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Occupational safety of morticians: A case study of mortuary facilities in Cape Coast, Ghana

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ABSTRACT

Risk assessment is helpful for risk management because it makes significant workplace concerns easier to understand. Because of the numerous risks involved, the death care sector is regarded as one of the riskiest places to work. Nevertheless, not enough research has been done on the safety of mortuary staff in low-resource environments. This study assessed the risks associated with identified hazards in two mortuary facilities at the University of Cape Coast in Ghana. This was a cross-sectional study that used a combination of methods. Thirty-six morticians participated in the study. Respondents scored low on knowledge, high on attitude, and awareness toward occupational health and safety. Only 9 (25.0%) participants knew the correct concentrations of chlorine solution required to disinfect surfaces. Only two of the six chosen volunteers could reconstitute the chlorine solution for disinfection correctly. Risks of chemical inhalation, musculoskeletal injuries, cuts, and traumatic injuries were evaluated as high. A review of incident registers revealed underreporting of injuries. While the study showed significant gaps in the occupational safety of morticians in low-resource environments, it also presents an opportunity for improvement. Regulatory agencies for morticians in Ghana must set out minimum qualifications for this critical category of health workers.

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1. INTRODUCTION

Through its sustainable development goal 8, the United Nations aims to achieve complete, productive, and decent jobs for all by 2030 [1]. The death care industry is experiencing global growth due to the world's aging population [2] and the rising number of deaths from infectious and chronic illnesses [3]. Although hazards are associated with every work activity, substantial occupational health risks are associated with this rapidly growing business.

The "process of evaluating the risks to safety and health arising from workplace hazards" is what the International Labor Organization (ILO) [1] defines as risk assessment. Studies in risk analysis have described

three main categories of techniques. These are quantitative, qualitative, and semi-quantitative [4]. Quantitative techniques consider risk as a quantity that can be measured or estimated and can be expressed by mathematical relationships. In semi-quantitative techniques, one parameter, such as the likelihood of occurrence, is assigned a numerical or descriptive ranking, while the other parameter is expressed quantitatively [5]. Qualitative techniques use descriptive or numerical ranking scales to categorize each risk's potential outcomes and probability. Compared to the others, qualitative techniques are simple, require fewer logistical and financial challenges, and could be undertaken by non-experts. As a result, they are the most used risk analysis techniques [6]. They allow clarity and prioritization of tasks more quickly and cost-effectively. Therefore, this study will employ the decision matrix technique, a qualitative technique.

When risks are significant, a hierarchy of controls (HOC) can be applied. In occupational safety and health, the hierarchy of controls framework is used to understand the relative efficacy of various risk reduction measures and help identify workable and efficient solutions [7]. The HOC model has five categories in decreasing order of efficacy: Elimination, substitution, engineering controls, administrative controls, and personal protective equipment (PPE). Several techniques for identifying hazards include interviewing workers about potential risks, having experts visually evaluate the workplace, and reviewing incident registers [8].

Morticians handle and treat dead bodies, exposing them to a variety of airborne particulates and aerosols of hazardous organic pollutants found in disinfectants, embalming, and antimicrobial agents [9], [10]. During different stages of handling dead bodies, Morticians are at very high risk of severe sickness because of the high volatility of toxic vapors that may flow continually from cadavers. Formaldehyde, a significant component of embalming solutions, is known to be carcinogenic and can cause severe dermatitis when it comes into contact with the skin [11]. Mortuary attendants have a wide range of duties, such as handling, storing, participating in autopsies, and embalming [12]. A study revealed that morticians in Ghana also participate in autopsies and embalming [12]. Some previous studies conducted globally have found that morticians are exposed to many occupational hazards during their work [13], [14]. When they receive mutilated bodies, mortuary workers have the task of suturing, mobilizing, and putting the body pieces together [12]. While undertaking these duties, they are exposed to needle stick injuries [15]. Furthermore, morticians also carry dead bodies from the hospital wards to the morgue. Mortuary staff are also at risk of secondary traumatic stress disorder as a result of excessive exposure to trauma and horrific events [16]. Anxiety and depression are two major psychological health outcomes that might result from these kinds of exposures [17]. However, only a few of these studies have been conducted in the African subregion, seeking to assess the knowledge and practices of mortuary workers regarding occupational health and safety [15], [18], [19].

In resource-constrained environments like Ghana, the risks are exacerbated by limited access to safety training, inadequate availability of PPE, and insufficient regulatory oversight. Prior studies in Ghana have reported mortuary workers' direct exposure to human fluids [18], [20], low vaccination rates against occupational infections [21], and poor adherence to universal safety protocols [21]. Furthermore, the psychological toll of working with traumatic cases and bereaved families is compounded by the lack of mental health support [12]. Despite these challenges, there is a dearth of research assessing the specific risks faced by mortuary workers and the efficacy of existing workplace safety measures in low-resource settings. Our search in published literature found no risk assessment studies conducted in Ghana's death care industry. Therefore, little is known about the safety of mortuary facilities in Ghana and how morticians' knowledge impacts their occupational health and safety (OHS) practices.

This study, therefore, addresses these critical gaps by assessing the occupational health and safety knowledge, attitudes, and practices of mortuary workers in two facilities in Cape Coast, Ghana. Using a decision matrix risk assessment tool, this study aims to identify common workplace hazards, evaluate associated risks, and provide actionable insights to mitigate these risks. By highlighting these issues, the study seeks to inform policymakers and stakeholders, offering a pathway to improve the safety and well-being of mortuary workers, who remain an overlooked yet vital component of the healthcare continuum.

2. METHOD

2.1. Study setting

The study was conducted at the University of Cape Coast, which has two mortuary facilities: the University of Cape Coast Hospital mortuary and the School of Medical Sciences mortuary. The University of Cape Coast is a public university located in Cape Coast, the capital of the Central Region of Ghana. These two conveniently selected public mortuaries have the most significant number of staff in the metropolis.

2.2. Study design

This cross-sectional study employed an array of approaches. Hazards were meticulously identified through a questionnaire, surprise workplace visits to monitor work procedures and inspection of accident reports. The study began in February 2023 and was completed in June 2023.

2.3. Study population and sampling

The study sample included all morticians employed by the facility and having worked there for at least one year. Twenty-five people work in the morgue at the University of Cape Coast Hospital, while fifteen employees at the School of Medical Science have been there for at least a year. Following the inclusion criteria, the census sample technique was used on all 40 eligible staff members.

2.4. Potential sources of bias

Recognizing the potential sources of bias, we took several measures to ensure the validity and reliability of our findings. The two identified sources were the possibility of participants giving socially acceptable answers and experts' subjective assessment of hazards. A variety of additional data sources were utilized to counteract these. An observation checklist was included to verify participants' statements, and three experts independently evaluated the risks to avoid potential bias resulting from subjectivity.

2.5. Study variables

This study had two response variables and eleven explanatory variables. Metric scale variables made up the response or dependent variables. These were the safety precautions that the responders were aware of and had taken. Occupation (categorical but nominal), educational attainment (categorical but ordinal variable), age, job experience, attitude, perceived danger, awareness, and availability of PPEs (metric scale variables) were the explanatory or independent variables.

2.6. Statistical methods

Standard deviations and means were employed to summarize continuous variables, frequencies and percentages were used to summarize categorical variables, and Chi-square was used to estimate the relationship between the independent and dependent variables. The computer software package SPSS v 22 was used to process the data. The 95% and 5% confidence intervals were used to determine statistical significance.

2.7. Instruments

2.7.1. Questionnaires

This study included a self-administered, structured questionnaire. A pilot study involving ten mortuary staff members at Cape Coast Metropolitan Hospital was carried out to verify the validity of the questionnaire. This made it possible to make the required changes to the questionnaire. Additionally, proven instruments from related investigations were modified [22]. Comparing three independent experts' evaluation results for the same risks increased reliability. Six components made up the questionnaire. Section A aimed to gather information on the respondents' sociodemographic traits. Section B gathered information on respondents' levels of awareness, knowledge, and practice about occupational health and safety. Section C assessed the participants' attitudes toward risks and the use of occupational health and safety. Section D evaluated the workers' self-reported exposure to workplace hazards. While Section F investigated the effects of occupational hazards on the staff the previous year, Section E was used to gather data on workplace measures available for hazard control. The cumulative scores of the knowledge, attitude, practices, and awareness variables were summarized and classified as good or bad (knowledge and practice), low or high (awareness), and positive or negative (attitude). The criteria for classification was the derived median score for each variable. Low/poor/negative scores were defined as those below the median, while high/good/positive scores were defined as those equal to or above.

2.7.2. Observational checklist

After examining earlier comparable research, an observational checklist was created [12], [20], [23]. It was divided into eight sections: first aid, general security, electrical safety, fire safety, general safety, PPE availability, OHS policies, and worker PPE use. The team of experts used the checklist to corroborate self-reported workplace safety conditions.

2.7.3. Incident register

The mortuary facilities' incident registers were reviewed to look for occupational accidents from April 2022 to April 2023. All worksites are expected to maintain an incident register, which a designated safety officer should keep. All incidents at the worksite must be recorded in the register. In this study, records in the register were compared to self-reported incidents in the survey.

2.7.4. Risk assessment tool

The study modified a validated risk assessment matrix [24] from an earlier investigation, adjusting to account for the observed hazards. This tool is relatively simple and can be used by people with minimal

training, especially in low-resourced settings. Three experts utilized the tool to assess the risks of the main hazards discovered throughout the risk identification procedures.

2.8. Risk calculation

Table 1 shows the scale used to score the probability and severity of each risk in this study. The Risk score (R) for each risk was calculated by multiplying the probability of the event (P) and the severity of the event (S). Table 2 gives the definitions of the risk scores: Insignificant risk (1), tolerable/low risk (2, 3, 4, 5, and 6), moderate/medium risk (8, 9, 10, and 12), significant/high risk (15, 16, and 20), and intolerable risk (25). Tables 1 and 2 were adopted with modifications from a previous study [24]. The probability of the incident (P) and the event's severity (S) were multiplied to determine the risk score (R). Table 2 provides the definitions of the risk scores.

2.9. Ethical consideration

All participants provided written informed consent. The data obtained was not named to ensure anonymity. To guarantee data security, the data was stored on a password-protected computer. Every study team member received training on the value of maintaining anonymity.

Table 1. 5×5 L-shaped risk matrix used to score risk

Probability	Severity				
	1	2	3	4	5
	Negligible	Minor	Moderate	Significant	Severe
1	1	2	3	4	5
Very unlikely	Insignificant	Low	Low	Low	Low
2	2	4	6	8	10
Unlikely	Low	Low	Low	Medium	Medium
3	3	6	9	12	15
Possible	Low	Low	Medium	Medium	High
4	4	8	12	16	20
Likely	Low	Medium	Medium	High	High
5	5	10	15	20	25
Very likely	Low	Medium	High	High	Intolerable

Table 2. Interpretation of risk assessment scores

Risk score	Result
25 = R	Intolerable risk, the operation must be stopped immediately
15 = R<20	High risk, it should be improved in the short term
8 = R<15	Significant risk, it can be improved in the long term
R<8	Acceptable risk, control measures must be maintained

3. RESULTS AND DISCUSSION

In total, 36 mortuary workers agreed to participate, representing 90% of all eligible respondents. Table 3 shows the demographic characteristics of participants. The sample size for this study, even though small, is similar to what was used in some previous studies among morticians in Africa [19], [25].

Most participants were in the 30-39-year age group, similar to what was found among mortuary staff in earlier studies in Nigeria [14], [15] and Ghana [12]. Also, all participants were males. Some previous studies in Ghana [12], [21] have reported female morticians in a male-dominated workforce. This study did not, however, ascertain reasons for the absence of females among the mortuary workforce in these facilities. In this study, almost all participants (86.1%) had only primary and secondary education. Some previous studies in Ghana among morticians [20], [21] reported similar levels of education among participants. There are currently needs to be specific qualifications for morticians in Ghana. The Ghana Morticians and Funeral Facilities Act, 1998 (Act 563) does not state particular qualifications required to practice in the death care industry in Ghana [26]. Most morticians in Ghana acquired their skills through apprenticeship [12]. Since morticians engage in cutting and suturing of cadavers as well as embalming, which involves the identification of arteries and veins, they need to be provided with some knowledge of the anatomy and physiology of the human body. In 2022, Pentecost University became the first institution of higher learning in Ghana to introduce a certificate program in Mortuary Science and Funeral Studies [27]. However, none of the participants in this study obtained this certificate because there is no policy mandating practitioners to seek higher education.

3.1. Knowledge and awareness of occupational health and safety

Respondents' knowledge of occupational health was poor, with an overall mean score of 2.56±1.03 (maximum score of 7). Knowledge scores were not significantly associated with respondents' age group (X2-

3.25, p-0.197) and years of working (X2- 2.25, p-0.522). A weak and non-significant correlation existed between knowledge scores and occupational health and safety practices (r = 0.24, p = 0.16).

Even though all participants indicated that they had been preparing chlorine solutions for disinfection, only nine (25.0%) knew the proper concentrations of chlorine solution needed to clean surfaces soiled with bodily fluids. Two (5.5%) people could accurately state the formula for determining the required chlorine concentration. Almost all respondents, 33 (91.7%), were not aware of any existing protocols in the worksite that dealt with occupational exposures. Most participants, 28 (77.8%), did not know of any designated office or officer to manage occupational health issues if they should occur. Even though most respondents, 32 (88.9%), reported that they had received occupational health training at least once during their work, none reported having received formal training on occupational health in the last 12 months before the survey. Regarding how they obtained their knowledge of OHS, 26 (72.2%) stated their training period to become morticians, while 4 (11.1%) said it was after being employed. Only 2 (10%) indicated that they received pre-employment training in occupational health and safety.

The poor knowledge of participants on OHS found in this study agrees with the findings of a similar study conducted in South Africa. The study found that 67% of participants did not understand the concept of a hazard [19]. Other studies have found good OHS knowledge among mortuary workers in Nigeria [14], [18] The differences in findings could be attributed to some reasons. Unlike the current study, which is limited by a small sample size, the Nigerian study [18] had a larger sample size of 150 and involved many facilities. All the studies also differed in the assessment tools used. The lack of pre-employment training and the low educational backgrounds of participants could have contributed to the poor knowledge of OHS found in this study. Even though most respondents indicated that they had received some training in OHS in their practice, only 4 (11.1%) reported receiving any such training in the last year, suggesting a lack of opportunities for continuous professional development similar to what was found in a previous study in Ghana [12]. Studies have shown that safety training significantly predicts workplace accidents and other occupational exposures [28]. Thus, OHS educational program tailored to the needs of mortuary workers must be regularly organized.

Table 3. Demographic characteristics of respondents

Demographic variable	Frequency	Percentage
Age – group (years)		
30 – 39	18	50
40 – 49	16	44.4
50 – 59	2	5.6
Years of working		
<5	8	22.2
5 – 10	16	44.4
11 – 15	4	11.1
>15	8	22.2
Educational level		
Basic	21	58.3
Secondary	10	27.8
Tertiary	5	13.9

3.2. Perception of risk and attitudes towards occupational safety

All participants perceived their jobs as risky. These were mainly classified as high-risk. Such a collective perception is a critical insight, as it underscores both the physical and psychological vulnerability of workers in this under-researched professional group. The overall attitude score was 51.06±3.12 (maximum score of 55). This score suggests a strong personal inclination among workers to engage in safe practices.

3.3. Availability of and use of PPEs

Every participant stated that face masks, gloves, hand-washing stations, and lab coats were always available. Nonetheless, a few participants mentioned that goggles (24, 66.7%) and safety footwear (12, 33.3%) were not always accessible. Participants' use of PPEs and their availability showed a substantial and positive association (r = 0.746, p = 0.001). Even though all participants stated that hepatitis B vaccines were available, only 8 (22.2%) were sure of completing their vaccinations against hepatitis B. There was a low uptake of tetanus toxoid vaccine. Only 7 (19.4%) participants indicated they had received a tetanus vaccine ever in their adult life.

3.4. Awareness and practice of safety precautions

The participants' awareness of safety concerns was rated highly (10.7±2.42) with a maximum score of 14. There was a weak and non-significant connection between knowledge of safety precautions and their actual application (r= 0.149, p= 0.387). This highlights a potential gap between awareness and behavior.

3.5. Perceived effects of occupational hazards on health

Any health issues respondents had experienced in the year before the survey that they believed were related to their line of work were disclosed. Skin conditions accounted for 15 (41.7%) of the respondents' health concerns, followed by low back pain 12 (33.3%), eye issues 10 (27.8%), wrist joint pain 8 (22.2%), and neck pain 6 (16.7%). The high level of musculoskeletal disorders, mainly low back and wrist joint pains reported, agrees with an earlier study that also found musculoskeletal injuries to be a significant health concern for mortuary workers in the United States of America [13]. This high incidence of musculoskeletal disorders among the participants is not surprising considering that their work routinely involves manual lifting of cadavers, push and pull forces involved in moving corpses, and adopting non-neutral positions while working [13]. In this study, it was observed that there were no hoists for lifting the bodies, and the workers assumed awkward postures and engaged in repetitive motions when performing embalming. There were reports of skin disorders among participants. Some participants in previous studies have also reported experiencing skin disorders as a result of occupational exposures [29], [30]. In an earlier qualitative study that explored the effects of formalin on mortuary attendants in Ghana [20], many participants reported that they had experienced the adverse effects of the chemical on the eyes, respiratory tract, and skin. Mortuary workers risk skin disorders because of exposure to chemicals such as formaldehyde, glutaraldehyde, and chlorine. Formaldehyde is a volatile chemical that is also known to cause respiratory and eye problems as well as cancer of the nose and lungs [31]. Therefore, it is urgently necessary to ensure that all morticians protect their skin and respiratory tract using PPEs such as gloves and face masks.

3.6. Exposure to hazards

Survey participants self-reported the prevalence of exposure to occupational hazards in any form in the year preceding the study. Table 4 presents the self-reported exposures to specific occupational hazards. Chemical inhalation (32, 88.9%) and time pressures (22, 61.1%) were the most commonly cited dangers. The high self-reported exposure to volatile chemicals could be due to the frequent use of such chemicals like formaldehyde and workers not adhering to the use of face masks, as found by researchers when they visited the work sites. 16 (44.4%) reported experiencing needle stick injuries. This prevalence of needle stick injuries is lower than the 73.5% found in a study conducted in Nigeria [15] but higher than the 32.7% found in an Indian study [32]. It is, however, similar to the 43% prevalence found among mortuary workers in Iran [33]. Despite this high self-reported prevalence of needle stick injuries in this study, only 8 (22.2%) were sure of completing their vaccinations against Hepatitis B. An earlier study conducted among mortuary workers in South Africa also found a low Hepatitis B vaccine uptake of 17% [19]. There is, therefore, the need to enforce policies on Hepatitis B vaccination in the workplace. The uptake of the tetanus toxoid vaccine was also deficient. Tetanus vaccine uptake is low in low-resource settings. A study in Somalia [34] found a 10.8% self-reported uptake among participants who were health workers. The low uptake of the tetanus vaccine among participants could be due to the lack of a policy on immunization mandating adults to take the tetanus vaccine in Ghana and the possibility that many of them may have received the vaccine as infants. Tetanus vaccines have been part of Ghana's immunization program since 1987 [35]. However, to ensure continued protection against tetanus and diphtheria, the Advisory Committee on Immunization Practices of the Centers for Disease Control recommended that individuals obtain a booster shot every ten years [36].

Most respondents, 29 (80.6%), viewed their job as stressful. The primary sources of stress were given by participants as handling and preparing bodies 20 (68.9%), dealing with wailing bereaved families 18 (62.1%), and listening to details of what killed people from relatives 15 (51.7%). The main drivers of stress found in this study, such as dealing with wailing bereaved families and handling and preparing bodies, have also been reported by earlier studies [37], [38]. When asked how they cope with the stress experienced, the responses were using alcohol 12 (41.4%) and psyching themselves (27.6%). Other studies have also found the use of alcohol among morticians as a coping strategy [19], [39]. An earlier study in Namibia [40] also found that some mortuary workers resorted to alcohol intake as a coping strategy. Given the negative impact of alcohol on the human body, mortuary workers must be assisted to use better coping strategies. These may include the provision of counselling services [39]. Of those surveyed, 28 (77.8%) said they occasionally disclose their exposures to the authorities, while 8 (22.2%) said they never report them. Not knowing who to report to 20 (55.6%), forgetting to report 16 (44.4%), minor injuries 13 (36.1%), and believing that nothing would be done about the complaints 7 (19.4%) were some of the reasons why occurrences were only sometimes reported.

3.7. Expert evaluation

General safety: No wet floors were visible, and the lighting system was functioning correctly. Unfortunately, not all office furniture, including the seats and tables, was ergonomically designed. All washrooms were functioning. The storage rooms for chemicals were inadequate. Some staff belongings were observed in these rooms. This was also observed in an earlier study [19]. Considering the flammable nature

of common compounds such as formaldehyde and some disinfectants, appropriate storage facilities must be provided for them. In contrast to the findings in a South African study [19], the mortuary facilities in this study were observed to be clean, adequately ventilated, and free of bad odors.

Electrical and fire safety: There were no overloaded extension cords, and most outlets were in good working order. A couple of switches and sockets were broken. Sufficient fire extinguishers were stationed strategically, and smoke detectors were in many working spaces. However, not a single fire exit sign was visible. It was improper to keep flammable goods, and fire-resistant blankets were unavailable. Only 4 out of 10 workers could demonstrate correctly how to operate the fire extinguishers. All the workers need to be trained in using fire extinguishers.

General security: Security personnel were on hand and equipped with adequate resources. Availability of PPEs: Every facility visited had face masks, goggles, safety boots, plastic aprons, and utility gloves. However, chemical-resistant gloves and eyewash fountains were not available. First Aid: None of the facilities visited had a well-stocked first aid box and no staff were skilled in providing first aid. Policies: Procedures were directed by posted guidelines. However, no committee for occupational health and safety or safety manager existed.

Transport of bodies and embalming: The trolleys used to transport bodies from the ward to the morgue or when receiving them from family members were found to be in good condition. There were no exposed metal parts. However, morticians were not adequately dressed in the required PPEs when transporting bodies from the wards to the morgue and when receiving the bodies from vehicles that brought them. Even though all observed were in gloves, none wore an apron and were not wearing face masks. Perhaps mortuary workers view this aspect of their job as less dangerous even though such bodies may still have body fluids that they could be exposed to. A Nigerian study also noted that mortuary workers were not appropriately dressed when transporting bodies to the morgue [41]. There were no hoists for lifting cadavers, putting workers at risk of developing musculoskeletal injuries. The room for embalming bodies was adequately ventilated. However, one of the facilities did not have a local exhaust ventilation system. All the morticians observed conducting embalming wore gloves, boots, and aprons. Some morticians did not adhere to the use of goggles and face masks, even in dangerous procedures like embalming. An earlier study in Nigeria [18] also made similar observations.

Preparation of chlorine: Six staff members, three from each facility, were conveniently selected to demonstrate how to prepare 0.5% and 0.05% chlorine solutions from a 12% sodium hypochlorite solution stock. None correctly prepared the solutions in one facility, while two staff members in the other facility could reconstitute the stock solutions to the required solutions correctly. It is worrisome to find out that only 2 participants knew the right formula for reconstitution of chlorine for disinfection, and just 2 out of 6 could demonstrate the correct reconstitution procedure of the stock solution. For blood and body fluids, a 0.5% chlorine solution is recommended for disinfection [42]. Considering the myriads of dangerous organisms morticians are exposed to during their work, great efforts will have to be made to regularly train them on how to prepare this very important disinfectant correctly.

Table 4. Exposure to occupational hazards among participants

Hazard	Exposed Frequency (%)	Not exposed Frequency (%)
Slippery floors	8 (22.2)	28 (77.8)
Volatile chemicals	32 (88.9)	4 (11.1)
Cuts by sharp objects	6 (16.7)	30 (83.3)
Noise	16 (44.4)	20 (55.6)
Stress	29 (80.6)	7 (19.4)
Needle pricks	18 (50.0)	18 (50.0)
Poor ventilation	9 (25.0)	27 (75.0)
Chemical splash to skin	7 (19.4)	29 (80.6)

3.8. Incident register

Each facility has an incident register. The review of the incident registers revealed a high level of underreporting of occupational exposures. Even though many participants indicated in the survey that they have been exposed to many hazards, such as needlestick injuries, only three incidents were documented in the two facilities. All three incidents occurred during embalming. All victims were sent to the hospital and placed on post-exposure prophylaxis for human immunodeficiency virus (HIV). One of the main reasons respondents gave for not reporting workplace injuries was not knowing who to respond to. This must be addressed by appointing a safety manager to handle all workplace occupational health and safety issues.

3.9. Risk assessment

Table 5 reveals the findings of the decision matrix risk assessment conducted at the two mortuary facilities at the University of Cape Coast (UCC). This procedure assessed and identified common risks in the workplace. Staff were found to be most at risk of musculoskeletal injuries (Risk Score 20), chemical inhalation (Risk Score 20), cuts and traumatic injuries (Risk Score 20), and chemical splash to skin (Risk Score 12).

Table 5. Risk assessment matrix evaluating common hazards identified at two mortuary facilities at the University of Cape Coast

Risk/Activity	Hazards	Probability of Occurrence (P)	Severity (S)	Risk Score (P×S)	Outcome	Proposed control measures
Chemical inhalation	Presence of formaldehyde a volatile chemical, non-usage of nose masks, poor ventilation	5	4	20	High risk	The use of face masks, using alternative chemicals where possible, using of local exhaust ventilation system
Slips and falls	Lack of safety signs for slippery surfaces, non-usage of boots	3	2	6	Low risk	Provision of safety signs for slippery surfaces and the use of appropriate footwear
Musculoskeletal injuries	Non-adjustable tables and chairs, and no equipment for lifting the corpse	5	4	20	High risk	There is an urgent need for adjustable tables and chairs and equipment for lifting the corpse
Stress	Heavy workload, constant exposure to wailing relatives	3	4	12	Medium risk	Need to employ more staff to reduce workload, provision of psychological services
Burns to the skin from chemical exposure	Lack of functional showers, lack of emergency eye washes, and unavailability of chemical-resistant gloves	3	4	12	Medium risk	Procurement of chemical-resistant gloves, functional showers, and eye washes
Cuts to body by sharp objects	The use of many sharp objects like band saws and needles for suturing	4	5	20	High risk	Enforcing the use of utility gloves, practice of proper sharp disposal techniques

When risks were evaluated using the decision matrix risk assessment technique at the two study sites, the risks for musculoskeletal injuries, chemical inhalation, cuts, and traumatic injuries were found to be high. These risks need to be controlled by employing the concept of the hierarchy of controls [7]. Even though most hazards in the death care industry cannot be eliminated or substituted, engineering and administrative controls and the provision of PPEs can reduce the risks. Engineering strategies may include fixing local ventilation systems and redesigning the structures for more storage space. Administrative controls also include implementing policies on adherence to PPEs, improving tetanus and hepatitis B vaccine uptake, and providing counseling services to the staff. More PPEs, such as chemical-resistant gloves, must be procured for all staff.

Because the study was limited to two mortuary facilities, its conclusions cannot be applied to other Ghanaian morgues. However, the relatively simple risk assessment method can easily be applied in other low-resource settings. The small sample size also limits the study. Furthermore, because the study was cross-sectional, conclusions about causality could not be drawn.

4. CONCLUSION

This study highlights critical occupational health and safety (OHS) gaps among mortuary workers in low-resource settings, focusing on risks such as chemical exposure, musculoskeletal injuries and inadequate safety practices. It demonstrates the utility of a relatively simple but effective risk assessment tool for identifying and prioritizing occupational risks in a resource-constrained environment. But the findings underscore a broader, systemic challenge: a lack of institutionalized safety training, policy enforcement and infrastructure investment that perpetuate unsafe working conditions in the bereavement sector. In addition to addressing the immediate safety issues, this study highlights the need for a paradigm shift in the approach to OHS in the mortuary profession. Regulatory bodies should prioritize the development of standardized training programs, such as those focused on the use of PPE and proper disinfection protocols, and mandate continuing professional development. In addition, low vaccination uptake and underreporting of injuries reflect systemic deficiencies in workplace health management, requiring stronger institutional accountability and worker support. The implications go beyond funeral homes in Ghana. Similar problems are likely to exist in other low- and middle-income countries, where informal training and underfunded safety measures leave workers vulnerable. Policymakers thus have the opportunity to use the findings from this study to develop

globally adaptable OHS frameworks, incorporating scalable risk assessment tools and emphasizing a proactive safety culture. These measures not only protect workers, but also contribute to broader public health goals by reducing occupational hazards that could increase the risk of infectious disease transmission. Future research should explore innovative, context-specific interventions such as telelearning modules or partnerships with local health organizations to improve safety outcomes. Furthermore, examining the psychosocial dimensions of the profession – such as stress, trauma, and coping mechanisms – can offer a more comprehensive understanding of the needs of mortuary workers and contribute to safer and more supportive work environments worldwide.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration. The table below shows each author's contribution to the paper.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

This research related to human use has complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the University of Cape Coast Institutional Review Board (UCC/IRB/EXT/2023/13).

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [JKP], upon reasonable request.

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