The Effect of COVID-19 Pandemic on Bio-Medical Waste Management and Generation in Private Hospitals in Cagayan Province

Wacky Al C. Maggay, Angeline C. Taquiqui, Jedelbert A. Tulauan,
Marilove G. Tumolva, Nickson B. Cammayo

Medical Technology Department
School of Health and Allied Sciences
University of Saint Louis
Tuguegarao City, Cagayan

Corresponding author:
1300653@usl.edu.ph

Abstract*—Due to the rapidly increasing cases of COVID-19, hospitals became compacted, healthcare workers weakened, and waste piled up. This study was conducted as a healthcare management strategy to analyze the bio-medical waste management of hospitals in Cagayan. Enhancing their awareness, knowledge, and understanding of waste management to reduce the risk of harm and infection caused by biological waste. It aimed to describe the effect of COVID-19 on Bio-Medical Waste Management and Generation of Private Hospitals in Cagayan. The study utilized a descriptive qualitative design. The purposive sampling method was used in selecting the respondents. Health and non-health personnel were interviewed using open-ended questions to describe and elaborate the effect of COVID-19 on bio-medical waste management and generation. Throughout the face-to-face interview, the researchers adhered to the COVID-19 precautions. Major themes included in this study were 1) COVID-19 caused in Bio-Medical Waste Generation, 2) Hospital Safety, and 3) Bio-Medical Waste Management Practices during COVID-19. Results showed that the generation rate of bio-medical waste increased during the COVID-19 pandemic due to the extensive use of disposable PPEs. The patient flow was seen to be directly proportional to the use of PPEs. The introduction of the COVID-19 pandemic highlights the critical importance of developing new viewpoints and methodologies in implementation, such as the inclusion of innovative and rigorous ways to collect bio-medical waste. There are protocols implemented to prevent the spread of the virus. The massive volume of COVID-19 trash includes medical and non-medical equipment such as PPEs. This increase puts further strain on bio-medical waste (BMW) disposal facilitators. As a result, there is now a greater focus on the necessity to separate bio-medical waste from regular garbage, primarily houses with COVID-19 patients. The data showed that most of Cagayan's private hospitals do well in COVID-19 waste management.

Keywords— biomedical waste management, waste generation, COVID-19, health and non-health personnel

I. INTRODUCTION

The COVID-19 is one of the most devastating pandemics the world has ever seen. As of December 2021, it is estimated that there have been 276 million confirmed cases and roughly 5 million confirmed deaths (WHO, 2021). Due to the rapidly increasing cases of COVID-19, schools, offices, businesses were affected. The hospitals are struggling to accommodate the increase of patients affected with COVID-19. Because of the rapidly increasing number of cases, some hospitals had to improvise and use every facility to keep up with the demand.

As a result, hospitals became compacted, healthcare workers weakened, and the waste piled up. With the increase in cases, waste is being generated rapidly on a larger scale. If not appropriately treated, waste could cause environmental effects and raise health concerns for animals and humans (Chand et al., 2021).

Biomedical waste is generated in the diagnosis, prevention, and treatment of a human being. It includes human waste, animal waste, microbiological waste, sharps, discarded medicines and drugs, chemical waste, radioactive waste, and other waste. It also includes any research activities or processes that involve biological testing (Chamberlain, 2020). On average, it was estimated that biomedical waste accounts only for 1% to 2% of the total waste produced in urban places (Dehghan et al., 2019). However, these wastes are needed to be appropriately treated as they may pose detrimental effects to human health due to their potentially infectious nature. From the hospital's segregation, treatment and disposal to landfills must be adequately performed to ensure that wastes will not seep into the landfills or groundwater source, which may cause environmental hazards and outbreaks of deadly diseases to humans living in nearby settlements (Chamberlain, 2020).

Evidence suggests that the number of patients is among the most critical factors contributing to waste generation. Meleko et al. (2017) stated that as the number of patients increases, more and more materials are being used, resulting in waste generation. According to the study of Rajak et al. (2021), the waste generation due to COVID-19 has increased exponentially. From June to December 2020, it is estimated that India generated over 33,000 metric tons of waste. Aneja et al. (2021) had the same findings as the previous study. They stated

that as the day passed by, the use of biomedical waste worsened due to quarantine waste and isolation wards. Due to increased production, it is challenging to manage and maintain adequate waste management guidelines correctly, and the chances of spreading COVID-19 increases (Hossain, 2020). Because of this, government agencies started to publish guidelines for waste management during treatment, diagnosis, and isolation of patients to prevent further transmission of COVID-19 in the community (Jyoti et6 al., 2021).

With the concepts being brought as to how COVID-19 affects waste generation. These studies were conducted to determine the effects of COVID-19 on Bio-medical waste management. Many studies showed the waste management of different regions. However, none assess the biomedical waste management in Cagayan. This study will assess the biomedical waste management of health and non-health personnel of Private Hospitals in Cagayan.

II. METHODS

A. Research Design

This study utilized a basic qualitative design wherein it focused on explaining how the COVID-19 pandemic affected the bio-medical waste management and generation of private hospitals in Cagayan. The chosen design involved a survey and analysis of the effect of the COVID-19 pandemic and bio-medical waste management and generation. Using the said design allows the researchers to describe the effect of the pandemic after thorough collection procedures from the informants.

B. Locale and Respondents

The research study was conducted among health and non-health personnel of the Private Hospitals in Cagayan. The hospitals that were part of this study were only those that had given their full permission to the researchers. The researchers included 20 informants which included safety control officers and infection control officers of the and other health personnel such as nurses, medical technologists, radiologic technologists and hospitals governing bodies directly involved in the bio-medical waste management and generation in their respective posts. Informants were selected via purposive sampling and considered their involvement and knowledge in bio-medical waste management and generation during the COVID-19 pandemic.

C. Instrument

The researchers used one-on-one open-ended questions interviews with health and non-health personnel of private hospitals in Cagayan to describe the effect of COVID-19 on bio-medical waste management and generation. A group of experts like biologists, nurses, and medical technologists validated the interview questions that researchers used. This research utilized printed interview questions, while researchers recorded the informants' answers through a voice recorder with their consent. The interview questions consist of three questions with follow-up questions. Researchers stored the interview recordings in the researchers' device, which the researchers have only access to and deleted after transcribing the response of the informants.

D. Data Analysis

a) Qualitative data gathered via interview were analyzed using thematic analysis. The following steps were followed by the researchers in doing content analysis of the qualitative data based on Maguire and Delahunt (2017):

a) Transcribing interview content. All the verbalizations of the respondents for both interviews were transcribed into textual format. This will facilitate the analysis of the data by the researchers.

b) Dividing text into meaning units. The transcribed texts were read and re-read by the researchers to identify the meanings of the verbalizations of respondents. The impressions of the meanings of the verbalizations were noted after each time the text is re-read. Divide the whole of the text to smaller units that still represent the entire meaning of the text as whole. These meaning units were then condensed or shortened ready for the next step.

c) Formulating codes. Each condensed meaning unit was given labels or codes which concisely described these meaning units.

d) Developing categories and themes. The codes formulated in the previous step were sorted into categories. This was done by appraising the codes and determining which belonged together, combining codes that appear to deal with the same issue/ topic. From the categories, themes were then formulated, which will describe the underlying meaning of the categories formulated.

E. Ethical Considerations

In conducting the study, the researchers strictly adhere to ethical issues. The informants were interviewed during their free time or during working hours as approved by their supervisors. The informants were free to choose a place where they felt most comfortable conducting the interview. All personal data obtained from informants in this study are used purely for research purposes and kept strictly confidential. The information gathered, specifically the interview recordings, was deleted immediately after the researchers have transcribed, coded, and analyzed the data. Alphanumeric codes were assigned to the informants during transcription to ensure anonymity and confidentiality.

The researchers ensured that the informants' dignity was not violated. In doing this study, the researchers had no conflicts of interest. This study underwent Institutional Review Board clearance in Region II Trauma and Medical Center. The researchers, however, will be giving tokens to each informant that will be part of the study. All communications about the research are delivered with clarity and sincerity.

III. RESULTS AND DISCUSSION

The researchers transcribed the data given by the informants, carefully classified the significant statements, and inferred the meanings. Similar statements were then grouped to develop three significant themes and subthemes, namely, 1) COVID-19 Caused in Bio-Medical Waste Generation 2) Safety Intervention Improvements 2.1) Effects of Bio-Medical Waste Management to Safety 2.2) Interventions Done to Address

Safety Issues 3) Current Bio-Medical Waste Management Practices.

A. COVID-19 Caused Bio-Medical Waste Generation

Personal or individual reasons play an important role in the generation rate of bio-medical waste instantaneously increases during the COVID-19 pandemic—including PPE such as gloves, masks, gowns, and hazmat suits. Infectious and dry waste was also observed to increase in volume. Informants observed that the number of patients contributes to the volume of waste generated by a hospital. Some of the verbalizations of the informants are as follows:

Informant 8: "Ahm... before du-during the pandemic talaga nag increase yung waste namin. Ah na observe talaga namin kahit kami nasasayangan kami kasi, everytime we have patient that are COVID suspect or covid… confirmed, ang PPE namin nun yung white, yung faceshield, yung gloves, lahat yun ilang minutes lang namin tanggal tapon, kaya makita namin ang dami. Isang patient lang yun tapos may next patient so, sa isang araw, sobrang dami na naming mga infectious waste. Yun talaga yung significant na napansin namin na... Iniisip pa nga namin kung saan mapupunta ang mga basurang to sa sobrang dami talaga."

Informant 9: Ah… during the pandemic mas nagkaroon ng inflation ng mga number of wastes lalo na specially sa mga PPE's natin ah... Pag i-specify ko yung ating face mask, ah mga face shield, gloves yun yung mga pinaka common tsaka yung aming PPE na disposable, lalo siyang nag increase compared nung wala pang pandemic.

Informant 11: Ngayon nga na merong pandemya, tumaas yung... Ano ng infection na basura, mga infectious waste. Dahil sa maraming patient dun dumarami yung covid cases. Marami dun yung pasyente namin kaya lahat dun infectious, puro disposable lahat ng ginagamit.

B. Hospital Safety and Biomedical Waste

The introduction of the COVID-19 pandemic highlights the critical importance of developing new viewpoints and methodologies in the implementation, such as the inclusion of innovative and rigorous ways to collect biomedical waste and prevent the spread of the virus. Hospitals mandate both health and non-health workers to attend monthly webinars and seminars to facilitate proper waste management practice, proper donning and doffing, and such to prevent the spread of the virus. Some of the verbalizations of the informants are as follows:

Informant 4: "Ah tulad nga ng sin..ah… ah… binanggit ko kanina. Ah meron kaming ano ah..ah separate room, ah.. separate area for donning and doffing of kuwan of PPE tapos meron ding ah waste segregation dun, dun namin nilalagay lahat ng mga waste tapos ah sineseparate ng… Ng infection control nurse para maprevent ang cross contamination tsaka infection."

Informant 6: "for this institution they conduct ah every now and then a monthly ah webinar and also ah they conducted the course audit for each employee for every 6 months and annually ah to know if the employees are knowledgeable regarding the risk reductions, regarding the safety such as yung ah how to eleva… ah... how to ahm eradicate the ahm infection through-throughout this ano by proper waste dis-disposal tapos ah how to manage ah COVID-19."

Informant 15: "The administration, ahm… do ahm…strong ah... implementation of ah proper waste management. So yun ang inistriktuhan talaga nila, yung proper waste management."

C. Bio-Medical Waste Management Practices during COVID-19

The Bio-Medical Waste Management practices during the COVID-19 pandemic are strictly implemented by private hospitals. Treatment and disposal of COVID-19 ward's waste are separated from other types of waste. The current biomedical waste management is the same. However, the hospital mandates strict compliance and monitoring of proper waste management to both health and non-health workers during the COVID-19 pandemic. Anyone violating these protocols undergoes disciplinary action. Other guidelines are also implemented for the treatment of COVID-19 pandemic waste. Some of verbalizations of the respondents are as follows:

Informant 5: "Ang current ahh ano namin sa bio..ah medical waste natin… ah…. Ah wala kasing updates regarding dun eh pero may mga sanitary inspecs… ins-inspector naman na pumunta at ah… at yung ICN natin ah inano yung kung pano yun, yung training na yon. Hindi pana-nasasabi samin."

Informant 9: "dito sa hospital namin, ah... ang mga basura namin kung makikita nyo may yellow, may green tsaka may black na plastic ah... ah garbage collector bin. Ah yun kasi ah nasesegregate namin yung mga basura and then kung napansin nyo may mga ano tayo doon for sharps, for ano syringe mga ganun, hinihiwalay namin yung mga basura, hindi siya pwedeng pinagsama-sama lalo na yung mga nagamit sa infectious cases."

Informant 10: "from time to time kasi ah they do check ah yung mga waste namin so they make sure na ah all our properly labeled sa–sa mga waste disposals namin like ah segregated yung ferps, plungers, ah the infectious ones like ah the yung mga.. pangalan neto... mga… mga.. PPE's, gloves mga ganun so well segregated naman sya."

Informant 15: "ang practice namin dito... ah... Syempre yung proper waste segregation. And then ah… ahm... Along lalo na yung mga needles, ahm syringe..ah chinicheck yan ng mga ICN namin every morning, then ah… ah kapag ahm may nakita siyang ahm.. medyo... Ah hindi…pagtupad ng regulation na yun... Ahm…nagbibigay siya ng ano... Ahm... ng reports sa amin. Notice for explanation para ma… manotify kami na mali yung ginagawa namin. Kung hindi… Hindi nag comply yung

isang department o isang employee ah… subject sya for disciplinary action."

Throughout the course of the pandemic, the waste generation of most private hospitals in Cagayan have spiked in volume. In a study by Rajak et al (2021), most bio-medical waste generated is from hospitals, quarantine centers and laboratory testing centers. Due to PPEs and other specialized healthcare products used among health care staff and patients, the COVID-19 pandemic has resulted in an unusually large volume of BMW. Consequently, it was found out that waste including sharps and PPEs like face shields, face masks, gloves and other disposables related to COVID-19 have been observed in this study (Goswami et al., 2021; Jyoti et. al, 2021). Most wastes generated from the hospitals are mostly related to COVID-19 procedures and treatment. It was also stated (Cook et al., 2020; Sarkodie & Owusu, 2021) that an unusual amount of medical waste reported to have increased from medical equipment like gloves, face masks, and eye protection due to a surge in personal protective equipment and immediate disposal after use.

In a recent studies (Goswami et al., 2021; Sangkham, 2020), there is a direct relationship between the number of accumulated biomedical waste and the number of patients infected with COVID-19 admitted. With regard to this, there is a need for administrative measures to counter the nosocomial infections and infectious diseases attributed to the current status of the pandemic. Additional policy interventions include ensuring that all hospitals and quarantine facilities have a sufficient supply of yellow, red, white, and blue bags/containers for onsite proper segregation and disposal. The regulations required all individuals interacting with BMW in isolation wards to wear PPE. COVID-19 Isolation Ward mandates the use of color-coded containers, the use of double-layered bags for waste collection and the labeling of COVID-19 wastes accordingly for distinction (Capoor & Parida, 2021). Separate rooms for donning and doffing PPEs to segregate likely and prospective cross-contamination, as well as the usage of ultraviolet to prevent microbe development in the specified area. Private hospitals must have a different room for donning and doffing, health and non-health workers must use different sets of PPEs for different patients or procedures conducted to avoid the spread of COVID-19. Because of the COVID-19 pandemic, preventative measures are in place to decrease the likelihood of the virus spreading.

The private hospitals in Cagayan are congruent to the practices described by current studies. Aside from the segregation of wastes as per order of the World Health Organization (e.g., the use of color-coded containers for waste segregation), monthly webinars and seminars are conducted to facilitate retention of knowledge on proper waste management and handling. Private hospitals in Cagayan mandate health and non-health personnel to attend monthly webinars and seminars to maintain and update their knowledge regarding waste management and practices. Health and non-health workers violating the waste management and practice are subjected to penalties and disciplinary actions as per the hospital's rules and regulation (Chand et al, 2021; Jalal et al., 2021). The segregation of wastes is still in practice with gloves during collection and transportation, color coding, and labeling of bins. Some minor tweaks include triple packaging of wastes, health, and non-health personnel discarding their gloves in every laboratory, and regularly disinfecting (Krithiga et al., 2021). Bio-medical waste management is all done with social distancing norms. Hand hygiene, health, and non-health personnel are equipped with PPE and respiratory etiquettes (Capoor & Parida, 2021; Jalal et al., 2021). Treatment and disposal of wastes has also been a dilemma and some hospitals due to the increase of waste generated have allotted a separate room for storing biomedical waste. Hospital management implemented new rules and regulations for all healthcare professionals, which may aid in the prevention of the virus. They also put in place some protocols and training on safe waste management and disposal in order to reduce the rising volume of wastes during the inevitable COVID-19 outbreak. Due to the lack of facilities to accommodate an onsite treatment of biomedical wastes, private hospitals in Cagayan have had contractual agreements with non-government companies to collect their accumulated biomedical waste for them. In contrast to the study of Chand et al (2021), the government mandates some institutions with proper facilities for the treatment and disposal of their own waste.

The study lacked some literature review findings since COVID-19 pandemic has not yet been studied so far in the research area. The researchers lack sufficient prior research to get knowledge of current study and arguments pertinent to a specific subject or area of interest. The study was unable to conduct interviews in most of the hospitals in Cagayan due to ethical concerns. Only a few hospitals agreed to take part in the study. Due to limited access with some of the hospitals in Cagayan, the researchers only interviewed some respondents who were assigned by the hospital to participate in the study. Since the pandemic, the researchers have been having a hard time conducting research in the hospitals because of some protocols and interventions that must be followed not only for the safety of their personnel and patients but for the researchers as well. The researchers were unable to obtain information about garbage disposal in the hospital because respondents only provided information about waste transportation.

IV. CONCLUSION

During the pandemic, there was a significant rise in the quantity of COVID-19 related BMW from hospitals, quarantine facilities, and testing laboratories. This massive volume of COVID-19 trash includes medical and non-medical equipment such as PPEs. This increase put further strain on BMW disposal facilitators. As a result, there is now a greater focus on the necessity to separate BMW from regular garbage, mainly houses with COVID-19 patients. The data show that most of Cagayan's private hospitals do well in COVID-19 waste management. As a result, the average daily trash creation rate continues to rise. Biomedical waste is a crucial public health issue. Improper handling of biomedical waste can be a cause of infections. The pandemic's underlying cause is exceptionally infectious and can spread quickly from one person to another through various routes. Because of its high transmission rate,

the risk of becoming infected is always present. During the pandemic, the DOH issued new guidelines requiring stringent compliance from health and non-health workers. These guidelines make it easier and safer to manage the massive increase in BMW, not only for hospital staff but also for the environment and community.

V. RECOMMENDATIONS

The study recommends studying the impact of the COVID-19 pandemic on healthcare workers and other hospitals affected particularly the COVID-19 center that accommodates most of the COVID-19 cases in Cagayan. The study's finding was lacking due to the insufficient time and number of informants, thus, the data may not represent all of the hospitals in Cagayan. It is recommended to include all hospitals in Cagayan. The result of the study may be used as a basis for future researchers to review, reassess and reevaluate the current guidelines and protocols in handling biomedical waste and as a basis in case of another outbreak in Cagayan.

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