

Occupational safety and health hazards associated with the slaughtering and meat processing industry in urban areas of Zimbabwe: A case study of the Gweru city Municipal Abattoir

Steven Jerie^{1*}
Kennedy Matunhira¹

Abstract

This study examined occupational safety and health hazards associated with the slaughtering and meat processing industry in the Gweru City Municipal abattoir in Zimbabwe. Qualitative and quantitative research designs were employed. The study population involved all the 23 workers including flayers and labourers who are directly involved in slaughtering and meat processing. Data was collected with questionnaire administration, interviews and field observations. Safety and health hazards associated with slaughtering and meat processing at the abattoir included physical, biological, ergonomic, mechanical, environmental and food safety hazards, all with the risk of causing significant harm to the workers. The lack of experience on job operations was one of the key risk factors increasing the likelihood of workers getting injured and increased frequency of injuries. Workers who had more working years at the abattoir encountered injuries less frequently than those who had fewer working years. The abattoir's occupational safety and health management system was not effective in solving safety and health risks and required improvement. One effective way that can be implemented is to establish a stand-alone safety, health and environment department within the Gweru City Council to give priority to occupational safety and health issues. Training programmes for workers and management on safety and health are recommended to improve workers' skills on job tasks, hazard identification, and risk assessment and to improve workers' behaviour as well as to enhance awareness on safety and health among management, which ultimately improves management commitments.

Key words: Abattoir health, meat processing occupational risks, safety, slaughtering

¹Department of Geography and Environmental Studies, Midlands State University, Gweru, Zimbabwe.

*Corresponding Author's e-mail: jeries@staff.msu.ac.zw

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Introduction

The meat processing industry is one of the world's largest industries that employs a significant number of workers and holds critical economic and social importance in most urban areas (Swai and Schoonman, 2012). Meat products are excellent sources of complete proteins, minerals and vitamins, which are essential for a nutritional balanced diet; hence consumed daily. According to the FAO (2014) and Food Outlook Report (2014), 311.6 million tonnes of meat were produced worldwide in 2014 alone with estimates of further growth in the industry expected. In developing countries such as Kenya and Zimbabwe, the meat industry is especially critical for the economic development since agriculture is the backbone of the economy. This makes the meat industry one of the most profitable and dominating industries globally. However, having higher volumes of production, greater efficiency in processing and higher profits taking greater priority, the welfare of workers involved is usually undermined. Gracey et al. (1999) note that in an industry where livestock are handled, machinery and knives are used and where floors are often slippery due to water, blood and fat deposits and where workers are in close contact with animal tissue; accidents, injuries and infections are inevitable and are usually fatal. They further highlight that the slaughtering and meat processing industry is an inherently dangerous industry. Many slaughterhouses and meat processing workers labour each day in conditions with predictable and preventable risks, which are contributed to by risk factors that can result in unacceptable and regrettable fatal accidents. All too frequent such occupational safety and health hazards and risks are due to inadequate and often non-existing occupational safety and health management programs (Meat and Livestock Australia, 2001; Rovetta et al., 1996; Ridriguez et al., 2012; Swai and Schoonman, 2012; Sofos and Smith, 2004).

According to a British Meat Industry Report, the British meat industry reports over 200 major injuries every year and other numerous reportable injuries that do not account for under-reported accidents involving deep lacerations, eye injuries, falls and animal attacks, all associated with slaughtering and meat processing (British Meat Processors Association, 2014). The report further states that the meat industry has the highest injuries per 100,000 workers as compared to other sectors in the food industry. Slips, trips and falls are caused by broken uneven floors, wet slippery floors, unsuitable footwear, smooth floors, slippery stairs, obstructions, stairs in poor condition, badly lit working areas, outside yards (rain, ice) and uncovered drainage channels are other serious hazards known to be associated with abattoirs globally. Ergonomic hazards also contribute significantly to occupational injuries and muscular-skeletal disorders, which usually develop into conditions over time. Tasks associated with slaughtering and meat processing require manual dexterity, high strength demand as well as highly repetitive actions. Harmse et al. (2016) argue that muscular-skeletal disorders are yet the biggest cause of occupational ill health among abattoir workers globally. In addition, frequent disorders include disorders of the upper limbs, lower back, and right wrist as well as upper extremity disorders. High number of muscular-skeletal disorders in abattoirs are mostly caused by inadequate or the lack of musculo-skeletal disorder identification and classification systems facilitated by an occupational safety and health management system (Tapping et al., 2006).

Zoonotic infections, chemical hazards, inexperienced workers, poor first-aid facilities, psychosocial hazards, and risky behaviour are among some serious safety and health concerns also associated with the meat industry. There are also others such as sub-standard abattoir infrastructure, the lack of comprehensive training, wellness and awareness programs that build preventive safety and health cultures as well as lack of management commitment to safety and health contributing significantly to the occurrence of occupational injuries and accidents (Awosile et al., 2013; Bala et al., 2011; Banjo et al., 2013). An occupational safety and health management system; when implemented, thereby addresses such problems in a proactive manner that identifies hazards systematically, recognizing that some hazards are more difficult to identify due to the complexity of the activities, long-term implications as well as technological improvements. Thus, such hazards may require proactive in-depth analysis. Risks are then quantified with the help of risk rating systems. After hazards have been identified and the associated risks have been assessed, performance standards can be set, stating clearly, what employees and employers have to do to control the risks in practical terms and have the system reviewed frequently through internal audits.

According to the Zimbabwe National Occupational Safety and Health Policy, occupational safety and health in Zimbabwe should be managed and facilitated through an approach that will ensure the prevention of injuries, diseases and fatalities in the workplace (Government of Zimbabwe, 2014). Workplaces and factories are obligated to have occupational safety, health and environment policies and management systems that involve hazard identification and risk assessment, infection prevention, occupational health surveillance. There is also the need for employee wellness programs, emergency preparedness and response as well as proper occupational safety and health training programs and abattoirs are no exception. However, it is regrettable to note that the majority of local municipality owned abattoirs have inadequate, poorly coordinated and often non-existing occupational safety and health management programs in place. These would facilitate training and awareness, hazard identification and risk assessment, as well as proper systematic reporting, recording and investigation of potential hazards and risks involved. Several fatal accidents have occurred in the municipality-owned abattoirs in Zimbabwe resulting in some workers being seriously injured and others losing their jobs. Most tasks and operations in the local abattoirs are handled manually, which presents several potential hazards and risks coupled with sub-standard abattoir-infrastructure and poor working environments adding to the problem. This research, therefore, endeavours assess the current occupational safety and health hazards faced by workers in the abattoirs in the Gweru City Municipal abattoir as well as an assessment of the effectiveness of the safety and health management systems.

Many abattoir workers in Zimbabwe are faced with serious occupational safety and health hazards at the workplace that frequently result in deaths and illnesses according to the senior Environmental Health Officer at Gweru City Council. The Gweru City Municipal abattoir slaughters and processes up to 30 cattle per day with a production quota of up to 50 cattle per day. This notwithstanding, there are several challenges in its occupational safety and health management procedures involving hazard identification and risk assessment, monitoring and evaluation, emergency preparedness and response, accident recoding and investigation, infection prevention including first aid procedures which pose numerous health and safety hazards and risks to workers. At least four reportable accidents and injuries occur in only one month, including several under-reported near misses and minor incidences, which are of great concern. Despite the fact that there are Safety Health and Environment Policy with the objectives of achieving compliance with statutory requirements, achieving the highest level of safety and health among workers, accidents and serious injuries at the abattoir have been inevitable.

The results of this study would benefit the Gweru City Council as the operator of the City Municipal abattoir in establishing and enhancing a comprehensive, goal-orientated occupational safety and health management system with the objective of reducing or eliminating health and safety threats to workers and clients as well as the general communities at large. The study provides insight to the organization's management of the occupational safety and health hazards and risks present and the associated risk factors, which would assist management to determine how best and effective they can manage the identified risks. This would also assist the organization in reducing costs incurred through compensations, absenteeism from work, bad public relations as well as lawsuits from workers and occupational safety and health governing institutions. A well-recognized and efficient occupational safety and health performance has the capability of improving the abattoir's reputation and reliability. This is instrumental in fostering a professional culture from management down to the workers hence this maximizes business as well as give the abattoir a competitive edge. Other abattoirs, either privately or local authority owned may also adopt the results of this study in enhancing their occupational safety and health management systems

Literature Review

The risk of occupational safety and health hazards in abattoirs generally is escalated by the prevalence of several associated risk factors in the majority of meat processing plants (Awosile et al., 2013; Bala et al., 2011; Banjo et al., 2013; Meat and Livestock Australia, 2001; Ridriguez et al., 2012; Swai and Schoonman, 2012; Sofos and Smith, 2004). A risk factor is any attribute, characteristic, condition, element, behaviour or exposure of an individual that increases the likelihood or chances of developing a diseases or injury (Awosile et al 2013 and Bala et al 2011). One important risk factor or condition that contributes significantly to increased injuries and accidents in an abattoir is lack of training, skill or experience among the workers. Tapping et al, (2006) support this view by stating that a lack of skill and training is regularly cited as a factor for poor knife handling, sharpening methods as well as handling and processing techniques. When a worker has insufficient training and experience on safe job practices (e g. evisceration, skinning, slaughtering), procedures to safely handle escaped animals, proper use of personal protective clothing, identification or detection of infectious conditions including abnormal cysts or abscess in animals or proper code of conduct at work, the likelihood of that worker as well as other persons getting injured or the occurrence of accidents and infection is greatly increased because the worker lacks vital knowledge, caution and judgement. Gracey et al (1999) mentions that newly employed personnel lacking in efficiency are most often at risk of injuries in abattoirs. A survey carried out by Awosile et al. (2013) to determine the hazard exposures of workers of animal -related occupations in Abeokuta Southwestern, Nigeria used structured questionnaires to get examine their occupational hazard knowledge, and formal training and zoonoses awareness. The authors further discussed that the low levels of awareness and training observed was likely to expose the workers to an increased risk of contracting zoonoses, because knowledge about preventive measures is very much essential in reducing the chances of exposure and transmission of zoonotic diseases. Yet, Nossent et al. (1995, cited in Tapping *et al* 2006) also argue that deficiencies in training as a risk factor in the meat industry is not only limited to abattoir workers, but in management claiming that a lack of training and experience at the management level is likely to affect all levels of operations.

Inadequate first aid and emergency facilities is characteristic in abattoirs, which adds to the problem of infectious and transmission of zoonotic diseases. Banjo (2013) notes that compensation data and practical experience in the meat industry demonstrates that the industry provides a hazardous work environment requiring provision of sufficient first aid facilities. Abattoir operations are associated with deep cuts and lacerations including attacks by animals, which require immediate medical treatment of open wounds to reduce exposure to biological agents and other environmental factors such as *Clostridium tetani* that cause harm through such wounds. Gracey et al. (1999) support the view and state that the lack of adequate first aid facilities or personal increases the likelihood for wounds or cuts to be infected upon exposure to animal tissue, blood, and aborted foetuses. All wounds cuts, and abrasions should immediately be treated to prevent *Tetanus* infection and tetanus toxoid should be administrated especially in case of deep penetrating wounds (Gracey et al.,1999). This, however, is only possible if the facility has the adequate first aid equipment, if not the chances of infection is greatly escalated.

Furthermore, Banjo et al. (2013) also note that some related predisposing risk factors in abattoirs to include putting of contaminated hands and fingers into the mouth, nose or eyes; breathing-in of infectious aerosols/droplets from the smoky air during burning of hides; respiratory discharges such as coughs and sneezes, contaminated dust; splashes of blood and other body fluids into the eye and other mucous membranes and broken skin in direct contact with the microorganism. The Australasian Meat Industry Employees Union (1995) also mentions several risk factors associated with manual handling injuries in an abattoir. Some of the identified risks include forceful movement of knife hand, often with wrist in awkward position and at extreme of working range of movement, frequent forceful gripping of hide or skin with non-knife hand, considerable forward bending of the neck for long periods, continuous bending and standing for long periods, lifting from below mid-thigh height to above shoulder height, using bent knee to lift

carcass resulting in unstable footing while lifting, carrying load on one shoulder with neck strained sideways, working in a cold environment as well as carrying heavy, large loads that are awkward difficult to grasp among others. These characteristics associated with operations increases the risk of injury and accidents in abattoirs.

Methodology

Research Design

This research triangulated the qualitative and quantitative research designs. The qualitative approach was mainly used in descriptive and observational aspects of the study that aimed at studying the human behaviour, working habits and cultures and risk factors. Conditions of the working environment as well as employee attitude and views concerning the occupational safety and health management systems employed at the abattoir were examined. The qualitative research approach enabled the researcher to achieve the research objectives, which aimed at identifying, or investigating the health and safety hazards associated with slaughtering and meat processing, the risk factors contributing to the hazards as well as the effectiveness of the safety and health management systems in risk management. The quantitative research method on the other hand, facilitated the proper assessment and analysis of data collected through quantitative means. This included, for example, analysis of responses to closed ended questionnaires as well as giving statistical representation of data involving number of accidents that occurred, frequency of minor injuries, near misses and number of disabling or fatal injuries including number of days taken off work due to injury.

The target population included the abattoir workers. The municipal abattoir has a total number of 23 workers including flayers and labourers who are directly involved in slaughtering and meat processing. The saturation sampling technique thus allowed the study to include all of the 23 workers as the population sample to respond to designed questionnaires.

These key aspects of the study could not be measured quantitatively hence, the qualitative technique of data collection was used to represent them. On the other hand, the quantitative research approach was used in complimenting the qualitative approach in representing specific numerical values and calculations that enhanced the quality of data collected. Statistical representation of data was capable of conveying a vivid picture of the situations under study when combined with qualitative data while enabling deductive logic. The qualitative research approach facilitated data collection using direct field observations, structured interviews, open-ended questionnaires as well as examination of written documents. Direct observations were critical and enabled the examination of workers as they carried out different activities and tasks to identify and assess occupational safety and health hazards associated with those tasks. Open and closed ended questionnaires and interviews also enabled the researcher to assess the views, knowledge and attitudes of workers and managerial personnel on occupational safety and health issues, safety and health management systems, not excluding the effectiveness of those systems in hazard control. The quantitative approach also allowed calculations of range, correlations, standard deviations and frequencies to determine the severity of the problem as well as discovering new variables and their relationships. Combining the two data, collection methods enabled the study to be comprehensive and thorough.

Study Area

The Gweru City Municipality Abattoir is owned and operated by the City of Gweru under the City Health Department. The City of Gweru is situated 275 km south of Harare, the capital city of Zimbabwe and the city abattoir is located within the City of Gweru, 2 kilometres North-West from the city's Central Business District (CBD) within the Gweru District, Midlands Province, Zimbabwe (Figure 1). The municipality-

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owned abattoir is certified and registered by the Veterinary Technical Services under the Public Health Regulations (Abattoirs, Animal and Bird Slaughter and Meat Hygiene Statutory Instrument 50 of 1995). The abattoir has been registered and certified to have a production quota of 50 Bovine units per day, 100 sheep/goats per day and 50 pigs per day. The abattoir property is generally comprised of the slaughterhouse, loading area, dumpsite as well as boiler rooms. The municipal abattoir slaughters and processes meat products supplying many butcheries in Gweru as well as other surrounding areas. Major areas that supply cattle for slaughter in the abattoir include surrounding areas as Lower Gweru, Somabhula and Shangani areas including various organization and individually owned farms for example the Midlands State University farms as well as those bought from the market.

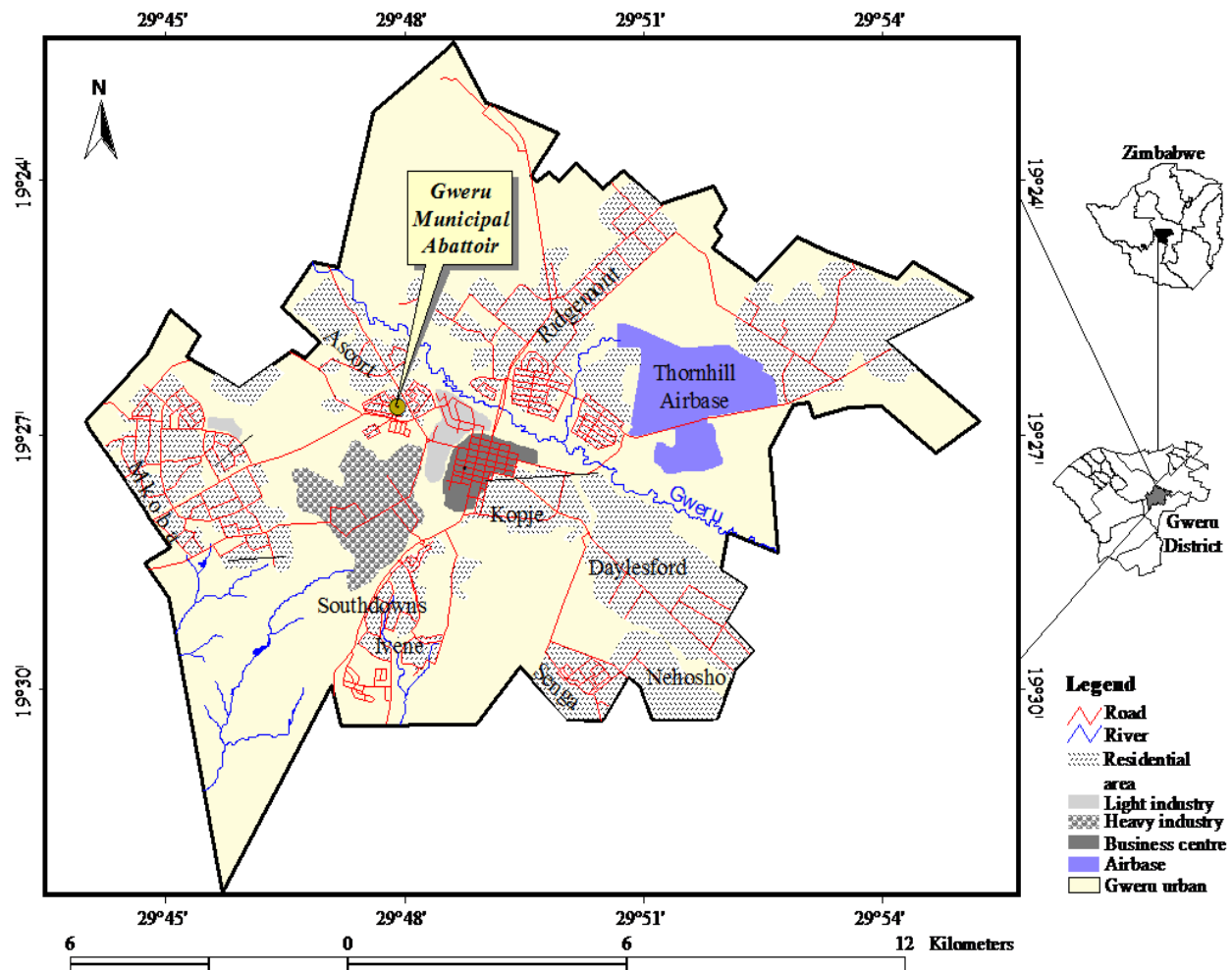


Figure 1: Map showing the study area

Results and Discussion

Types of occupational safety and health hazards and risks at the Gweru Municipal abattoir

Slaughtering and meat processing at the Municipal abattoir exposed workers to numerous safety and health hazards and risks that include physical, biological, ergonomic, environmental and psychosocial hazards. All of these have severe implications on workers' health and safety which ultimately affects the performance of workers. Figure 2 shows the types of commonly identified hazards with high potential of endangering the safety and health of workers at the municipal abattoir.

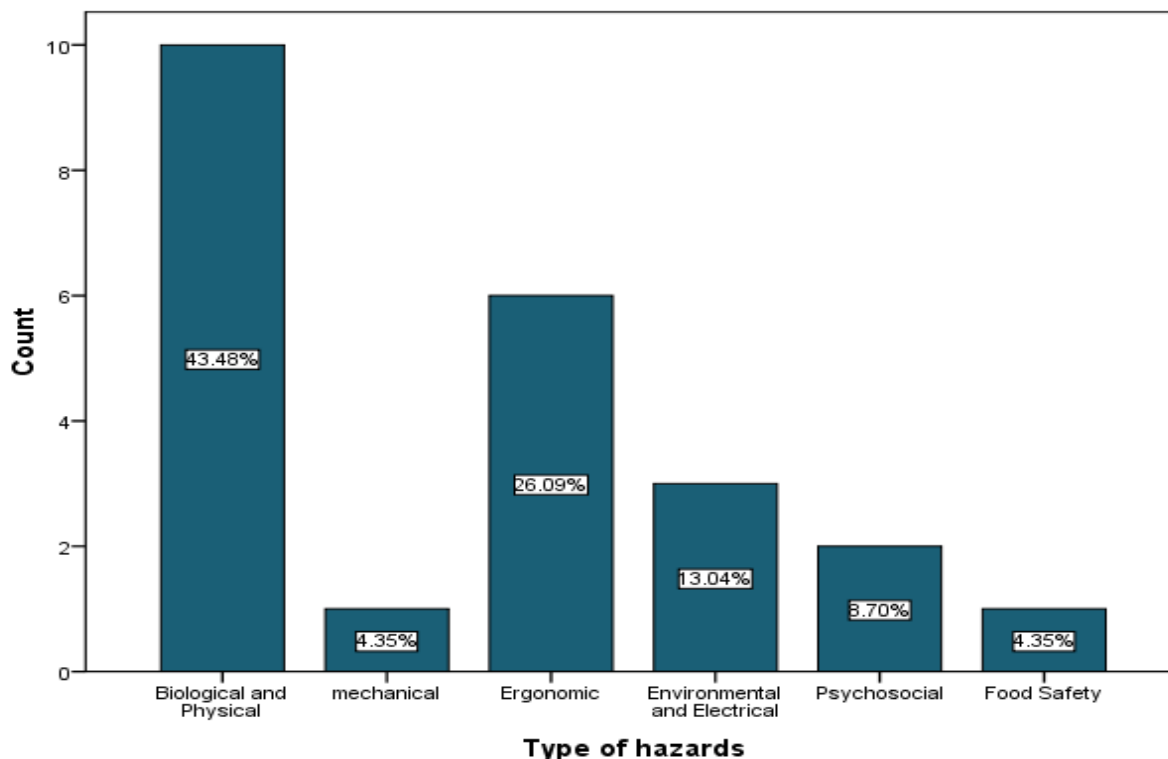


Figure 2: Types of identified hazards at the Municipal Abattoir

Biological and Physical Hazards

Figure 2 shows that biological and physical hazards are the most prevalent types of hazards associated with slaughtering and meat processing at the municipal abattoir, constituting 43.48% of hazards commonly identified. Biological hazards at the abattoir mainly involve viral infections, parasites, fungi or bacteria with a potential of transmission to workers and causing diseases. Exposure to biological hazards is through frequent and close contact with blood and blood protein of animals, animal tissue, bile, foetus discharges and membrane, discharges as well as exposure to calving animals during slaughtering and processing. Animal blood is also a potential hazard since it contains exogenous agents such as proteins, antibodies or enzymes, which can react with the workers' skin causing contact dermatitis. More than 87% of workers indicated that they suffer from skin conditions such as peeling of skin (epidermis), irritation and inflammation whenever they contact animal blood especially when cutting the jugular vein during slaughtering. Certain zoonotic diseases such as brucellosis, anthrax, swine flu, tick-bite fever and Q fever

are also of significant danger to the workers. This is because the associated zoonotic bacteria can be transmitted from the animal to the worker directly through contact with the infected discharges of animals, through skin wounds as well as through respiratory conjunctive routes and can pass such diseases to the workers. One meat inspector at the municipal abattoir interviewed indicated that,

...Brucellosis was one common zoonotic disease identified in cattle slaughtered at the abattoir, which is caused by bacteria from the genus Brucella and usually appears as a hygroma or abscess on the flesh of the animal to which workers are exposed to the hazard when they come into contact with the abscess or when it breaks during skinning, evisceration or splitting of the carcass...

Brucellosis can affect almost any part of the human body when transmitted including the liver and heart (causing them to enlarge beyond their normal size), the reproductive system and central nervous system while chronic Brucellosis may cause complications in just one organ or throughout the body (Mayo Clinic 2014), which is a serious risk associated. The likelihood of harm from biological hazards is increased by the presences of open wounds and cuts that are very common with the workers.

In addition to biological hazards, physical hazards are also dominant at the municipal abattoir ranging from sharp objects (14.06%) such as knives, bone splinters, hand and band saw machine; manual handling (7.4%); falling and moving objects (11.8%) such as rail wheels, hooks, holding bars and carcasses to obstructions (17.01%) as reported by the workers through the questionnaire survey. A number of workers (21.7%) indicated that aggressive and escaping animals were by far the greatest cause of serious injuries and accidents at the abattoir. Exposure to aggressive animals is mainly a result of tasks such as receiving or unloading, handling, inspecting, driving or stunning of large animals like cattle that can cause significant crush, kick and stamp injuries. The smell of blood in the slaughter house including electric shocks passed to the cattle during driving were reported to be factors that cause the cattle to be agitated hence aggressive. Cattle with certain diseases such as measles; of a particular breed or those that are calving or that have been injured are also generally aggressive thus, exposure to such animals is also a serious physical hazard because they are likely to severely attack any person close-by. Physical hazards are also mainly from manual handling such as pulling the hide while skinning, rotating the pulley handle while hoisting the carcass which requires much effort or manually pulling the stunned animal from the stunning box into the slaughter house after slaughtering which can result in physical stress and strain of the body.

Ergonomic hazards

The slaughtering and processing of meat at the municipal abattoir also come with several ergonomic hazards constituting 26.09% of the hazards usually identified. Ergonomic hazards are particularly a result of manual handling, maintaining awkward postures, reaching out, heavy lifting, repetitive movements, and use of excessive force in pulling and pushing as well as vibrations. Skinning of the animals at the abattoir is characterized by having the worker bend the back with shoulders below hip level while raising the neck forward and exerting high force in that awkward posture to reach the carcass due to poor work and task design. This could result in muscle fatigue and injury. Repetitive motion is also caused by cutting of hides, which requires excessive repetitive force together with reaching out movements. Repeated bending of the knees is also associated with various tasks such as pulling the carcass from the stunning box, skinning and deboning. Holding the knife at a tight grip while applying excessive force with frequent wrist movement during cutting is also another source of potential harm to the wrist and arm of the workers particularly when using a poorly designed knife. Exposure to such hazards can cause degenerated lumbar and strain of the musculoskeletal system, tendons and ligaments including repetitive strain injury (RSI). Tenosynovitis is also a common musculoskeletal disease associated with skinning because of excessive strain of the muscles. Seventy-eight percent of the workers indicated that they experience lower back and neck pains; wrist, shoulders, forearms and elbow pains; stiffness as well as painful joints.

Ergonomic hazards also emanate from vibration produced by the electric saw band machine. Only one worker is tasked to operate the machine usually with no recovery due to high workload. This workload means one is exposed to the whole body vibrations that can put stress on the spinal tissues including development of 'dead or white fingers'. A known result of long-term use of hand-held vibrating equipment is 'dead or white fingers', or Reynard's phenomenon characterized by loss of sensitivity, later followed by increased flow of blood in fingers and tingling pain (Jerie, 2012). In addition, exposure to ergonomic hazards is mainly from heavy lifting while loading the carcasses into vehicles. The carcass is split into four quarters during processing which one assigned worker lifts and carries each processed quarter on his shoulders to the loading bay since there is no rail systems in the loading section. Majority of the workers (57.5%) indicated that 35 cattle are slaughtered per day, which means the loading worker carries 140 quarter parts of the carcasses on his shoulders per day. This may result in serious neck pains, back pains, paralysis of shoulder muscles as well as lumbar discs degeneration due to carrying awkward loads. Plate 1 depicts a worker carrying a quarter of a carcass while loading as an example of serious ergonomic hazards associated with slaughtering at the municipal abattoir.

Other ergonomic hazards are associated with maintaining awkward postures during evisceration. Plate 1 shows workers working whilst bending the back, exerting force and maintaining awkward and static postures during the skinning process as another example of exposure to ergonomic hazards in the abattoir, which can be a source of musculoskeletal disorders, in some cases the associated effects can develop after years of exposure.



Plate 1: Workers maintaining awkward postures while skinning a carcass

The above findings are in consonance with Harmse et al. (2016) who investigated the impact of physical and ergonomic hazards on poultry abattoir processing workers and established that abattoir workers are

exposed to ergonomic hazards such as stress from manual, repetitive tasks that require force such as hanging and cutting including forceful exertion, awkward work positions. They further indicated that fast work pace and the major effects or risks to these hazards include myalgia (muscle pain), chronic myofascial (chronic muscle pain), rotator cuff injuries (tendon inflammation in the shoulder), tendosynovitis, Raynaud syndrome and hand arm vibration syndrome among others.

Environmental and electrical hazards

Other hazardous phenomena associated with slaughtering, meat processing at the municipal abattoir are environmental, and electrical hazards constituting 13.04% of the hazards identified. Environmental hazards are mainly from slippery floors, uneven floors, and unclosed drainages. During slaughtering and meat processing blood and fat of animals are deposited on the floor, which makes the floors very slippery at all times. Exposure to wet floors, coupled with inadequate footwear that do not provide sufficient grip. The presence of sharp objects such as knives, usually in the hands of workers at all times thus makes slippery and uneven floor an enormous risk with the potential of causing fatal stabs or severe wounds if workers fall on them. The entire drainage system in the slaughterhouse is uncovered and workers use the drain to support the carcass when slaughtering thus, blocking water and blood from moving. This may cause tripping, falling or sprained ankles when workers step into the drain without seeing it particularly, when pulling the slaughtered animal into the slaughterhouse. Newly employed workers who lack the experience and knowledge of the working environment are mostly at risk in this regard.

Electrical hazards are mainly from the use of the electrical stunner in stunning the animals. The worker involved in this task is likely to get shocked by electricity or be electrocuted during stunning in the stunning box. This is particularly likely to be the case when driving cattle from the pens to the stunning box whilst holding an electrical stunner without proper insulation at the same time avoiding other attacking cattle. The likelihood of getting shocked by electricity is increased when the worker loses concentration due to fatigue and pressure to meet production quotas or during the rainy season when the worker drives the cattle from the pens to the stunning box when it is raining or wet. Exposed electric wires and outdated electrical wiring of the abattoir are also sources of electrical hazards. 37.4% of the workers reported that they had been shocked by electricity at least once because of contact with metal surfaces mostly due to a fault from the main socket.

Mechanical and Psychosocial hazards

Other hazards associated with slaughtering and meat processing at the municipal abattoir include mechanical hazards (4.35%) and psychosocial hazards (8.70%). Mechanical hazards are mainly from the use of the electric saw band machine. The machine has moving and rotating parts including a sharp rotating blade, which can cut the operator, including the risk of being electrocuted. The Principal Occupational Safety and Health Officer from NSSA indicated during an interview that:

...the person using or operating a machine is always at high risk. One of the major hazards identified at the abattoir when we carry out inspections is an unguarded electric saw band machine which has no proper safety devices such as interlocking devices, emergency power off switches or even proper servicing.

Psychosocial hazards also result from heavy workload associated with demands to meet daily work targets, noise as well as behaviour and stress. 61.9% of the workers indicated that the workload was heavy while 21.7% highlighted that it was very heavy which cause workers to have fatigue, loss focus making them prone to other hazards or even develop musculoskeletal disorders. The behaviour of workers is also another related psychosocial hazard. A Meat Inspector interviewed mentioned that:

...the behaviour of workers at this abattoir is a concern, workers do hose playing and make a lot of noise in the working area for example shouting, singing and arguing which disrupts follow of communication such that when an emergency occurs, such as an escaped cattle into the abattoir, workers may not hear warnings; all this shows lack of training.

Sixty-four of the workers also indicated that the behaviour of workers had in some cases contributed to injuries and accidents. This explains why some workers work under the influence of alcohol whilst others work in a rush to finish and knock off early, with others receive bribes from clients to slaughter their cattle faster hence; they work in a rush and take short cuts, which puts them at high risk of being injured. The exposure to noise also has significant effects of reducing the alertness of the worker and triggers in psychological fatigue. 75.04% of the workers also indicated that late payment of salaries and pressure from clients and supervisors to finish slaughtering early contributes significantly to stress. The occupational stress can result in change in behaviour, drug and alcohol abuse, which increases the rate of injury and accidents.

Food safety hazards

Food safety hazards (4.35%) at the municipal abattoir are mainly biological hazards, involving bacteria, fungi and viruses such as *Salmonellas*, *Salmonella typhus* and *Escherichia coli* (*E coli*) emanating from the abattoir which can contaminate the meat posing significant threat to the health of the public who consume the meat slaughtered at the abattoir. Such biological hazards are mainly caused by poor hygiene in the abattoir. For instance, there could be lack of hot water to sterilize the knives, lack of chemical sanitary detergents in footbaths, lack of fly and rodent proof systems to prevent fly and rodents from entering the slaughterhouse. Others may include the absence of a cold room as well as lack of soap for workers to wash their hands properly, which all can introduce or multiple bacteria in the slaughterhouse. Contamination of the meat by biological hazards may also be due to a low rail system, which results in the carcasses being in contact with the floors, which are not clean. One Meat Inspector who was interviewed observed that;

...the standard gap accepted by legislation (Public Health (Abattoir, Animal and Bird Slaughter and Meat Hygiene) Regulations SI 50 of 1995) between the floor and the carcass is between 30cm-50cm to prevent contamination but in this abattoir the carcasses contact the floor exposing them to biological agents.

Lifting and carrying parts of the carcass on the workers shoulders during loading also exposes the meat to contamination by biological hazards. The lack of hazard management systems such as the Hazard Analysis Critical Control Point (HACCP) was also observed to be a major risk factor associated with food safety hazards. The abattoir superintendent mentioned in an interview that HACCP has not been introduced at the abattoir hence critical control points have not been established which a major risk factor to food contamination is also.

Environmental degradation

Other examples of hazards observed at the municipal abattoir are associated with chemical and biological pollution and environmental degradation from abattoir waste that is generated in great volumes. This chemical and biological pollution poses great threat to flora and fauna. Waste products such as animal blood, fat, trimmings, liquid offal contents and wastewater are discharged straight into the municipal sewer system while solid waste such as abdominal offal contents, animal waste (dung), hair, thoracic offal and dead livestock are disposed behind the slaughterhouse in an open dumpsite manner. Plates 2 and 3 depict

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some of the waste management practices at the municipal abattoir, which may pose significant threats to the natural environment.



Plate 2: Slaughter waste being discharged direct into the sewer system



Plate 3: Waste dumpsite behind the abattoir

Discharging slaughter waste that is high in organic load into the sewer system can have detrimental effects on the environment. Some of these effects include de-oxygenating water bodies due to high Biochemical

Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) loads when the sewerage is discharged into the environment without treatment, which affects aquatic ecosystems including possible blockages of public sewerage systems. This sewerage discharge results in serious environmental health effects. Disposing solid waste in open dumps also causes emission of greenhouse gases such and methane due to decomposition as well as providing vectors for the spread of diseases. Figure 3 shows the types of common injuries usually encountered at the municipal abattoir

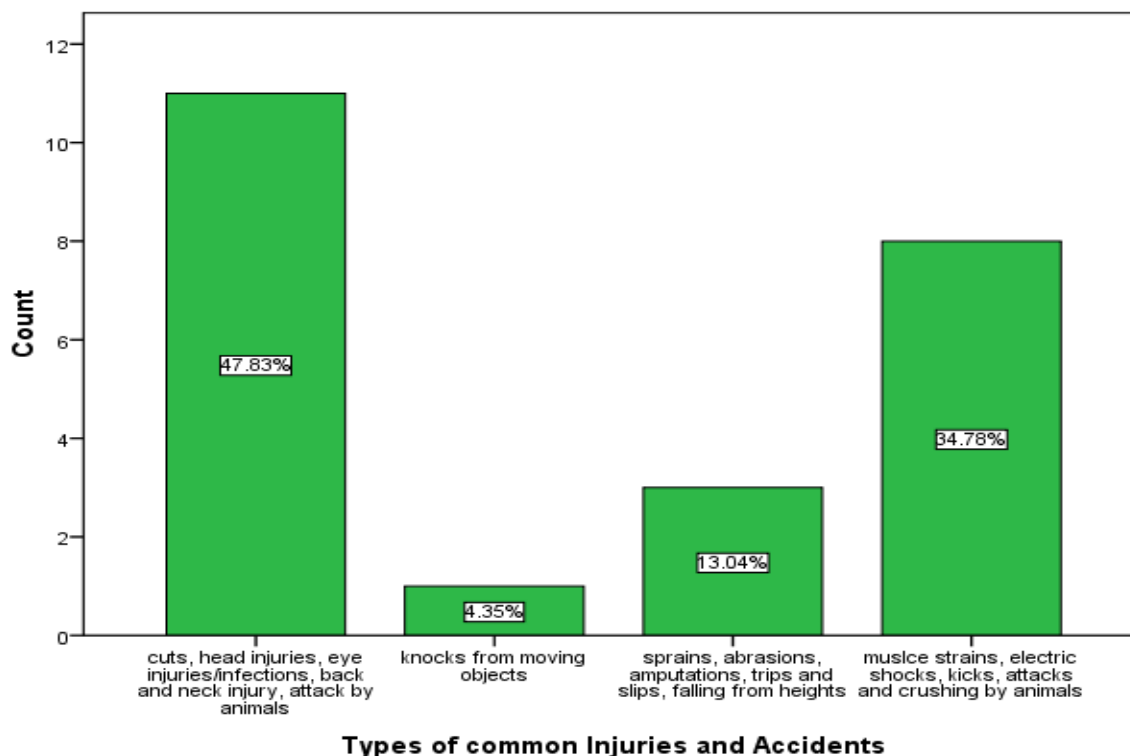


Figure 3 Types of common injuries and accidents

A statistical Chi-square test was used to determine the association between the types of hazards identified and the types of injuries and accidents at the abattoir. This was done to establish if the identified hazards are related with the forms of injuries and accidents at the abattoir.

The following hypothesis was tested:

H_0 – There is no association between identified hazards and the types of injuries and accidents

H_1 - There is association between identified hazards and the types of injuries and accidents

Using 0.05 as the Probability Value

If X^2 is greater than probability, value reject H_0 and accept H_1

If X^2 is lesser than probability, value reject H_1 and accept H_0

The test result is shown in Table 4.

Table 1 Chi-Square Test

	Value	df	Assymp. Sig
Pearson Chi Square	18.000	6	0.006
Likelihood value	18.558	6	0.005
No of valid cases	23		

From Table 4, $0.05 > 0.006$, therefore, we accept H_1 reject H_0 . In this context, there is an association between the types of hazards identified at the abattoir and the types of injuries and accidents experienced. This means that the occupational safety and health hazards that were identified at the municipal abattoir have a strong relationship with the types of injuries and accidents encountered. This also shows that the safety and health hazards identified at the municipal abattoir have a risk of causing harm to the workers.

Major risk factors associated with occupational safety and health hazards at the municipal abattoir

Lack of first aid facilities

In all, thirty percent of the respondents indicated that the lack of first aid facilities was one critical factor increasing the likelihood or chances of workers getting injured or developing infections. This lack of first aid facilities in an abattoir can be regarded as a critical risk factor. Cuts and open wounds are too frequent among the workers, which is attributable to the exposure to sharp objects and bone. Closely linked to this is the presence and exposure to biological agents, which is significantly high and makes the likelihood of the workers getting infected through untreated wounds alarmingly high. It is of utmost importance that any cut or open wound be treated immediately to reduce the possibility of infection, however this is only possible if the first aid facilities are available and adequate including the availability of trained personnel among the workers to provide first aid. Pal et al. (2013) emphasize on this view by stating that prevention and control of zoonotic infections among abattoir workers is dependent on immediate medical attention to skin injuries and cuts. It was observed that the municipal abattoir did not have any form of first aid facility or trained personnel and so the workers continued to work with open wounds and cuts exposed to blood protein and animal tissues, which is a high risk factor to infections.

Lack of management commitment

The absence of first aid facilities at the Municipal abattoir could be related to the lack of management commitment to safety and health of workers. Sixty-seven percent of the respondents also strongly agreed that management lacked commitment and precedence in addressing safety and health issues at the abattoir. One major indicator of a lack of management commitment to safety and health in various industries is the absence of hazard identification and risk assessment procedures. Accordingly, , 73.9% of the respondents agreed that hazard identification and risk assessment procedures were not being carried out at the abattoir.

Failure to report near miss and minor accidents and injuries

The reason why near misses or minor accidents and injuries may not be reported is that there are no proper means or procedures at the abattoir to report such accidents. Sixty-eight percent of the respondents indicated that there was no near miss or accident reporting procedures at the abattoir. Another reason why near misses or minor accidents may not be reported could be that workers cover up near misses or minor injuries in order to maintain good working record or they do not want to be recognized as being victims of a near miss accident or injury. In any case, failure to report near miss accidents or injuries is also a strong risk factor because the root cause of the accident or the hazard will not be identified, addressed or corrected which means the accident can occur again with higher severity thus increasing the risk. Morrison (2014) highlights that collecting near miss reports is vital in creating a culture that seeks to identify and control hazards and that can reduce risks and the potential harm.

Unsafe behaviour

Unsafe behaviour is also a critical risk factor observed at the municipal abattoir. Risky behavioural practices observed among the workers included noise pollution, sharing knives during meat processing (posing the risk of transmission of infectious diseases such as HIV/AIDS, and Hepatitis B). There are also cases of walking whilst holding knives in hands, persistent unhygienic practices such as not washing hands, using

steel without guards, sleeping at work, working under the influence of alcohol and drugs, doing work in a rush to finish, taking shortcuts in job operations, smoking in the slaughter house as well as encouragement to take risks. Such behaviour greatly increases the likelihood of occurrence of accidents, injuries and infections that may harm the workers and property or lead to food contamination. Behaviour such as rushing to finish work or carrying out job operations under the influence of alcohol or drugs greatly impairs the judgment of the worker particularly for tasks such as skinning where there is very close contact between the knife and the non-knife-holding hand and precision is vital. In such an assignment, a slight error in judgement would cause a deep cut injury. Risky behaviour at work may be a result of poor training and lack of safety procedures to prevent such risk factors. One of the Meat Inspectors interviewed also highlighted that "...if a person lacks training and there are no guiding measures, they are prone to get injured..." These findings are somewhat in line with the findings of Banjo et al. (2013) who demonstrated that risky behaviour among abattoir workers included cuts on hands, respiratory discharges, splashing of blood and other body fluids into the eye and other mucous membranes. Others identified included broken skin in direct contact with the microorganism, sharing of razors during meat processing activities and exposure to smoke from burning of hides, which also increased the possibilities of them developing diseases or injuries. Gracey et al. (1999) also explain that carelessness and irresponsible behaviour also account for some of the accidents in abattoirs. This indicates that unsafe behavioural practices are also critical risk factors associated with slaughtering and meat processing in abattoirs.

Lack of adequate Personal Protective Clothing

While risky behaviour may be considered as a critical risk factor, the absence of Personal Protective Clothing/Equipment is also another strong risk factor, which greatly increases the possibilities of developing injuries and accidents. It was observed that workers did not have basic abattoir personal protective equipment such as helmets, goggles, hairnets, hearing protection and chain mesh gloves and aprons. Plate 4 depicts workers carrying out job operations in the slaughterhouse without putting on safety helmets, hairnets, goggles or chain-mesh aprons as was observed which increases the risk of being injured.



Plate 4: Workers carrying out tasks in the slaughterhouse without helmets or hairnets

The lack of personal protective equipment greatly increases the chances of hazards such as physical and biological hazards causing harm to the worker. For example, the likelihood of falling objects causing harm is increased greatly by the lack of safety helmets. Similarly, the lack of goggles increases the risk of eye infection and injuries from splashing blood. Several workers (32.01%) indicated that they had been struck in the head and were injured by falling rail wheels that were loose or broken. The lack of Personal Protective Equipment at the abattoir can also be related to a lack of management commitment to safety and health.

Lack of Training and Experience

In addition to the above discussed issues, the lack of training and experience may also be the greatest risk factors at the municipal abattoir. 67.2% of the respondents agreed that workers are poorly trained on occupational safety and health issues and hazards that are likely to affect them, which means that they are not in a position to identify hazards that may cause harm. This inability to identify the hazards that can cause harm increases chances of any hazard to cause harm. The Director of Health Services mentioned in an interview that:

...there are no training programs for workers at the abattoir which is a major risk factor. Training is essential in developing skill in a person but also critical in shaping the behaviour of the worker. If a worker is properly trained they will be aware of what to do and what not to do while working including the dangers to look out for, but if they are not, they will be at high risk of getting injured...

Another meat inspector who was interviewed explained that a worker could only know that if they are cut by a knife or bone they should get immediate medical attention. This would help them to cover the wound and to stop contact with animal blood and the reason for doing so or how to hold a knife properly when cutting or how to lift heavy objects properly if they have been trained. This lack of knowledge in handling equipment shows that training is critical in reducing injuries and accidents and likewise a lack of training becomes a significant risk factor.

Effectiveness of the abattoirs occupational safety and health management system

Seventy-four percent of the respondents agreed that hazard identification and risk assessment procedures were not being implemented at the municipal abattoir or have not been introduced. Hazard identification and risk assessment are the principal corner-stone components of effective occupational safety and health management. Consequently, the hazard identification and risk assessment procedures indicate the presence of a system that aims at addressing or controlling safety and health issues. Taderera (2012) states that the hazard identification process serves as the basis for establishing a system for safety and health management where no safety and health management system exists, or if the organization is newly established since what is not known cannot be managed. Thus, if the hazard identification process is not being implemented initially or carried out at the abattoir, the safety and health management system is not effective or it may not be existing.

Eighty-seven percent of the workers also indicated that an occupational safety and health management system was not available at the municipal abattoir. This could be so because some workers may be not aware of the safety and health management system or its implementation. However, the Principal Occupational Safety and Health Officer from NSSA mentioned in an interview that “the abattoir does not have any occupational safety and health management system being implemented”. On the other hand, the Director of Health Services also highlighted that:

...there is no occupational safety and health management system at the abattoir. Its effectiveness cannot be examined because it does not exist. Safety and health has a low priority amongst management, some of the members of the management team do not have any idea what safety and health is hence it is sidelined among other matters and profit making is the aim...

This may also be an indication that the safety and health management system is not effective since some key stakeholders and workers are not aware of its existence or it has not been introduced at the municipal abattoir initially.

Proper training of workers is another critical component or element characterizing an effective occupational safety and health management system for an organization. Taderera (2012) states that one main element of occupational safety and health management system at an organizational level is training, and training programs should cover all members of the organization including initial and refresher training at appropriate intervals. Fifty-seven percent of the workers agreed that there was lack of training on safety and health issues while 34.8% strongly agreed. This means that workers do not receive any initial orientation, refresher training and awareness programs on safety and health, safety cultures as well as job procedures, which should be included in the implementation stage of the management system. This, therefore, shows that the occupational safety and health management system is also not effective in terms of workers training and awareness.

Although the organization has a Safety, Health and Environment Policy formulated, indicating a framework for action, its implementation at the municipal abattoir is minimum. 84.8% of the respondents agree that the implementation of the policy was very minimum. The Director of Health services also indicated that:

...the policy is there but it is not adhered to, for instance one of its provisions is to ensure that each work station has a first aid kit and a qualified first aider with a valid certificate, but that is not implemented hence it is just a document...

This also shows that the policy has little implementation. Furthermore, an occupational safety and health management system is supported by several interrelated and interdependent components, including planning, implementation, monitoring and management review (Plan-Do-Check-Act), which are all aimed at enhancing the existing policy in an ongoing process.

Therefore, having a policy or plan without the other related components is also another indication that the system is not being implemented and thus, likely to be ineffective.

Conclusion and recommendations

Occupational safety and health is a necessary discipline that is critical in addressing and solving health and safety issues associated with urban slaughtering and meat processing abattoirs and its implementation is of utmost importance. Safety and health is directly related to efficiency and due diligence and should therefore, be put on abattoir operations. The monitoring would result in an effective economic investment. Proper occupational safety and health is anchored on the application of an occupational safety and health management system in which hazard identification is a critical component of the system that aims at identifying associated hazards since what is not known cannot be managed. It is, therefore, necessary to identify hazards associated with abattoir operations in order to facilitate the implementation of the management system.

Slaughtering and meat processing at the municipal abattoir exposes workers to severe safety and health hazards that endanger the well-being of the workers. Most critical safety and health hazards identified included biological, physical, ergonomic, environmental and mechanical hazards. Some of the main sources of potential harm to the workers identified are poor task and work environment design, risky behaviour, sub-standard abattoir equipment and working environment, nature of the job as well as the lack of training. It was also observed that these identified safety and health hazards have a close relationship with the nature or forms of injuries and accidents encountered at the municipal abattoir hence it can be concluded that the

hazards that were identified have a high risk of causing harm. Therefore, there is need for a systematic management approach to effectively minimize or eliminate the dangers.

Workers who had more working years at the abattoir encountered injuries less frequently while those with few working years encountered injuries more frequently and are more vulnerable to safety and health hazards. The main conclusion drawn from this is that the lack of work experience on job operations puts workers at high risk of being injured. More efforts must be put, therefore, into training of workers and training programs to enhance work skills. The enhancement in work skills would ultimately improve the efficiency of the workers as well as shape the behaviour and attitudes of the workers to develop safety cultures. This also call for the implementation of a comprehensive, robust and scientific management system that facilitates all the aspects of occupational safety and health highlighted in this study to ensure elimination or minimization of hazards and workers well-being.

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