Biomedical waste management at Sokponta healthcare facility in Benin

Abstract

Biomedical waste was a public health and environmental problem. The presence of waste was linked to healthcare activities that generated an increasing amount of hospital waste. Various articles had shown that the current conditions for the management of biomedical waste were not satisfactory on a global scale. The objective of this study is to evaluate the management of biomedical waste at the Sokponta health center.

This was a descriptive cross-sectional study with an analytical purpose carried out from March 11 to May 11, 2024 in the Sokponta health center. The research focus was on: waste sorting out at source, collection, transport and treatment of waste.

The management of biomedical waste at the Sokponta health centre remained to be improved. There was a low level of training on the management of Biomedical Waste (BMW), this was evident in 3/7 of the respondents. The method adopted for the treatment of waste was incineration

There was an urgent need to introduce new, more organized and well-structured strategies for sustainable and efficient biomedical waste management.

Keywords: Management; Biomedical waste, health facility, health safety

Introduction

Biomedical waste represents a major public health and environmental protection issue. Its management is becoming critical due to the constant increase in waste generated by healthcare activities in healthcare facilities. Rigorous management of all hospital waste is necessary to continuously improve the quality and safety of care, in particular by reducing the risks associated with nosocomial infections (Bertin et al., 2015). According to the International Committee of the Red Cross (2011, p.15), it is the responsibility of hospitals to effectively manage the waste they produce (ICRC, 2011). This institution also specifies that the handling, treatment and disposal of waste must be carried out in such a way as to avoid any risk to the health of patients and staff, as well as any negative impact on the environment. In many developing countries, poor management of biomedical waste poses significant risks to public health (Ndiaye et al. 2012; N'Zi et al. 2018; Kouassi, 2021; Gnaro et al., 2023; Diabaté, 2023). The World Health Organization (WHO) has sounded the alarm on the seriousness of this problem (WHO, 2024). The production of biomedical waste continues to increase worldwide (Anagonou, 2022). For example, the annual production of biomedical waste in Brazzaville, Congo is estimated at around 341 tonnes for hospitals with minimal expanded activities, while the treatment of this waste remains unsatisfactory in this city (Mouankié et al., 2015). The management of this waste requires rigorous sorting at source, suitable transport and specific treatments (Kra, 2023; Baztami, 2019). Aware of this need, the Hubert Koutoukou Maga National Teaching Hospital Center (CNHU-HKM) in Cotonou, through its health and safety commission, is working to implement measures to reduce

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biomedical waste (Todedji et al., 2021). This study aims to evaluate biomedical waste management practices at the Sokponta health facility in 2024.

Comment [AB3]: What is Biomedical waste?

Comment [AB4]: Is this the objective of the study or the overall aim of the study?

1. Methods

This research is a descriptive cross-sectional study with an observational aim, carried out from March 11 to May 11, 2024.

The study took place at the Sokponta Arrondissement health center, in the Dassa-Glazoué health zone, located in the Collines department of Benin. The Sokponta health center serves the Sokponta health area made up of five (05) villages with an estimated population of 9,772 inhabitants, spread over an area of 2 hectares (Maimouna, 2023, p.12). It is located in the Sokponta center village, Ekpa district, and is bordered to the north by the Sokponta public primary school, to the south by the Abbraccio hospital, to the east by the URHC church of Sokponta and to the west by the Saint Martin College boarding school. Photo 1 shows the main entrance to the Sokponta health facility.

Photo 1: Moudila-Mankassa L. May 2024

Photo 1 illustrates the main entrance to the Sokponta District health center, with its signboard. The Sokponta hospital is an entity offering promotional, preventive and curative care services. It is under the supervision of a coordinating physician. The staff of the Sokponta health center is composed of a nurse responsible for the dispensary, a midwife responsible for the maternity ward, four nursing assistants (two at the dispensary and two at the maternity ward), two clerks and a maintenance worker.

The study was conducted among the healthcare staff of the Sokponta health facility and the staff in charge of biomedical waste management.

The inclusion criteria included members of the healthcare staff working in the Sokponta health center or those involved in biomedical waste management. Persons absent at the time of the survey (due to illness, administrative leave, or mission) were not included in the study. Non-probability sampling, based on a reasoned choice, was used to select participants. The sample consisted of seven (7) subjects: one (01) nurse, one (01) midwife, four (04) nursing assistants and one (01) maintenance worker. Data were collected by direct observation and semi-directed interviews with participants. An interview guide and an observation grid were used to collect the data. The information collected was organized by themes of interest and then analyzed using Microsoft Word 2019 and Microsoft Excel 2019 software.

2. Results

2.1 Description of the practices of collection, storage and treatment of BMW at the Sokponta health center

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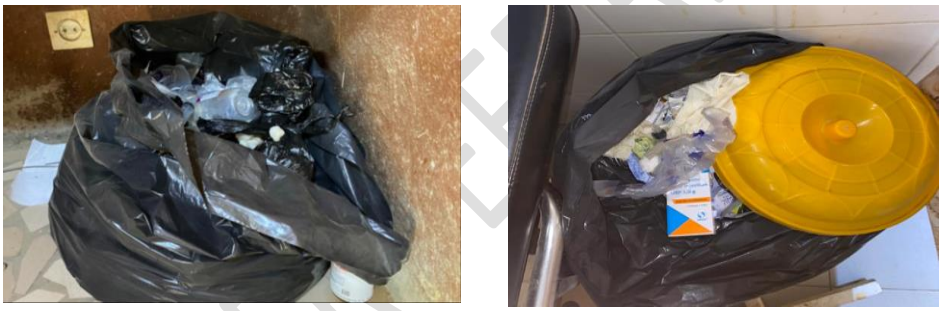
Observations on the management of biomedical waste were carried out in the two departments concerned: the maternity ward and the dispensary. The hospital hygiene department is responsible for monitoring the management of biomedical waste at the Sokponta health center.

2.1.1. Sorting out of biomedical waste at source

The field observation revealed several dysfunctions in the management of biomedical waste:

- there was no separation between biomedical waste (BMW) and waste similar to Domestic Waste (DW) in all departments;

- the color coding system to distinguish the different categories of waste was not applied. The waste was placed in plastic bins and bags. In the maternity ward, the coding for anatomical waste was not respected, the staff use a blue bin with a lid; - Although safety boxes for sharp objects are available in the wards, their use was limited. These boxes were often filled to the brim, leading to risks of overflow. In addition, the absence of specific collection bags and labels corresponding to the different categories of waste was noted, thus compromising the adequate identification of waste. Picture 1 shows a sorting at source of biomedical waste at the Sokponta health center.



Picture 1: Unsorted biomedical waste at the Sokponta health center

Photographed by: Moudila-Mankassa L. May 2024

Picture 1 highlights an accumulation of unsorted biomedical waste at the Sokponta health center. There is a clear lack of separation between the different categories of waste, including biomedical waste and waste similar to household waste. The waste, of various types and risks, is piled up without any sorting.

2.1.2 Collection of biomedical waste at the Sokponta health center

This step involves moving the trash cans from the offices or treatment rooms to the containers located in the intermediate or central waste storage areas. It is clear from the observation that it was the nursing assistants who removed the waste from the various departments where it was located. They transported them to the intermediate storage area and cleaned the wards once a day at 6 a.m.

- collection was not daily in all departments, waste remains there for 4 or even 5 days;

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- on site, garbage collection is done by hand because there is a lack of carts reserved for waste collection and transport;

- during the study, staff completely filled the bags and left them open;

- there was only one intermediate storage location for all the departments surveyed, accessible to all.

Photo 2 shows a safety box, used for the management of biomedical waste in the Sokponta health center, filled and opened during transport.

Photo 2: Safety box for the management of DBM full and open during transport

Photo taken by: Moudila-Mankassa L. May 2024

2.1.3 Storage of biomedical waste at the Sokponta health center

Comment [AB9]: Another objective of the study

The intermediate storage room in Sokponta did not meet the requirements (covered, regularly cleaned, protected from animals, well ventilated and lit). At the Sokponta health center, waste is deposited in the intermediate storage area for more than eight (8) days before removal by the agent responsible for incineration. This resulted in an accumulation of hazardous hospital waste. Photo 3 shows the intermediate storage room in the management of biomedical waste at the Sokponta health center

Photo 3: Intermediate storage room in the management of biomedical waste at the Sokponta health center

Photo taken by: Moudila-Mankassa L. May 2024

Photo 3 shows the intermediate storage room for the management of biomedical waste at the Sokponta health center. This room is a dedicated space, where medical waste is temporarily

stored before its final treatment or disposal. Its function is crucial to limit exposure to infectious risks and to ensure controlled handling of waste.

2.1.4 Transport of biomedical waste at the Sokponta health center

Comment [AB10]: Another objective...

The carrier is not approved to transport hazardous materials. The photo highlights the failures to comply with the safety standards necessary to avoid any risk of contamination or incident during the transport of these risky materials (Photo 4).

Photo 4: Transporting biomedical waste for disposal as part ~~of Biomedical~~of Biomedical Waste (BMW) disposal at the Sokponta health center

Photograph: Moudila-Mankassa L. May 2024

Photo 4 shows a transporter using a wheelbarrow to move hazardous materials, clearly without proper care or safety equipment. The wheelbarrow, a simple model made of worn metal, does not have any of the characteristics normally required for transporting hazardous substances. No specific protection is visible on the transporter: no gloves, mask or protective clothing.

2.1.5 Treatment and disposal of biomedical waste

There was an autoclave that was not functional. The disposal of solid biomedical waste is done by incineration in the health center. This treatment is carried out by the security guard. Liquid biomedical waste is diluted in bleach and is dumped into sewers. Photo 5 shows an incinerator for disposing of biomedical waste at the Sokponta health center.

Photo 5: Incinerator for disposal in biomedical waste management

Photograph: Moudila-Mankassa L. May 2024

Photo 5 shows an incinerator dedicated to the disposal of biomedical waste, an essential device in the management of this type of waste to ensure health and environmental safety.

This incinerator is specially designed to destroy infectious waste, sharp objects, and other potentially hazardous materials from healthcare facilities.

2.1.6 Staff protection measures at the Sokponta health center

Personal Protective Equipment (PPE) was available including protective gloves, masks and boots for the agent responsible for processing biomedical waste. However, they are not always worn.

2.2 Assessment of health personnel's knowledge on the management of BMW at the Sokponta health center

2.2.1 Knowledge of the definition of waste

Table I: Opinions of staff surveyed on the definition of waste in the context of biomedical waste management at the Sokponta health center

Items investigated	Frequency	Ratio
Materials that can be thrown away	1	1/7
An unusable residue	6	**6/7**

Source: March, May 2024 Survey

Table I reveals that the majority of respondents correctly defined waste as unusable residue.

Comment [AB11]: Is this a qualitative research or quantitative or a mixed method?

2.2. Knowledge of national legislations and regulatory norms on waste management

Table II: Opinions of staff surveyed according to their knowledge of national legislations or regulatory norms on the management of BMW at the Sokponta health center

Items investigated	Frequency	Ratio
NO	6	6/7
YES	1	**1/7**

Source: March, May 2024 Survey

Table II reveals a significant lack of knowledge among the staff surveyed regarding national legislation and regulations on biomedical waste management (BMW). Indeed, only one (01) out of seven (07) respondents said they were aware of these references.

2.2.3 Perception of the importance of BMW management in hospital hygiene

Table III: Perspectives on the importance of BMW management in hospital hygiene by the staff surveyed at the Sokponta health center

Items investigated	Frequency	Ratio
They are source of contamination	5	5/7
They are not source of contamination	2	**2/7**

Source: March, May 2024 survey

Table III shows that BMW were important in hospital hygiene because they were a source of contamination for the majority of respondents.

2.2.4 Knowledge of the major classes of BMW

Table IV: Opinions on knowledge of the major types of BMw by the staff surveyed on the management of BMW at the Sokponta health center

Investigated Items	Frequency	Ratio
Don't know	2	2/7
General Waste	5	5/7
Infectious Waste	5	5/7
Sharps Waste	5	5/7
Anatomical Waste	5	5/7
Pharmaceutical Waste	5	5/7

Source: March, May 2024 Survey

Table IV shows that the staff of the Sokponta health center were aware of five (05) major types of BMW.

2.2.5 Knowledge of the categories of waste produced in the services

Table V: Opinions of respondents on knowledge of the categories of waste produced in the Sokponta health facility according to staff surveyed on the management of BMW

Investigated Items	Frequency	Ratio
Don't know	2	2/7
General Waste	5	5/7
Infectious Waste	5	5/7
Sharps Waste	5	5/7
Anatomical Waste	5	5/7

Source: March, May 2024 Survey

Table V shows that in the Sokponta health center, four (04) categories of waste are encountered.

2.2.6 Staff training

Table VI: Polls on BMW disposal training received by the staff with regards to efficiency at the Sokponta health center

Investigated Items	Frequency	Ratio
NO	3	3/7

YES	4	4/7

Source: Survey from March to May 2024

Table VI shows that a significant proportion of people (4 out of 7) said they had received training on hospital waste management.

2.2.7 Usefulness of sorting and separation of BMW at source

According to all respondents, sorting was useful for the management of biomedical waste.

2.2.8 Practice of sorting at source by healthcare staff

Table VII: Distribution according to the practice of sorting at source by the staff surveyed on the management of BMW at the Sokponta health center

Items Investigated	Frequency	Ratios
NO	1	1/6
YES	5	5/6

Source: Field survey, May 2024

Table VII indicates that five (5) out of 6 respondents were used to sorting BMW.

2.2.9 Knowledge of color codes and type of regulatory containers corresponding to the types of biomedical waste by staff

In the Sokponta health center, safety boxes are used to receive needles, breakable bottles and sharp objects. Yellow plastic bags are intended for soiled gloves, compresses and tampons. Red plastic bags were for human anatomical waste. Black plastic bags are reserved for ordinary waste.

2.2.10 Knowledge of the extent to which collection bags are filled by staff

Table VIII: Distribution according to the extent to which collection bags are filled

Items Investigated	Frequency	Ratio
Don’t know	5	5/7
Filling up to 3/4	1	1/7
Filling up to 4/4	1	1/7

Source: Field survey, May 2024

Table VIII indicates that the majority (5/7) of respondents had no knowledge of the filling limit of the collection bags.

2.2.11 Staff knowledge of the risks associated with BMW

According to the staff surveyed, BMW presented a serious risk. This risk was infectious and/or biological.

2.2.12 Waste collection

Table IX: Distribution according to the rate of waste collection, of the staff surveyed on the management of BMW at the Sokponta health center

Items Investigated	Frequency	Ratio
Irregular	1	1/7
Regular	6	6/7

Source: March, May 2024 survey

Table IX shows that waste collection was regular according to 6 out of 7 respondents and this was done every 24 hours.

2.2.13 Use of protective equipment during handling of BMW

Table X: Distribution according to the use of protective equipment during handling of BMW by the staff surveyed on the management of BMW at the Sokponta health center in 2024

Items Investigated	Frequency	Ratios
Rarely	5	5/7
Often	1	1/7
Always	1	1/7

Source: Field survey, May 2024

Table X shows that the use of protective equipment during handling is not effective for the majority of respondents.

2.2.14 Proposed solutions

Table XI: Various approaches used by the staff as part of solution for effective management of BMW

Items Investigated	Total respondents	Ratio
Staff training on BMW management	7	7/7
Availability of adequate tools and equipments	6	6/7
Enhanced sanitary conditions for staff	4	4/7

Source : March, May 2024 survey

3. Dicussions

The hospital hygiene department is responsible for monitoring waste management at Sokponta Health Center. The data collected indicate that there is monitoring of waste collection, but this is done only by the hospital hygiene manager. Lack of staff limits the effectiveness of biomedical waste management (BMW), despite the manager's efforts. Only one officer is assigned to waste collection for the entire center. According to WHO in 2005, adequate human, material and financial resources are needed to properly manage medical waste (Rushbrook and Zghondi 2005). A significant proportion of respondents (4 out of 7) at

Sokponta Health Center reported having received training on hospital waste management. This could indicate a certain level of awareness and commitment to improve waste management at the health center. Five (5) out of 6 respondents were used to sorting BMW. This means that the majority of respondents are aware of the importance of sorting this waste, which is essential to reduce health and environmental risks linked to poor management of BMW. This result is contrary to that of Mouankié and Abéna who reported a lack of sorting in the management of biomedical waste in Brazzaville (Mouankié et al. 2015). However, the management of biomedical waste requires the involvement of all stakeholders in health facilities for good safety of care, patients and nursing staff. This analysis is also in line with (Gnaro et al. 2023). According to the World Health Organization, the low proportion of health workers who have received sufficient training on hospital waste management negatively impacts their management (WHO, 2024). Despite the efforts of the manager to ensure effective management of DBM at the Sokponta health center, weaknesses remain. These weaknesses are related to waste sorting, filling waste collection bags, and wearing protective equipment. These results are consistent with those of a study on medical waste management and biological risk at the Cocody University Hospital in Côte d'Ivoire, where the authors reported that only sharp, pointed and cutting objects were sorted at source (N'Zi et al. 2018). The Basel Convention cited by Anagonou also recommends that biomedical waste be treated not far from its place of production (Anagonou, 2022). In addition, the Sokponta health center does not have an incinerator internally, the waste being stored in an area before being disposed of, which increases the risk of contamination. The center also does not apply sorting of infectious waste, and incineration is outsourced, a process that is not completely reliable in terms of safety. Finally, it should be noted that the center's agents are vaccinated against certain infectious diseases such as hepatitis A and B and tetanus, in order to limit the risks of contamination in the absence of fully compliant waste management measures. This vaccination practice should be encouraged for the safety of staff and patients. This result is contrary to that reported by a study carried out in Congo where 55.57% of agents were not vaccinated (Mouankié et al. 2015).

Conclusion

From this study, it appears that at the Sokponta health center, the quality of biomedical waste treatment remains to be improved. A great effort is being made in the context of biomedical waste management. However, increading the number of the staff in charge of this management, the equipment as well as quality training will ensure better safety of patients, staff and users of the Sokponta health center and preserve the environment.

References

1. Anagonou, Désiré. 2022. “Biomedical waste management methods and environmental sustainability at the maternal and child university hospital in Cotonou (Benin)”. https://www.revue-geotrope.com/update/root_revue/20220720/4-Anangonou.pdf.
2. Baztami, Youssef. 2019. “Medical waste management : prevalence; sorting and treatment”. https://toubkal.imist.ma/bitstream/handle/123456789/19025/P0152019.pdf?sequence=1.

3. Mouankié, Jean Bertin, Abéna Ange Antoine, Okémy Andissa Nadège, and Diakouka Diambalou Rancia C. 2015. “Biomedical waste management in Brazzaville, capital of Congo”. European Scientific Journal, ESJ 11 (23). https://eujournal.org/index.php/esj/article/view/6087.
4. ICRC. n.d. “Manual on Medical Waste Management.” Accessed 9 December 2024. https://www.google.com/search?client=firefox-b-d&q=International+Committee+of+the+Red+Cross+2011%2C+p.15%29%2C+it+is+the+responsibility+of+hospitals+to+effectively+manage+the+waste+they+produce.
5. Diabaté, Arouna. 2023. “Biomedical Waste Management in the Yirimadio Community Health Center 2022.” PhD Thesis, University of Sciences, Techniques and Technologies of Bamako. https://bibliosante.ml/handle/123456789/6675.
6. Gnaro, Takpaya, Awedeou Ali, Kokou Ayamekpe, Cyriaque Degbey, Farouk Salami-Odjo, Abdoul-Rahim Ouro-Koura, Panaveyi Malou Adom, Ghislain Emmanuel Sopoh, and Didier Koumavi Ekouevi. 2023. “Hospital Stakeholders’ Perception on Environmental Effects Related to Biomedical Waste in Togo’s University Hospitals (UHC) in 2021.” Open Journal of Preventive Medicine 13 (2): 57-72. https://doi.org/10.4236/ojpm.2023.132005.
7. Kouassi, Anaïs Audrey. 2021. “Medical Waste Management in Côte d’Ivoire”. International Journal of Management Sciences 4 (4). https://revue-isg.com/index.php/home/article/view/796.
8. Kra, Kouakou Edouard. 2023. “Biomedical Waste Management in the Gbêkê Health Region: Limits and Socio-Health Impacts. Phd thesis, Alassane OUATTARA University Bouake-Côte d’Ivoire”. https://theses.hal.science/tel-04715652/.
9. Mouankié, Jean Bertin, Abéna Ange Antoine, Andissa Nadège Okémy, and Rancia C Diankouka Diambalou. 2015. “Biomedical Waste Management in Brazzaville, Capital of Congo”. European Scientific Journal 11 (23): 317-24.
10. Ndiaye, M., L. El Metghari, M. M. Soumah, and M. L. Sow. 2012. “Management of biomedical waste in five hospital structures in Dakar, Senegal.” Bulletin of the Society of Exotic Pathology, 1-9.
11. N’Zi, Konan Constant, Youssouf Traoré, Médé Roger Dindji, Yapo Blaise Acho, and Jean-Sylvain Bonny. 2018. “Management of medical waste and biological risk at the University Hospital of Cocody, Côte d’Ivoire.” Public Health 30 (5): 747-54. https://doi.org/10.3917/spub.186.0747.
12. WHO. 2024. “Healthcare waste.” 2024. https://www.who.int/fr/news-room/fact-sheets/detail/health-care-waste.
13. Rushbrook, P., and R. Zghondi. 2005. “Improved management of health care waste: An integral component of investment in health.” WHO. https://www.google.com/url?sa=t&source=web&rct=j&opi=89978449&url=https://iris.who.int/bitstream/handle/10665/119762/dsa1181.pdf&ved=2ahUKEwjVzqfXzJKKAxVFD1kFHdytHgEQFnoECBYQAQ&usg=AOvVaw3fkEcP3DNjfQk_CKL0MU8p.
14. Todedji, Judicaël Nounagnon, Justin Somadje Okambawa, Waris Kéwouyèmi Chouti, Comlan Cyriaque Degbey, Achille Dedjiho, and Daouda Mama. 2021. “Evaluation of the effectiveness of chemical treatment of university hospital effluents in the coastal department in the Republic of Benin.” Journal of the West African Chemical Society

50. https://soachim.info/document/journal-soachim/article/Vol-050Num-1-de693b923970af1c74f06d0f8703aef2.pdf.