+	+
Spurgeon et al (1992)[14]	Painters (90)	+	+	

+, Exposure-related effects observed; –, exposure related effects not seen.

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