

A qualitative exploratory study on the effects of formalin on mortuary attendants

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John Kwasi Akortiakumah¹, Anita Fafa Dartey¹,
Anthony Kolsabilik Kuug¹, Comfort Worna Lotse¹,
Gideon K Gnagmache² and Abdul Sakibu Raji³ 

Abstract

Objectives: To explore the effects of formalin on mortuary attendants in nine selected hospitals in Ghana.

Methods: The study applies a qualitative exploratory descriptive design in the overall collection and analysis of data. Purposive sampling was used to reach the saturation of 19 participants. The data were collected through semi-structured interviews and manually analysed using content analysis.

Results: Five themes developed from the analysed data, namely, effects of formalin on the eyes, effects of formalin on the respiratory system, effects of formalin on the skin, effects on appetite, and formalin as a cancer-causing agent.

Conclusion: This study has unveiled the negative effects of formalin on morgue attendants, which is likely to cause long-time health problems. It is therefore recommended that all mortuaries in Ghana should be assisted with protective equipment, in-service training, and practice of universal safety to help reduce risks associated with chemical hazards, especially formalin. There should be regular surveillance in the mortuaries and workers be screened regularly.

Keywords

Chemicals, death, exposure, formaldehyde, mortuary attendants

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Introduction

Workplace safety is expected in all occupations, regardless of the nature of the job or the risks involved. Workers may significantly reduce their exposure to workplace hazards if they recognize the types and nature of the hazards they face. Formalin exposure of mortuary attendants is a major concern, especially in developed countries, because of the health risks.

Formaldehyde (a concentrated form of formalin) is a chemical that is used worldwide to prevent dead bodies from decaying. Formaldehyde is the most common aldehyde in the world, occurring spontaneously through the oxidation of hydrocarbons.^{1,2} It is a colourless, pungent-smelling gas often present in aqueous (water-based) solutions, and it is dangerous and easily polymerized at room temperature.³ Formaldehyde has a molecular weight of 30.03 and is soluble in ethers, alcohols, and water (400 g/Lat 20°C).⁴ Earlier in 1989, the World Health Organization (WHO) identified that in the presence of air and moisture at room temperature, formaldehyde can quickly polymerise to a 65%–75% formaldehyde air mixture, which is easily

flammable. Formaldehyde decomposes into methanol and carbon monoxide at temperatures over 150°C, and under atmospheric conditions, formaldehyde is photo-oxidized in sunlight to carbon dioxide.¹

Formaldehyde is produced from methanol at 600°C–650°C, partial oxidation and dehydrogenation with air are conducted in the presence of silver crystals, which act as a catalyst.¹ Formaldehyde is often used in both the workplace and homes, and since it is a hydrophilic compound, it is easily ingested into the lungs, gastrointestinal tract, and eyes. The health consequences of its use are most likely to occur when the

¹School of Nursing and Midwifery, University of Health and Allied Sciences, Ho, Ghana

²Karaga District Hospital, Karaga, Ghana

³Department of Basic and Applied Biology, School of Sciences, University of Energy and Natural Resources, Sunyani, Ghana

Corresponding author:

Abdul Sakibu Raji, Department of Basic and Applied Biology, School of Sciences, University of Energy and Natural Resources, P.O. Box 214, Sunyani, Bono Region +233, Ghana.
Email: abdul.raji@uenr.edu.gh



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compound comes into close contact with the body.⁵⁻⁷ In the hospital autopsy room or mortuary, mean-level exposures are greatest. Respiratory, ocular, and/or dermal inflammations are the primary short-term signs of toxicity. Permanent metaplastic alterations in the nasopharynx and oropharynx, which may lead to nasal or lung cancer, are among the most serious long-term symptoms.⁸ The International Agency for Research on Cancer (IARC) identified formaldehyde as ‘carcinogenic to humans’ (Group 1) as early as 2004, and its European classification was updated in 2011 to category 1B carcinogen (possibly carcinogenic to humans) and category 2 mutagen (possibly carcinogenic to humans).^{2,6,8,9} WHO’s 2019 health survey added that formalin is a possible carcinogen and an environmental hazard.¹⁰

According to Kamruzzaman,⁸ the safety precautions requiring routine inspection of formalin air-level concentrations under acceptable thresholds are often overlooked due to poor scheduling, personnel crises, lack of oversight by managers and main stakeholders, as well as inadequate understanding, or often just sheer carelessness. Owing to their proximity to embalmed corpses, mortuary workers, some healthcare practitioners, and laboratory technicians are often exposed to higher amounts of formaldehyde than the general population.¹ Since the discovery of formaldehyde’s tissue-hardening effects, mortuaries and funeral homes in Ghana have used it as a preservation and embalming agent.¹ According to studies, the majority of mortuaries lack a standard operating procedure (SOP) or a legislative framework/body that enforces certain applicable rules.¹ In Ghana, the permissible exposure level (PEL) for formaldehyde and other chemicals is poorly known and established. Despite the extreme health threats posed by this chemical, the Ministry of Health (MOH), Ghana Standards Board (GSB), and Trades Union Congress (TUC) have not properly enforced the general guidelines for the health sector.¹¹

Given the harmful effects of formaldehyde, there was a scarcity of research evidence on the occupational effects of formaldehyde on mortuary attendants in Ghana, prompting the conduct of this study.

Materials and methods

The research method focusses on the architecture, data collection and data collection instruments, population and sampling, data sources, and data analysis strategy tools and techniques.¹² The study used a qualitative analysis method, with exploratory and descriptive designs, to achieve a better understanding of mortuary attendants’ viewpoints on the effects of formalin, and it enabled the researchers to present data that retained the participants’ stands.¹³ This research aimed to explore the effects of formalin on mortuary attendants.

Study setting

The research was carried out in nine health facilities in Ghana’s Volta, Oti, and Bono East regions. One teaching

hospital, one regional referral hospital, two municipal hospitals, and five district hospitals were used. Each of these hospitals is the leading hospital in its respective regional geographical area, providing the researchers with a unique insight into the research issue at hand.¹⁴

Study population

A sample population is described as the whole community of people or subjects who meet the study’s inclusion criteria and are of interest to the researcher.¹⁵ Mortuary attendants from the Volta, Oti, and Bono East regions of Ghana acted as the study’s focus population. The participants included in the study were (a) mortuary workers who were employed as either full-time staff or part-time workers and had served in the chosen mortuary facilities in the Volta, Oti, and Bono East regions of Ghana, (b) mortuary staff who directly work on dead bodies in the selected mortuaries which were all attached to specific hospitals, (c) mortuary attendants with at least 1-year working experience in the selected mortuaries, and (d) mortuary staff who accepted to participate in the study.¹⁶ Exclusion criteria were the mortuary attendants who work in private mortuaries or funeral homes, mortuary workers who engage in private home care of dead bodies and were not attached to any designated hospital in the selected regions of Ghana, those with less than a year of working experience and who did not consent to participate in the study.

Sampling technique

Since mortuary attendants were the only members of the healthcare team who could answer questions about their work, sampling was done with purpose. Many of the healthcare facilities had an average capacity of three mortuary attendants. Prior approval for the collection of the data was sent to them through their hospital administration.¹⁷ After interviewing 19 mortuary attendants from the chosen sites, data saturation was accomplished using purposive sampling. The researchers recruited the mortuary attendants by explaining the study’s contents to those (mortuary attendants) who fulfilled the inclusion criteria. The study’s sample size was limited by data saturation. After 19 mortuary attendants from the nine, mortuary facilities were sampled and interviewed, saturation was reached.

Data collection methods

Face-to-face interviews with a semi-structured interview guide were used to gather data, between October 2019 and March 2020. Written informed consent was obtained from all subjects before the study. The interviews were conducted in either English or Ewe, based on the choice of the participants. The researchers probed the participants’ reactions based on their input. An interview guide was created to gather participants’ socio-demographic knowledge, as

well as an awareness of their jobs and the problems that affect their working conditions. The interviews were taped on a portable voice recorder and verbatim transcribed, subsequently. The face-to-face interview lasted between 45 min and 1 h. Participants' nonverbal behaviours were identified and recorded as field notes to provide depth to the results.¹⁸

Data analysis

To ensure that the patterns that originated from the data were saturated, data processing was performed simultaneously with data collection. To get a better interpretation of the participants' world, transcripts were read many times. The data were manually handled and evaluated following the steps of a thematic content analysis approach.¹⁹ The data were organized and coded, and themes were created. The researchers went through the categories and topics repeatedly, making sure that the participants' world was accurately captured and portrayed. To bring more depth to the analysis, field notes were checked.²⁰

Rigour

At different stages of the analysis, the concepts of credibility, dependability, confirmability, and transferability were extended to ensure the study's trustworthiness.²¹ Data were tested to ensure that accurate definitions and valid interpretations of data produced by participants were confirmed, thus raising the reliability of the results, which in turn improved the study's confirmability. All participants were interviewed using the same semi-structured interview guide to ensure consistency. The researchers were given study training, and a thorough overview of the whole research method was written up for use in future experiments in similar environments. Peer debriefing was also conducted for the researchers to ensure that all facets of the results were addressed. A detailed explanation of the research background was used to ensure transferability, enabling other researchers to perform a similar analysis.²²

Ethical considerations

The protocol identifier number for the research is 'UHAS-REC A.1 [35] 19-20', and it was approved by the University of Health and Allied Sciences' Ethical Review Committee. The management of the facilities where the research was performed gave their written consent. Written informed consent was obtained from all subjects before the study. The study's purpose and why participants were invited to participate were explained to them. Using pseudonyms to represent participants, the study was able to ensure the privacy and secrecy of their identities and records.²³ The names of the main body bones, for example, were used to represent the mortuary attendants who took part in the research.

Results

Participants' demographic data include their age, ethnicity, marital status, religion, years of work experience, and educational level. Their ages ranged from 30 to 65 years, and their mean age was 44 years. One female and 18 males were present. There were 14 married people, two single people, two unmarried people, and one widow. One was a Muslim, while the others were Christians. The participants had between 2 and 38 years of work experience. Participants had elementary education as their lowest educational level and secondary school as their highest level of education. Five themes emerged from the data analysed and these are effects of formalin on the eyes, effects of formalin on the respiratory system, effects of formalin on the skin, effects on appetite, and formalin as a cancer-causing agent. Most of these themes had sub-themes that are discussed under their respective themes (Table 1).

According to the mortuary attendants, they embalm the cadavers using an average of 2 litres of formalin diluted with an equal volume of water (2 litres) for an average body of 70 kg. However, the volume of formalin used on the corpses varies with their weight or body surface area. The dieners usually use 60 ml syringes and needles to inject the entire dead body until all parts are completely covered with the formalin and made ready for preservation in the fridges or cold rooms. This practice exposes them to formalin for the entire period of the injection. However, a few mortuary workers use the intravenous method of administering the formalin. They usually use the saphenous vein as the port of entry to infuse the formalin into the dead body. This method instead reduces their exposure to the formalin.

The mortuary workers usually inject the formalin in the mortuary rooms, which are typically enclosed. Still, they stated that they open the windows during the procedure to escape the formalin's vapour to the atmosphere. Most of them do not have air-conditioners functioning at their workplaces where they usually inject the formalin into the dead bodies; hence, their workstations become stuffy and filled with the pungent smell of the formaldehyde.

Generally, the results of the study indicated that formalin could affect any part of the body. The participants reported that formalin had effects on the eyes, respiratory system, skin, and appetite. They also mention that it is a cancer-causing agent. To them, the impact of formalin could be serious and could pose danger to their health and also give the reason for self-protection. This was clearly illustrated by participants in the data analysed:

Yeah, formalin can affect us seriously. It can affect any part of our body. That is why you need to protect yourself before working. **CLAVICLE**

Yes. It is very dangerous for human health as it affects many parts of the body. So, without any proper protection, it can affect our health. **SKULL**

Table 1. Themes and sub-themes.

Themes	Sub-themes
1. Effects of formalin on the eyes	i. Eye problems ii. Teary and painful eyes iii. Feeling of blindness
2. Effects of formalin on the respiratory system	i. Difficulty in breathing
3. Effects of formalin on the skin	i. Dehydration
4. Effects on appetite	i. Loss of appetite
5. Formalin as a cancer-causing agent	i. Risk for cancer

Theme 1: effects of formalin on the eyes

The current data discovered that formalin caused eye problems to the participants; there were tearing eyes and feelings of blindness. All these had adverse effects on the participants' eyes, making them feel uneasy.

Eyes problems

According to the majority (14) of participants, the impact of formalin is uncomfortable initially after exposure and later, they experience reading difficulties. The use of formalin at work was linked to these participants' vision problems:

When the formalin enters your eyes, you feel it. It's uncomfortable! . . . now my eyes have a problem. Previously, I could read well, but nowadays, I cannot read anything. **CARPEL**

When the eye specialists came to do screening for us, one of my health problems identified was my eyes. Now if I don't use glasses, I can't read. **METACARPALS**

The reaction of formalin in my eyes is what I want to talk about. Formerly I could read very well, but now I can't read no matter what without the aid of glasses. It is only my eyes that am worried about, for it is serious. **SKULL**

Teary and painful eyes

Participants were united in reporting that their eyes got teary anytime they used formalin at work.

According to the participants, one becomes very sad when you see them in that state:

Some of the chemicals especially, formalin, when entering your eyes, a lot of tears will be flowing. That is one of the challenges we face here [at work]. **SKULL**

Our eyes are mostly tearing anytime we use the formalin [at work]. Sometimes it's very bad. You will feel sad when you see us. **METACARPALS**

In addition to teary eyes, participants reported the pains caused by formalin and related it to the pain and discomfort caused by onions or pepper touching a person's eyes:

Also, formalin sometimes has onion pain effects on our eyes. **ULNA**

Formalin affects my eyes, it pains like pepper when it enters my eyes. Even if I wash water, it still pains you. **HUMERUS**

When it [formalin] enters your eye, it is like pepper. And this is an everyday thing. You can't come to this [work] place without dealing with or coming into contact with formalin. **FEMUR**

The biggest challenge we face here is during the embalming [process], the formalin is a powerful chemical. When it enters your eyes, it pains like pepper has been sprayed. **ISCHIUM**

According to one of the participants, not even the wearing of goggles could stop formalin from entering their eyes:

Formalin is a strong chemical that we use during embalming. We use goggles, but they still enter our eyes. The severity of its exposure is however reduced when the fans in the room are working to blow the concentrated air. So, if there's no fan there you can't be in the room, so when there's a fan is better but no matter what you do, it will enter your eyes even if you wear the goggles and mask. **PUBIS**

Sometimes, the effect of formalin feels like fire in one's eye that reduces the ability to see well according to another participant:

Yes, it doesn't make me see well. The formalin has entered my eyes severely. But one time, it hurts as if the eyes had come into contact with fire. That day, we were carrying the corpse into the top shelf of the freezer using manpower when formalin dripped into my eyes. I had to use seawater to wash it for about one week. And I couldn't wash it immediately. **ISCHIUM**

Feeling of blindness

Some participants stated feeling blind after exposure to formalin at work. They said that when formalin gets into their brains, they can't see right away. They described the sensation as 'blindness':

Seriously, When the formalin chemical gets to your eyes, you can even feel like you are blind. **PELVIS**

I quite remember that I was using the improvised machine [tubes connected to gallons] to introduce formalin into a body and then the tube got torn. So, I was trying to see how I could repair the torn tube and all the formalin, straight into my eyes. I was like a blind man. I used the wall as a guide to get to where the water was before I washed my eyes. **FEMUR**

Formalin affects my eyes. We can see partially, not like the way God made it. It becomes blurred. **HUMERUS**

Participants testified that sometimes, the eyes get reddish and swollen as a result of the use of formalin:

When you embalm for some time; say many bodies in a day; the eyes get overexposed. It will take about three weeks before the eye will stop paining you so at times when you see my eyes it's red. Even if you use the goggles, the moment air blows it will enter your eyes and you will the pain. **FIBULA**

Two participants recounted that their eyes get swollen as a result of exposure to formalin:

This work affects us, especially when we are using the chemical formalin. It gets into our eyes and itches. On some occasions, the eyes do get swollen as a result. **RIBS**

When the formalin gets into our eyes it causes our eyes to swell. **RADIUS**

Some participants said they reported to the hospital for treatment in most cases to get relief from the eye pains caused by formalin use:

Yes. The last time formalin entered my eyes I struggled to see. So, I went to the OPD and they treated me well. **STERNUM**

Yeah, I have had adverse reactions to my eyes from exposure to formalin and I needed to report to the hospital for treatment for quick relief. **ULNA**

Some participants are concerned that the effects of formalin will become more noticeable in the future when they have aged and retired to their homes:

Yeah, from the stories and what I have heard it can affect us in the future, even if we don't see it now. A man was working here till he retired at 60, he is now blind. The observation is that it is because of the formalin. **FEMUR**

I know it's a chemical and it's affecting our cells gradually. I will someday retire home before realizing its effect. **HUMERUS**

Theme 2: effects of formalin on the respiratory system

According to the findings, 15 of the participants stated that formalin affects their lungs, inducing chest pain, choking, and coughing. The quotations below illustrate this:

Yes. When formalin goes into our chest, it makes us cough. **PUBIS**

Yes, when you use the formalin and you get choked by it you can cough for some time. I do feel pain in my chest and cough too as a result of the formalin. **FIBULA**

My senior colleague cannot work again because when he enters the cold room and

inhale the formalin he gets choked in the heart. **CARPEL**

When you work with formalin especially, during the mixing [preparation], it results in coughing. **ISCHIUM**

. . . After the embalming, you will be feeling pains in your chest. It feels like there is a wound inside your chest, at times it will take you three days before you will recover from it. **TIBIA**

Some mortuary attendants find it impossible to continue working because the formalin influences their respiratory systems. Some participants have trouble entering and staying in the cold room for extended periods because they cough from inhaling formalin, a situation of presenteeism (present at work without taking part in the work activities):

. . . my senior man chokes and coughs anytime he is exposed to formalin in the cold room and he has to come out and stay outside for a while. Because of that, I can say he is not healthy to help with the work. **CARPEL**

The formalin is too hard for my co-worker, so he cannot perform the formalin work again. Even though he comes to work, his condition is not good for him to work. He cannot enter the cold room to work. **SACRUM**

According to RIBS, formalin also affects his throat:

Formalin affects me for sure. It affects my vocal cords and causes dryness in my throat. **RIBS**

Formalin's adverse effects included difficulty breathing, which resulted in sleeplessness:

When you put the formalin into the water to dilute [preparation], the chemical will enter your chest [exposure]. When you lay down to sleep at night, you feel pains in your chest and have difficulty breathing. **MANDIBLE**

Anytime I work in the cold room, I feel the formalin. It gets into my head causing difficulty in breathing. **PUBIS**

Theme 3: effects of formalin on the skin

The results showed that formalin impacts the skin of 13 participants. They clarified that this is accompanied by a sense of dehydration, numbness in the body, and the sensation that the skin is corroded. Other participants experienced itching on their skin:

Dehydration

Participants in the current study observed that the formalin made them thirsty:

The moment you are out of the cold room, you will feel thirsty, because the formalin takes out a lot of water from your system [causes dehydration]. **SKULL**

As soon as you come out of the cold room, you have to drink lots of water because you feel so thirsty. **TIBIA**

Unanimously, the participants reported the effects of formalin on their skin as itching and corrosion:

When the formalin gets to your skin, it itches you. Sometimes the itching is severe. **RIBS**

The formalin affects us so much; that it itches our skins. **RADIUS**

As for the formalin, when it touches your skin, your skin will be denatured (takes away your natural skin from you), and sometimes corroded. **CLAVICLE**

Seriously yes, When the chemical formalin touches your body, you feel numb. **PELVIS**

Theme 4: effects on appetite

Participants in this study mentioned a loss of appetite. Participants (17) were unable to eat after dealing with formalin in the mortuary:

I lose appetite after using the formalin and I know it's because of the formalin. When I don't eat and I get to work, my tummy becomes full and it feels like I have already eaten. **FIBULA**

Yes! The formalin affects me. It gets into my stomach through my mask and I don't have the appetite for food. **PUBIS**

While some participants complained of loss of appetite, another complained of hunger anytime he worked using formalin:

Aside from the effects of formalin on every body part, it sometimes makes me go very hungry. **RIBS**

Theme 5: formalin is a cancer-causing agent

The participants in this study reported their knowledge of the carcinogenic effects of formalin. Inhaling formalin, the participants (7) stated that they know it can cause brain damage and cancer:

Formalin is very dangerous. It can give you cancer; cancer of the lung. You see, every air you breathe in goes straight into the lungs. So, inhalation of these chemicals can give you lung cancer. At times, inhaling it gives me a headache. **SCAPULA**

The chemical we are using to work on the dead bodies, which is the formaldehyde solution is cancerous. **FIBULA**

Yeah, it can affect us seriously. It can affect the brain and can give cancer. If formalin enters your body continuously, it will kill you slowly. It is like poison; I can say it is an acid. **STERNUM**

For one participant, he wonders what constitutes the chemical formalin for it to be this strong and harmful:

For the embalming, it is the formalin we use. It is a very strong chemical that can cause cancer and I don't know what is used to prepare it. No one here knows its constituents. **CLAVICLE**

Discussion

The study was conducted among 19 mortuary attendants in nine hospitals selected from three regions in Ghana, including Volta, Oti, and Bono East. The findings revealed that formalin can affect any part of the body, and that formalin had an impact on all of the participants in some way. It had an effect on the participants' eyes, respiratory system, skin, and appetite. Some participants felt some sort of blindness whereas others felt hotness in the eyes accompanied by the flow of tears. This is in line with a study conducted by Elshaer and Mahmoud,¹⁰ which found that participants complained of eye pain, itching in the eyes, and excessive lacrimation as side effects of formalin use. Findings from the study also indicated that formalin has effects on the participants' chest causing them some pains as well as choking and coughing. The effects of formalin are severe on some of the mortuary attendants. This makes it difficult for them to continue working for long hours in the cold room. Others also reported effects on their vocal cords and throat. This study is supported by Patil and Thorat,²⁴ who reported sore throat, difficulty in breathing, and cough. The use of formalin also caused difficulty in breathing which resulted in sleep deprivation. A case of very high inhalation of formalin mostly occurs during dilution of absolute formaldehyde to formalin for use. These are no different from respiratory tract irritation, and work-related bronchial asthma that was reported elsewhere.²⁵ In another study by Bhat et al.,²⁶ mortuary staff opined to suffering a severe cough, and difficulty in breathing when preparing formalin for embalming.

From the findings, it was clear that formalin had effects on the participants' skin. This they explained, comes with a feeling of numbness of the body, dehydration, as well as a feeling that the skin is corroded. Other participants further explained that they experienced itchy skin. Contact with formaldehyde vapour or formalin solutions usually caused skin irritations and skin burns.²⁵ In sensitized persons, contact dermatitis may develop at very low exposure levels. The staff of a mortuary reported symptoms of skin disorders, such as eczema, dryness, as well as allergic contact dermatitis.²⁶

Aside from the effects of formalin on the skin, some participants complained of the effects of formalin on appetite. Findings in this study revealed the contrasting effect of formalin in causing loss of appetite in some participants as well

as hunger in others. From the narratives, participants who did not eat before reporting to work feel full after working with formalin for embalming and do not have an appetite for food. On the other hand, some participants also felt so hungry and needed food immediately after working with formalin in the cold room.^{24,27,28} It emerged from the findings that some of the participants know about formalin's toxic and carcinogenic effects when exposed to it. Participants believed that inhaling formalin from work caused them headaches and that it could harm their brain and cause cancer. This is supported by Thompson et al.,² Kamruzzaman,⁸ and Sabarinath et al.,²⁹ who showed that formalin is very toxic, allergenic, and carcinogenic. Evaporation of formaldehyde from formalin-treated cadavers in the anatomy dissection rooms can produce high exposure to these mortuary attendants. Hence these mortuary attendants are at a high risk of developing cancer.^{26,30} To make matters worse, most of the participants do not know the chemical composition of formalin to be more meticulous. All they knew is that the chemical is very strong.

This study sought to understand the effects of formaldehyde on the mortuary attendants through qualitative enquiry; hence, the findings were limited to only 19 participants, including only one woman. In Ghana, mortuary work is extremely dominated by men since women largely have a phobia for handling dead bodies. However, it was observed that most of the findings were widespread among the participants. These findings will need to be confirmed using a larger study sample across all of Ghana's 16 regions through a quantitative study. This will help establish the extent of the health effects of formalin on the mortuary workers in Ghana. The participants also reported that their senior colleagues do not want further exposure to formalin and avoid spending more extended time in the cold rooms. Whenever they do, they experience choking, respiratory and other effects of formalin. It will be imperative to conduct further studies to understand any relationship between the duration of exposure or the length of working experience and the consequences of formalin on mortuary attendants, including more women who work in the mortuary. Histological analysis should be considered to investigate and establish the extent of biological effects, including reproductive system effects, of formalin on men and women who use the chemical on corpses.

The study's limitations include using a small sample size because the study adopted a qualitative design. Participants were chosen from hospital mortuary facilities in only three out of the 16 regions of Ghana, which included only one female mortuary attendant. Moreover, no histological assessment was done to confirm the extent of the biological effect of formalin on the mortuary attendants.

Conclusion

The study findings revealed that formalin had a detrimental impact on the participants' well-being. This research looked

at formalin's effects on the eyes, respiratory system, skin, and appetite, and the participants were aware of its cancer-causing properties when exposed to it. As a result, it is advised that mortuary attendants receive regular in-service training on the effects of formalin and how to mitigate them. It will be imperative to organize regular in-service training for all mortuary workers on using personal protective equipment and effective hand hygiene to minimize the effects of their exposure to formaldehyde. Training should be organized for mortuary workers to educate them on modern methods of administering the formalin, including the use of the intravenous route, which reduces exposure to the formalin and its adverse effects. Hospital administrators should undertake periodic supervision in the mortuary to ensure mortuary attendants adhere to safety protocols and the SOPs at the morgues. A legislative framework that enforces the safety precautionary measures and rules¹ in working with dead bodies and formalin should be established and used at all times among all handlers of dead bodies. Hospitals should also include mortuary attendants in their regular medical screening for staff, all those who may have some of the effects of formalin should be given appropriate and timely treatment and compensated according to the law of workman compensation where necessary. Ghana's health policymakers should consider establishing and monitoring the PEL for formaldehyde among mortuary workers for timely interventions.

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Author contributions

J.K.A. contributed to data collection, data analysis, results, and discussion; A.F.D. contributed to data collection, data analysis, results, and discussion; A.K.K. contributed to data collection, script proof reading, and editing; C.W.L. contributed to introduction and data collection; G.K.G. contributed to data collection; and A.S.R. contributed to data collection, data analysis, script editing, and correspondence.

Data availability statement

Data are available upon request from the University of Health and Allied Sciences, Ghana, which issued ethical clearance for the data collection.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The protocol identifier number for the research is 'UHAS-REC A.1 [35] 19-20', and it was approved by the University of Health and Allied Sciences' Ethical Review Committee.


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Informed consent

The management of the facilities where the research was performed gave their written consent. Each individual gave their informed consent and committed to the interviews being registered. The study's purpose and why participants were invited to participate were explained to them. Using pseudonyms to represent participants, the study was able to ensure the privacy and secrecy of their identities and records. The names of the main body bones, for example, were used to represent the mortuary attendants who took part in the research.

ORCID iD

Abdul Sakibu Raji  <https://orcid.org/0000-0002-6918-6961>

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