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FACTORS ASSOCIATED WITH THE MANAGEMENT OF BIOMEDICAL WASTE IN MILITARY HEALTHCARE FACILITIES IN KISANGANI. RESEARCH PROTOCOL.

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ABSTRACT

Introduction: The objective of this study is to evaluate the management of biomedical waste (BMW) and the factors associated with poor management in military healthcare facilities in Kisangani.

Material and methods: An analytical cross-sectional study will be conducted among 475 personnel from military healthcare facilities in Kisangani from July 31st to December 31st, 2023. Data will be collected through interviews, observations, and documentary reviews. The analysis of associated factors will be performed using the Pearson's Chi-square test at a significance level of 5%. Odds ratios (OR) with their 95% confidence intervals (CI) will be presented with the Wald p-value.

Expected results: The expected results include data on the sociodemographic characteristics of the personnel, their knowledge and practices regarding BMW management, the availability of resources and guidelines, and the factors associated with BMW management. This study anticipates revealing poor BMW management due to a lack of adequate knowledge and practices among personnel, as well as shortcomings in infrastructure and equipment. We expect to identify risk factors such as lack of training, absence of guidelines, and logistical problems, through statistical analyses (OR, 95% CI, p-value).

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Conclusion: The results of this study will provide essential evidence to inform interventions aimed at improving BMW management in military healthcare facilities in Kisangani. By identifying the factors associated with poor management, it will be possible to propose targeted measures to prevent risks and ensure the safety of personnel and the population.

KEYWORDS: biomedical waste, hospital waste management, military healthcare facilities, Kisangani.

1. INTRODUCTION

Public hospital services (PHS) have the fundamental principles of guaranteeing equal access for all to the care they provide. They are open to all individuals whose condition requires their services [1]. Due to their activities, healthcare facilities produce waste in large quantities and of very diverse nature; this is healthcare waste, also called biomedical waste (BMW). Biomedical waste is generated by major sources such as hospitals, clinics, laboratories, research centers, or by minor sources such as dental clinics, ambulance services, home care, etc. [2]. At the hospital level, these are solid, liquid, or gaseous substances resulting from care, diagnostic, or other activities [3].

Globally, the estimation of the quantity of waste produced per day and per patient depends on several factors. Studies have shown that the average production varies from one country to another; for example, in France it is 3.5 kg per occupied bed per day, in the United States 7 to 10 kg, in Japan 1.5 kg, in Taiwan 2.5 kg, and in Morocco 3 kg [4].

In 2015, a joint WHO/UNICEF assessment revealed that just over half (58%) of the sampled facilities from 24 countries had adequate systems for the safe disposal of healthcare waste. These same international organizations estimate that in 2021, only 61% of hospitals had basic healthcare waste management services, and the situation worsened in fragile contexts where, based on 2023 data, only 25% of healthcare facilities had biomedical waste management services that contain infectious agents and toxic chemical substances harmful to humans and the environment [5].

An assessment conducted by WHO alone in 2017 in 22 developing countries showed that the proportion of healthcare facilities that do not apply appropriate waste disposal methods ranges from 18% to 64%. Another study conducted by the same organization in 2018 showed that 16,000 cases of hepatitis B virus infections, 66,000 cases of hepatitis C virus infections, and 200 to 5,000 cases of HIV infections among healthcare workers were recorded worldwide, with poor biomedical waste management as the main cause [6].

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In Africa, the policy for quantifying waste from healthcare activities is not well established. According to a study conducted in 2018, the annual production of medical healthcare waste (MHW) in Ouagadougou varies between 270 and 320 tons. In Cotonou, it is 143.73 tons. In Dakar hospitals, production varies between 14.12 and 76.84 tons. As for Bamako, it is 49.26 tons [7]. In developing countries, particularly in sub-Saharan Africa, the disposal of biomedical waste is hardly satisfactory; poorly managed medical waste can not only lead to contamination, pollution, unnecessary carbon dioxide emissions, and waste of resources, but also pose a danger to patients, healthcare professionals, and the population as a whole [8]. It poses health risks for hospital staff as well as for the population coming into contact with this waste in 51% of cases. The current management of hospital waste and biomedical material can pose a real public health problem because, on the one hand, there are nosocomial infections contracted in hospital and healthcare settings by patients. There are also problems of ecological and environmental impact. Indeed, water, air, soil, and food are the main elements contaminated in 65% of cases by this waste. It is evident that an unhealthy environment contaminated by this waste can have harmful consequences on the health of the population [9]. A study conducted in Benin estimates that each year 3 million accidental injuries are responsible for 37% of new cases of hepatitis B, 39% for hepatitis C, and about 5.5% for HIV among healthcare workers. Despite this progress, in 2021, injections performed under unsafe conditions still resulted in 33,800 new HIV infections, 1.7 million cases of hepatitis B, and 315,000 cases of hepatitis C [10]. During another study conducted in Benin, a remarkable lack of knowledge of the different colors of solid BMW containers was noted (87%) among untrained staff and (80%) among trained staff, poor quality of waste sorting; collection equipment for solid BMW was sometimes lacking, and the collection and storage of solid BMW posed a problem [10]. Poor hospital waste management practices were observed in some earlier studies. In Côte d'Ivoire, it was observed that 71.1% of CHR staff did not sort the collected waste. The collected waste was transported by wheelbarrow, contrary to the recommendations of the World Health Organization (WHO). In the absence of a functional incinerator, sharp/cutting waste, pharmaceutical waste, non-sharp/non-cutting waste, and household waste were burned in the open air; as for anatomical waste, it was buried in pits [11]. In Algeria, it was reported that all surveyed health facilities applied the color code for sorting hospital waste, but a mixture of general waste with infectious waste is often done by staff lacking training in the management of this waste and using insufficient means to ensure their safety. Furthermore, the storage area is insecure for most facilities [12]. In Côte d'Ivoire, the management of biomedical waste was irrational for three reasons: insufficient management policy, lack of material resources, and lack of staff training. The biological risk was therefore evident for the staff. The results showed the absence of microplans (92.23%) and waste management tools (83.50%). No person responsible for biomedical waste management was identified in the departments (78.64%). Selective sorting was practiced for sharp, cutting, and piercing objects, with conventional safety boxes (59.22%), filled to overflowing (44.6%) [13]. During a study conducted in Senegal, it was observed that the sorting of BMW was inadequate in 53.5% of departments and the use of the color-coding system was effective in

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31.4% of departments. Safety boxes for the collection of sharp and piercing objects were available in 82.5% of departments, and their effective use was noted in 51.1% of them. In the majority of departments, inadequate packaging was noted in the form of using plastic bottles and bins for collection and overflowing safety boxes [14]. In the Democratic Republic of Congo (DRC), the results of a study conducted in Kinshasa in February 2023 found that health facilities poorly implement the national hospital waste management plan and related regulations. The lack of material and financial resources is believed to be the cause of this dysfunction [15]. The same study showed that needlestick injuries and/or other injuries are responsible for viral diseases such as AIDS, hepatitis C, or B in 41.2% of cases, yet every hospital structure is supposed to have a hospital hygiene department [15]. During a study conducted in 2018 at the Bukavu Provincial General Reference Hospital on BMW management, it was observed that the vast majority (91%) of respondents had high knowledge of BMW management, but the strategy for improving the biomedical waste management system was non-existent [16]. A study conducted in Kisangani on the management of waste from hospital establishments showed that, with the exception of pharmacies, pharmaceutical waste, infectious waste, and anatomical waste are present in all departments at rates of 51.7%, 41.4%, and 17.1%. The sorting of BMW was inadequate for 53.3% of departments, and the use of the color code system for 10.0% of departments. The transport of BMW was done by hand in 73.3% of departments, with carts or dollies in 10.0% of departments, and with wheelbarrows in 16.7% of departments. Working conditions were considered poor by 84.7% of the workers surveyed, and personal protective equipment was available in 49.1% of departments. Knowledge of BMW management was considered insufficient by 61.6% of the workers surveyed, and the health risks associated with BMW were known by 84.7% of them [17]. Given the ineffectiveness of public authorities or the lack of a general policy governing hospital waste management, biomedical waste is thrown everywhere without realizing its consequences on human health and the environment [18]. The particularity of military healthcare facilities is that these facilities primarily depend on the Ministry of Defense and do not benefit from the traditional technical and logistical support provided to other healthcare facilities: no supervision, no periodic data analysis, no training plan, and their needs in terms of infrastructure, personnel, and equipment are not taken into account in the operational action plan of the Provincial Health Division. This is why this study aims to investigate the issue of waste management in order to describe the biomedical waste management process in these facilities, to assess the level of knowledge of staff on biomedical waste management, and to identify the institutional and individual factors associated with poor BMW management in these military healthcare facilities.

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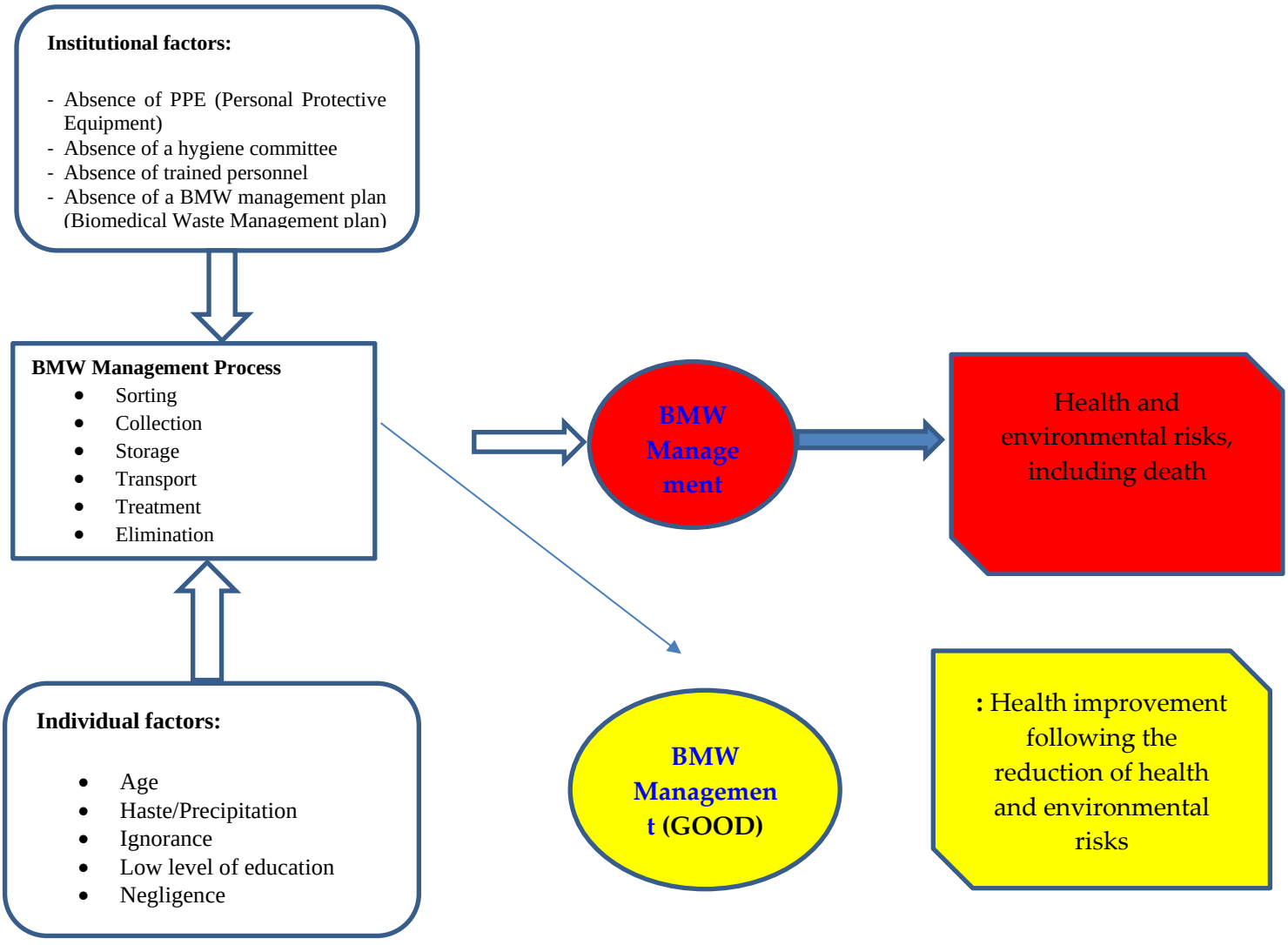

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II. MATERIAL AND METHODS

2.1. Material

2.1.1. Study setting This study will be conducted in all military healthcare facilities, including the military hospital of the 3rd Defense Zone located at the Makiso General Reference Hospital in Kisangani (in the Makiso commune), the KETELE Military Reference Health Center (in the Kabondo commune), the CI LOKUSA Military Reference Health Center (in the Lubunga commune), and the Camp Général Bahuma Military Reference Health Center (in the Makiso commune). All these healthcare facilities are located in the city of Kisangani, situated in the Northeast of the DRC. This city is the capital of the Tshopo province.

2.1.2. Study population the population of our study will consist of all personnel in the military healthcare facilities.

2.2. Methods

2.2.1. Study type and period Our study will be a cross-sectional study with an analytical aim, conducted during the period from July 31st to December 31st, 2023.

2.2.2. Sampling

2.2.2.1. Sample size the sample size will be calculated using SCHWARTZ's formula as follows:

$$n = \frac{Z^2 x\, p\, .(1\ -\ p)}{d^2}$$

n = required sample size; Z = confidence level at 95%; P = estimated proportion of use of BMW management services (50%); d = margin of error at 5%. With an anticipated non-response rate of 10%, we will have a sample of 422 subjects.

2.2.2.2. Sampling technique We will carry out an exhaustive sampling of military healthcare facilities. Within these healthcare facilities, we will evaluate, on the one hand, the biomedical waste management circuit, taking into account the sorting, collection, storage, transport, and disposal of waste, and on the other hand, the level of knowledge and practices of personnel involved in waste management. Since the total number of personnel involved in the waste management cycle in these healthcare facilities is close to our sample size, we will include all of them in our study, which will represent an exhaustive sample of 475 subjects.

2.2.3. Inclusion criteria All personnel involved in at least one step of biomedical waste management, working in the targeted healthcare facilities, and having agreed to participate voluntarily in our study will be included.

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2.2.4. Variables of interest

2.2.4.1. Dependent variable: biomedical waste management (Good or poor)

Biomedical waste management will be considered "Good" when:

- Waste collection is done using coded containers or bags, transported correctly, and stored separately; that is, proper adherence to the steps of the biomedical waste management process.
- Proper disposal by incineration and/or burial of the ash;
- No waste on the ground, around bins, or on the path leading to the incinerator.

2.2.4.2. Independent variables:

- Characteristics of personnel responsible for biomedical waste management: qualification, seniority, training received, PPE available, knowledge of infectious risks related to poor waste management;
- Waste management guidelines and standards: available, displayed;
- Existence of a waste management plan.

2.2.2.4.3. Operational definition

Knowledge of the risks associated with poor waste management will be considered good when:

- The respondent correctly defines biomedical waste as "waste resulting from diagnostic, monitoring, preventive, curative, or palliative activities in the field of human medicine that poses a physical hazard or a risk of biological or chemical contamination for humans and/or the environment";
- Correctly knows the steps of biomedical waste management: "sorting, collection, storage, transport, and disposal";
- Identifies the risks associated with poor management: "infectious risks (viral hepatitis, HIV/AIDS) and environmental risks (air pollution, contamination of groundwater and/or surface water)."

2.2.5. Data collection technique Data will be collected through a combination of interview, observation, and documentary review techniques. Guided interviews using a questionnaire will be administered to personnel of the military healthcare facilities. Observation will be done using a structured observation grid, focusing on the behavior of personnel, the waste management circuit, and waste management equipment. The documentary review will consist of verifying the existence of guideline documents on biomedical waste management.

2.2.6. Statistical analyses Our data will be extracted and encoded in an Excel database and then analyzed using STATA 13 software. The age of the respondents will be described using the mean ± standard

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deviation, and categorical variables will be presented using proportions. Bivariate analysis will be used to establish an association between biomedical waste management and certain factors. ORs and 95% CIs will be presented with the Wald p-value.

2.2.7. Ethical considerations for the conduct of this study, we will submit the protocol to the ethics committee of the FMP/UNIKIS for approval. The various authorizations will be obtained, including that of the commander of the 33rd Military Health Zone and those of the commanders of these military healthcare facilities. Oral consent will be sought from our respondents, and respect for the confidentiality and anonymity of personal data will be observed

III. EXPECTED RESULTS

Table 1. Sociodemographic characteristics of respondents: This will present the variables age, sex, level of education, seniority, prior training.

Table II. Respondents' knowledge of BMW management: This table will present, using frequencies and proportions, the respondents' knowledge in terms of understanding of BMW management concepts, knowledge of the steps of BMW management, and the overall level of knowledge on BMW management.

Table III. Respondents' practices in biomedical waste management: This table will present data on waste zones, sorting, the presence of coded bins, the contents of the bins, and waste transport.

Table IV. Availability of qualified personnel, hygiene committee, budget, standards, and guidelines: This table will present data on the presence of a hygiene committee, the existence of a budget, and BMW management standards and guidelines in the facilities.

Table V. Analysis of factors associated with BMW management: In this table, the analysis of factors associated with BMW management will be presented in a bivariate analysis table, with ORs, 95% CIs, and the Wald p-value. It will concern all independent variables and specify among them those that have a statistically significant relationship.

CONCLUSION

Based on our results, this study will show whether the management of BMW in these military healthcare facilities is adequate or not. The associated factors will be identified, and recommendations will be formulated regarding them for the attention of the actors involved.

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