

The Prevalence and Severity of the Symptoms of Darkroom Disease Among Darkroom Technicians in Harare, Zimbabwe

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Abstract: The purpose of the study was to investigate the prevalence and severity of darkroom diseases among darkroom technicians in Harare. After obtaining ethical approval, a total of 20 darkroom technicians employed by radiology departments in Harare and Chitungwiza were given questionnaires to complete. The questionnaire had three sections. The first section required the respondent to indicate whether he suffered from any symptoms of darkroom disease. The second section asked the respondent to indicate the severity of the symptoms while the third section asked the respondent whether the severity of the symptoms increased during working hours. Prevalence was calculated for each symptom of darkroom disease. This study established that there is a high prevalence of symptoms of headaches, sore throats, breathing difficulties, skin rashes, bad mouth taste (chemical taste) and that the severity of the symptoms increased during working hours. More than 50% of the DTs identified eleven out of fifteen (73.3%) of the symptoms of DD as symptoms that they experienced. There was a significant correlation between prevalence of symptoms and the severity of symptoms during work hours ($r=0.894$; $p\leq 0.001$). Only 30% of darkroom technicians were aware of darkroom disease. The study recommends that darkroom technicians be educated on the dangers of darkroom diseases and on ways of ameliorating the symptoms. Furthermore, employers should take a leading role in creating safe working environments.

Key words: Darkroom Disease • Darkroom Technicians • Asthma • Headache Glutaraldehyde

INTRODUCTION

Darkroom disease (DD) is a phenomenon used to describe the irritants or allergic type reactions linked to exposure to processing chemistry [1]. Darkroom technicians (DTs) are exposed to high levels of acetic acid, formaldehyde, glutaraldehyde and sulphur dioxide. Glutaraldehyde is listed as a main agent in triggering an allergic response [1]. Darkroom disease has been classified as a type of multiple-chemical sensitivity [1]. Common symptoms include headaches, runny nose, itchy eyes, nausea, asthma and fatigue. Processing chemicals enter the body via contact through the skin, inhalation into the lungs or ingestion. Darkroom technicians can be exposed to these chemicals through manual film processing, cleaning of the internal

components of the film processor or by fumes from the normal processing procedure, Quirce [2].

DD has been reported by various authors. Dimich-Ward [3] reported an excess of DD symptoms in a sample of radiographers compared to a similar sample of physiotherapists in British Columbia. This finding was corroborated by Leacy [4]'s work at two Dublin Hospitals. Similarly, Smedley and Inskip [5] reported that there was a clear excess of work related symptoms among the radiographers compared to a sample of physiotherapists. In particular, radiographers were more likely to complain of mouth soreness, sore, itchy, or runny eyes, persistent blocked nose, persistent itchy nose or sneezing, sore throat, headache and of lower respiratory tract symptoms and the symptoms were worse on workdays. These symptoms were attributed to exposure to automatic

processing machines. These studies also reported significant associations between psychosocial stressors and DD. Before the advent of substitutes for darkroom film processing technology darkroom disease was reported to be on the rise [6].

The advent of new technologies such as computed radiography has rendered darkroom technology obsolete and redundant in resource rich settings. However, in resource constrained environments, such as Zimbabwe, many radiology centers still utilize the darkroom film processing technologies. This exposes the darkroom technicians (DTs) to darkroom disease. The purpose of this survey was to establish the prevalence and severity of the symptoms of darkroom disease among DTs working in Harare. The specific objectives were:

- To investigate the prevalence of darkroom disease (DD) among DTs in Harare.
- To investigate the severity of DD during working hours.
- To evaluate whether darkrooms are properly equipped with ventilation systems and
- To assess the awareness of darkroom disease among darkroom technicians.

MATERIALS AND METHODS

The study was carried out at seven radiology centres in Harare, three of which were housed in government central hospitals. There was a total of 20 DTs in these centers and after obtaining ethics approval from the Joint Research Ethics Committee at the University of Zimbabwe College of Health Sciences, all the 20 were recruited to participate in the survey. Each participant completed a self report questionnaire. The questionnaire had three sections. The first section solicited information on demographic data. The second section was designed to establish the prevalence and severity of symptoms of DD. The participants were provided with a list of 15 common symptoms of DD. For each symptom the participant was asked to indicate whether or not he/she suffered from the symptom by choosing between “Yes” and “No”. Those that answered “Yes” were then requested to indicate whether the symptoms were mild, severe or very severe. They were also asked to indicate, by choosing between Yes and No, whether the symptoms increased during working hours. The third section had items that were

designed to measure the participants’ awareness of DD and the extent to which they engaged in behaviours that minimize their exposure to DD.

RESULTS

All the 20 recruited participants returned dully completed and usable questionnaires. Of the 20; 12 were male and 8 female. Twenty five percent of the participants had been working in the darkroom for less than 5 years, 40% had been working for a more than five years but less than 10, 15% for more than 10 but less than 20 years whilst 20% had worked for more than 20 years.

Doctor Diagnosed Health Conditions: Twenty percent of the participants reported that they had a known doctor diagnosed family history of asthma. The 10% which reported that they had already been diagnosed with asthma also reported a family history of the condition. However, the diagnosis of asthma was only made after they started working as darkroom technicians. All the participants (30%) with known chemical sensitivity also experience nasal and sinus problems. The participants were further asked to indicate whether these health problems predated their work in the darkroom. Only the 10% that had diagnosed asthma problems indicated that they were aware of the existence of these health problems prior to their taking up employment as DDs.

Symptoms and Severity of DD: Table 2 below presents a summary of the data on the prevalence and severity of the symptoms of DD. The prevalence was obtained from the participants that answered YES to a particular symptom. Severity was categorised as mild, severe and very severe according to the questionnaire responses. Work related increase in severity of symptoms was determined from the participants that indicated YES to the statement to that effect.

Eleven out of fifteen (73.3%) of the symptoms of DD had more than 50% of the DTs identifying them as symptoms that they experienced. The exceptions were Tinnitus (45%), arrhythmia (10%), dermatitis (45%) and unexplainable fatigue (35%). Metallic taste and headaches (90%) were the most common symptoms followed by sore eyes (85%) and nausea and sore throat (80 %). There was a significant correlation between prevalence of symptoms and the severity of symptoms during work hours ($r=0.894$; $p<0.001$).

Table 1: below presents a summary of the prevalence of doctor diagnosed health problems

Condition	Prevalence
Asthma	10%
Family History of Asthma	20%
Eye Problems	15%
History of smoking	5%
Nasal and Sinus Problems	30%
chemical Sensitivity	30%

Table 2: Summary of data on prevalence and severity of DD

Symptom	Prevalence	Mild	Severe	Very Severe	Work Related Increase in Severity
Headaches	90%	15%	30%	45%	80%
Sore Throats	80%	40%	35%	5%	80%
Unexplainable Fatigue	35%	15%	15%	5%	35%
Breathing Difficulties	70%	30%	35%	5%	70%
Nausea	85%	85%	0%	0%	80%
Skin Rashes	80%	60%	15%	5%	60%
Mouth Ulcers	60%	35%	20%	5%	40%
Sore Eyes	85%	50%	25%	10%	85%
Painful Joints	60%	30%	15%	15%	40%
Dermatitis	45%	25%	20%	0%	15%
Catarrh	60%	45%	15%	0%	25%
Arrythmia	10%	5%	0%	5%	10%
Metallic Taste	90%	55%	25%	10%	90%
Tinnitus	45%	45%	0%	0%	45%
Itchy Nose and Sneezing	85%	60%	20%	5%	70%

DD Awareness Among Dts: Up to 70% reported clogging floors with 25% intimating that floor drains always clog. Seventy five (75%) reported chemical spillages; and as many as 20% indicated that chemicals always spill. Frequent film jams were reported by 90% of the DTs. Fifty (50%) reported that they had to extricate trapped films more than 3 times weekly. The use of protective clothing during mixing of chemicals was also investigated. Seventy five percent (75%) did not use goggles when mixing chemicals, 30% did not use masks, 5% did not use aprons and 80% did not use wellington shoes. All DTs wore gloves when mixing chemicals.

DISCUSSION

Extant literature review reveals a lacuna in the reportage of prevalence rates of DD in DTs. When prevalence rate of darkroom disease has been reported it has tended to focus on radiographers and the rates ranged between 1.2% and 6.4% [3,7]. The studies found also reported on the prevalence rate of asthma instead of a whole gamut of symptoms. In the current study the prevalence rate of asthma was 10%. This is higher than the rates reported in other studies. Although both darkroom technicians and radiographers are radiology workers, the nature of the job of the darkroom technician

is such that he spends much more of his working time compared to other radiology workers in the darkroom in close proximity to the causative agents of the disease. Although the mechanism of causation has not been well articulated, processing chemicals such as glutaraldehyde and the fumes emanating from them have been linked to darkroom disease. A dose response relationship between exposure to glutaraldehyde and the prevalence of symptoms of DD was reported by Calder *et al.* [8]. The higher prevalence of asthma in darkroom technicians as reported in the current study dovetails neatly into the dose response thesis. However, it must be highlighted that the sample of darkroom technicians who participated in the current study is much smaller than the samples from the studies conducted with radiographers.

Spicer [1] identified fifteen common symptoms that characterize DD. These 15 symptoms formed the basis of this study, but it has to be underscored that this list of symptoms is by no means exhaustive. This study showed that there was a high prevalence of symptoms of DD among darkroom technicians in Harare. More than fifty per cent of darkroom technicians suffered from more than five of the symptoms of darkroom disease and reported that the severity of the symptoms increased during working hours.

Table 3: Work Characteristics

Variable	Frequency
Awareness of DD	30%
Monitoring for toxic fumes	10%
Presence of local exhaust ventilators	15%
Satisfaction with exhaust ventilators	15%
Detection of processing chemical odours	85%
Floor Drains Clogging	70%
Chemical spillage	75%
Film jamming	90%

Headaches and Bad mouth taste (metallic) (90%) were the most commonly mentioned symptoms. All the DTs who complained of these symptoms also reported that the symptoms worsened during working hours. This is not a new finding. Smedley and Inskip [5] reported a high prevalence of mouth soreness (bad mouth taste) and headaches among radiology workers. These symptoms are linked to the use of automatic processing machines. From this it can be inferred that the work environment is culpable. The work characteristics are shown in Table 3. Characteristics such as frequency of detection of odours, extricating jammed films, presence of ventilators and cleaning of chemical spills represent proxy measures of exposure. All the DTs in the current study processed more than 100 films a day and worked on a 40 hour week schedule. Increased odds ratios for darkroom symptoms were reported among radiographers who processed more than 50 films a day and worked a 30 hour week [3]. DTs in this sample are exposed more than radiology workers in other studies and this is in sync with the high prevalence of studied symptoms of DD.

Thirty percent of the DTs in this sample were aware of the existence of the DD phenomenon. This is important for two reasons. Firstly, the more aware the radiology workers are; the more likely they are to take steps to minimise their exposure. Secondly, the more aware and conscious of the symptoms they are, the more likely they are to report these symptoms. Thus awareness can create a reporting bias. In this study the awareness level was low and the prevalence of the symptoms was high. It is therefore likely that due to lack of awareness of the DD phenomenon the DTs are inadvertently exposing themselves to the associated factors. The existence of a reporting bias can therefore be excluded. Awareness of the existence of DD, however, should not be confused with perturbation with the problem. In one study 2880 radiographers ranked communicable diseases and radiation safety “high” in concern but DD associated factors such as chemical and latex allergies “average” in

concern, even below workplace ergonomics [9]. Hence interventions should seek to create both awareness and attitude change.

Darkroom disease is a human creation; and like all conditions where human agency has primacy, it is preventable. One important element of a prevention program is the monitoring for the presence of toxic fumes. In one study it was reported that fumes from glutaraldehyde even in low levels can cause problems Teschke [10]. The current study reports that 90% of the darkrooms had never been monitored for fumes. Furthermore, 85% of the machines did not have proper local exhausts ventilation systems. Kavanaugh [11] posits that local exhausts address the issue of avoiding the contamination of darkroom air by specific high-emission sources by capturing airborne contaminants before they are spread into the environment. Exposure can be limited by the use of local exhausts in conjunction with performing regular monitoring. Such simple actions can bring the technicians to a state of heightened alertness of the DD, which in turn can result in behaviour modification and reduction to exposure prone habits. On a larger scale the government department tasked with occupational health and safety should conduct regular industrial hygiene surveys designed to establish the conditions under which radiology workers operate.

Darkroom disease exacts a very heavy toll. Ide [12] reported that darkroom technicians took substantially more sick days leave than a sample of workers from occupational therapy with similar characteristics. The increased absence from work due to illness impacts negatively on productivity and departmental operations. The impact is even more disruptive in resource constrained environments characterised by a shortage of technicians and radiographers. Darkroom disease related deaths have also been reported. A case in point is the widely reported death of American radiologist Robert Zach [13]. Although the current study reports no fatalities and also did not measure the frequency of sick leave days; it is important to highlight that the high prevalence of symptoms does not bode well for the general health of the technicians.

High prevalence of DD also has far reaching legal ramifications for the employer. Most countries have legislative frameworks that deal with the use of hazardous substances. In Zimbabwe the relevant statute is the Hazardous Substances Control Act. In the United States The National Institute for Occupational Safety and Health has recommended exposure limit of 0.2 parts per million for

glutaraldehyde vapour [13]. Failure to comply with local legislative requirements can attract hefty penalties. Furthermore, possibilities of litigation by affected employees always exist. In the United States, darkroom technician Annie Cannon successfully sued her employers, while Marjorie Gordon was also successful in New Zealand. While cases of medical litigation are not that often in Africa, increased globalization of systems means the trend will not always be so.

In conclusion poor ventilation, unsafe practices, lack of hazard recognition and work overload can lead to increased exposure to darkroom disease among radiology workers. There is need to put in place policies and procedures that facilitate early detection and treatment of symptoms, reduce exposure and increase awareness of the disease among the workers.

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