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HEALTHCARE WASTE MANAGEMENT PRACTICES IN SELECTED HEALTHCARE FACILITIES: A QUANTITATIVE CROSS-SECTIONAL DESCRIPTIVE STUDY

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Abstract: The management of healthcare waste, known as Health Care Waste Management (HCWM), is an essential component of maintaining hygiene and proper upkeep within health facilities. This includes tasks such as the collection, transportation, treatment, and disposal of waste. Unfortunately, in developing countries like Nepal, poor HCWM practices pose a significant public health risk. Sadly, HCWM has not been prioritized, and has only received sporadic attention in recent years. In numerous instances, healthcare waste is disposed of through burning in metal drums or openly, leading to the release of toxic by-products into the environment. In Nepal, inadequate HCWM practices contribute to a range of health hazards, such as needle stick injuries (NSI) or other sharps injuries that can cause Hepatitis B, Hepatitis C, and HIV, as well as other health risks such as hemorrhagic fevers, skin infections, and gastroenteric infections. This study aimed to assess the practices of Health Care Waste Management (HCWM) in a specifically chosen health facility (HF) located in the Kailali district of Nepal. The research employed a descriptive cross-sectional study design and a quantitative method, in addition to a review and analysis of relevant literature and previous studies. The health facilities included in the study were both hospitals and health posts. The study employed an exploratory approach, and a purposive sampling method was used, where a total of 10 health facilities were visited; 5 government-run facilities and 5 private facilities. A semi-structured questionnaire was used to gather data, and responsible individuals from the institutions were interviewed regarding HCWM. On average, the ten health institutions (HI) generated 9 kg of waste per day. Out of the ten HIs, only five provided training in HCWM. Three HIs did not have guidelines for healthcare waste management and only four had waste management plans. Only one HI ensured that their waste handlers wore the necessary Personal Protective Equipment (PPE). Furthermore, nine out of the ten HIs did not have a monitoring system in place for HCWM. These findings highlight the need for mandatory training in HCWM for all responsible parties and the implementation of strict

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rules and regulations requiring the use of complete and necessary PPE by all responsible persons and waste handlers. Such measures would help prevent and protect against needle stick injuries and other diseases.

Keywords: Health Care Waste Management, Health Institution, Waste Handlers, Personal Protective Equipment

Introduction

Waste generated by healthcare establishments, research facilities, and laboratories is referred to as Health Care Waste (HCW). (Population, 2014) The majority of waste produced through healthcare activities, over 85%, is non-hazardous. The remaining 15% of healthcare waste, however, is considered hazardous and may include materials that are contagious, toxic, or radioactive.(Organization, 2014)The primary sources of healthcare waste include hospitals and other healthcare facilities, research centers and laboratories, mortuary and autopsy centers, animal research and testing labs, blood collection services, and nursing homes for the elderly.(Ortiz et al., 2023)Healthcare waste management encompasses all actions associated with the generation, classification, transportation, storage, treatment, and ultimate disposal of all types of waste produced in healthcare facilities. These stages require particular attention to ensure the necessary inputs, such as funding, equipment, and facilities, as well as activities and outputs, such as safe work environments, healthy surroundings, and healthy workers, are in place for the safe handling and disposal of healthcare waste. (Population, 2014)Healthcare waste poses risks due to its potential to contain contagious agents, genotoxic or cytotoxic chemicals, poisonous or dangerous chemicals or biologically aggressive pharmaceuticals, radioactivity, and sharp materials. (McPherson, 2015)

On a global scale, healthcare waste is considered to be the second most hazardous waste, following radiation waste.(Saqlain et al., 2020) Research has revealed that a significant proportion of individuals who handle waste and those residing in proximity to waste disposal sites are at risk of contracting gastrointestinal parasites and other diseases such as cholera, yellow fever, and salmonellosis.(Manyele & Anicetus, 2006)Approximately 5.2 million deaths per year, including 4 million child deaths, globally are attributed to inadequate waste management.(Akter, 2000)

HCWM in Nepal has been a low priority issue and has only been intermittently addressed over the past two decades, however, it has recently begun to receive more attention in recent years.(McPherson, 2015) A limited number of studies on healthcare waste management (HCWM) in Nepal have been conducted, all with consistent conclusions: there are no policies or guidelines in place for HCWM at the facility level; HCWM systems are inadequate; and healthcare workers lack knowledge about HCWM. While some larger hospitals reportedly have on-site incinerators, these do not have anti-pollution control features.(Population, 2014)Therefore, the objective of this study is to evaluate the practice of healthcare waste management (HCWM) among healthcare institutions (HCIs) in Nepal.

Methodology

Study site and justification

The Quantitative method was used to assess the present status of health care waste management in selected health facilities of Kailali district. The questionnaires, observation checklist and guidelines were developed to assess the practice adopted by institutions for health care waste management. Review and analysis of available literature/documents pertaining to the study from former research projects and sample survey especially with reference to medical waste management were also carried out.

Study Design

Descriptive cross-sectional study was used during study.

Study Variables

The study variables were as follows: -

- Types of waste
- Amount of waste
- Segregation of waste
- Collection of waste
- Transport of waste
- Storage of waste
- Treatment of waste
- Disposal of waste
- Knowledge and practice of sweepers

Study Area

The study was conducted in purposively selected health care institutions of Kailali district, Nepal.

Study Methods

Quantitative methods were used.

Sampling Method

Purposive sampling method and explorative study was done.

Data Collection Techniques and Tools

Data Collection Techniques

- **Interview**

In the study, information was collected through interviews by administering structured close and open-ended questionnaires.

Data Collection Tool

- **Questionnaire**

Semi-structured questionnaire was designed for the study. Responsible persons of the institutions were interviewed on their health care waste management practices regarding segregation, collection, transportation, storage, treatment and disposal of health care waste management.

Data Management, Analysis and Interpretation Procedure

Data Management

- Data compiling, editing and checking were done both manually and computerized to maintain consistency.
- Collected data were entered and entered data were exported to statistical package for social science (SPSS) version 16.
- Data coding, recoding, rechecking, and editing were performed promptly within the day of collection.

Data Analysis and Interpretation

- Data was imported into SPSS (version 16) and analysis was made further by using SPSS software.
- Quantitative analysis was done.
- All data were tabulated to analyze the data

Validity and Reliability of the study

- Validity and reliability were maintained by pre-test and necessary modifications.
- Consultations were done with the supervisors, guide, subject experts, and co-authors.
- Data were gathered promptly after collecting the data.
- Scientific tools and techniques were applied for the collection of data.
- Necessary help and support were taken from the experts and supervisors.
- Field work was carried out by the researcher herself and necessary help were taken from the experts.

Ethical Consideration

- Approval letters were taken from college.
- The approval letter was received from Nepal health research council (NHRC).
- Approval letters were taken from the health institution.
- Informed consent was taken from the respondent before starting the data collection process.
- The results were used only for study purposes.

- Confidentiality was maintained unless there were legal issues.
- The study group was also protected from physical and emotional harm during the study.
- Participants were not forced to participate in the study i.e. voluntary participation and they were able to withdraw at any time.

Results

Table 1: General profile of Health Care Institution

Parameter Health institution	No. of inpatients/day	No. of outpatients/day	Total no. of bed	Total occupancy rate
Hospital				
Malakheti	N\A	105	7	N/A
Navjeevan	25	55	50	50
Sudur	2	9	25	8
Padma	10	98	50	20
Dharma	N/A	20	N/A	N/A
Health post				
Beladevipur	N/A	25	N/A	N/A
Badhiya	N/A	40	1	N/A
Geta	N/A	45	1	N/A
Urma	N/A	35	1	N/A
Fulwari	N/A	60	4	N/A

As seen in Table 1, analysis of the general profile of health institutions revealed that Navjeevan Hospital had the highest number of inpatient admissions per day, with a count of 25. Padma Hospital had the second highest inpatient admissions, with a count of 10, followed by Sudur Hospital with 2 admissions per day. In terms of outpatient visits, Malakheti Hospital had the highest number of visits per day, with a count of 105, followed by Padma Hospital with 98 visits, Navajeevan Hospital with 55 visits, Dharma Hospital with 20 visits, and Sudur Hospital had the least number of outpatient visits per day with a count of 9. The highest number of hospital beds were found in both Navajeevan and Padma Hospitals, both with a count of 50 beds, followed by Sudur Paschim Hospital with 25 beds, and Malakheti Hospital with 7 beds.

Table 2: Designation of persons involved in segregation, collection, storage, transport, treatment and disposal of health care waste.

Variables		Health Institution	Frequency(N=11)
Designation of person	Sweeper	Badhiya, Sudur, Malakheti	3
	Helper	Navajeevan	1
	Office Assistant	Beladevipur ,Padma, Urma, Badhiya, Geta, Fulwari	6
	Peon	Dharma	1

As seen in Table 2, the identification of individuals involved in the management of healthcare waste was conducted. The results showed that the majority of health institutions had an Office Assistant designation (6) including Padma Hospital, Beladevipur, Urma, Badhiya, Geta, and Fulwari Healthpost. Badhiya Healthpost, Sudur and Malakheti Hospital had the designation of Sweeper. Only Dharma Hospital had the designation of Peon, while Navjeevan Hospital had the designation of Helper.

Table 3: Education status of persons involved in segregation, collection, storage, transport, treatment and disposal of HCW.

Variables		Health Institution	Frequency(N=15)
Education status	Illiterate	Padma Hospital	1
	Primary level	Fulwari , Sudur ,Padma ,Navajeevan , Malakheti	5
	Secondary level	Beladevipur , Dharmarudra, Fulwari, Navajevan, Geta, Badhiya, Urma, Padma	8
	Higher secondary	Navajeevan	1

As seen in Table 3, the educational attainment of individuals involved in Health Care Waste Management across various health institutions was analyzed. The results showed that a majority (80%) of health institution staff had completed their secondary education, with the highest number being from Beladevipur, Dharmarudra, Fulwari, Navajeevan, Geta, Badhiya, Urma, and Padma. Approximately 50% of the staff had completed their primary education, including those from Fulwari, Sudur, Padma, Navajeevan, and Malakheti. Additionally, 10% of the staff had achieved a higher secondary level of education, specifically at Navajeevan. Unfortunately, 10% of the staff were illiterate, which was mainly seen at Padma.

Table 4: Health Institution provides training on hospital waste management

Variables	Health Institution	Frequency
Training	Padma , Badhiya , Sudurpaschim , Dharma , Navajeevan , Malakheti , Fulwari , Beladevipur	8

As seen in Table 4, 8 of the 10 health institutions, namely Padma, Badhiya, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, and Beladevipur, offer training on health care waste management to their personnel.

Table 5: Type of training provided by Health Institution

Variables		Health Institution	Frequency
Types of training	Infection prevention	Padma , Badhiya , Fulwari	3
	Health Care Waste Management	Sudurpaschim , Dharma , Navajeevan , Malakheti , Beladevipur	5

As seen in Table 5, it illustrates the types of training offered by the Health Institutions. Five out of ten institutions, namely Sudurpaschim, Dharma, Navajeevan, Malakheti, and Beladevipur, offered Health Care Waste Management training. Three institutions, Padma, Badhiya, and Fulwari, provided training on Infection Prevention.

Table 6: Duration of Training Provided by Health Institutions

Variables		Health Institution	Frequency
Time (Day)	1	Navajeevan	1
	3	Beladevipur , Badhiya , Fulwari	3
	7	Padma , Sudurpaschim , Dharma , Malakheti	4

As seen in Table 6, it reveals that four of the ten Health Institutions (Padma, Sudurpaschim, Dharma, and Malakheti) provided training for a duration of seven days. Three institutions (Beladevipur, Badhiya, and Fulwari) provided training for three days, while the remaining one (Navajeevan) offered training for a single day.

Table 7: Budget of Health Institution that is invested on Health Care Waste Management per month

Health Institution	Variables	Average
	Budget(Rs.)	
Malakheti Hospital	10000	39555.55
Dharma Rudra hospital, Urma Hp	12000	
Geta HP	18000	
Beladevipur HP	20000	
Sudhur Paschim Hospital	25000	
Padma Hospital	30000	
Badhiya HP	36000	
Fulwari HP	40000	
Navajeevan Hospital	165000	

As seen in Table 7, the total monthly budget invested in healthcare waste management. The average budget invested across all healthcare institutions was found to be Rs. 39555.55. Navajeevan Hospital invested the highest budget of Rs. 165000, followed by Fulwari Health Post with Rs. 40000, Badhiya with Rs. 36000, Padma with Rs. 30000, Sudurpaschim with Rs. 25000, Beladevipur and Geta with Rs. 18000.

Dharma Rudra Hospital and Urma Health Post both invested an equal budget of Rs. 12000 in healthcare waste management. Meanwhile, only Rs. 10000 was invested by Malakheti Hospital for this purpose.

Table 8: Municipal support to manage the waste

Variables	Health Institution	Frequency
Municipal Support	Fulwari, Badhiya , Beladevipur , Urma ,Geta , Padma , Dharma Rudra, Sudurpaschim , Malakheti	9

As seen in Table 8, 9 out of 10 health institutions got municipal support to manage the waste.

Table 9: Municipality taking charges in Health Institutions

Health Institution	Variables	Frequency
Padma Hospital	(Charge)	1

As seen in Table 9, among ten Health Care Institution municipalities, the Municipality took charge only from Padma Hospital for supporting waste management.

Table 10: Colour of Bucket/Bag or places where General Waste are segregated

Variables		Health Institution	Frequency
Colour of bucket/bag or places	Dig	Beladevipur	1
	Blue	Geta	1
	Green	Padma, Fulwari, Malakheti, Dharma, Sudurpaschim, Badhiya, Urma	7
	Red	Navajeevan	1

As seen in Table 10, it displays the colors of the containers or locations where General Waste is separated. Seven out of ten Health Institutions segregate their general waste using green buckets, including Padma, Fulwari, Malakheti, Dharma, Sudurpaschim, Badhiya, and Urma. One health institution, Geta, uses a blue bucket for segregation, another, Navajeevan, uses a red bucket, and the final institution, Beladevipur, uses a dig method.

Table 11: Colour of Bucket/Bag or places where Sharp are segregated

Variables		Health Institution	Frequency
Colour of bucket/bag or places	Blue	Navajeevan	1
	Red	Dharma	1
	Tinbox	Beladevipur	1
	Safetybox	Padma, Urma, Badhiya, Geta,Sudurpaschim Malakheti, Fulwari	7

As seen in Table 11, it displays the color of the containers or locations where sharp waste is properly stored. Out of ten healthcare facilities, seven (Padma, Urma, Badhiya, Geta, Sudurpaschim, Malakheti, and Fulwari) utilize safety boxes for the segregation of sharp waste. Out of the remaining three health institutions, Navajeevan uses blue containers, while Dharma uses red containers. Beladevipur utilizes a tin box for this purpose.

Table 12: Colour of Bucket/Bag or places where Hazardous Waste are segregated

Variables		Health institution	Frequency
Colour of bucket/bag or places	Dig	Beladevipur ,	1
	Blue	Fulwari, Malakheti, Dharma, Sudurpaschim,	4
	Red	Geta, Badhiya, Urma, Padma	4
	Placenta pit	Navajeevan	1

As seen in Table 12, it illustrates the color of the bucket or bag and the location where hazardous waste is separated. Four out of ten health institutions, including Geta, Badhiya, Urma, and Padma, have segregated hazardous waste in red buckets. Another four institutions, namely Fulwari, Malakheti, Dharma, and Sudurpaschim, have segregated it in blue buckets. Lastly, Navajeevan has a pit for placenta and Beladevipur has a ditch for hazardous waste.

Table 13: Colour of Bucket/Bag or Places where Pharmaceuticals Waste are segregated.

Variables		Health Institution	Frequency
Colour of bucket/bag or places	Dig	Beladevipur	1
	Blue	Padma, Urma, Sudurpaschim, Malakheti, Fulwari	5
	Green	Navajeevan	1
	Red	Badhiya	1
	Separate blue	Geta	1

As seen in Table 13, it displays the color of the buckets/bags used for the segregation of pharmaceutical waste in different health institutions. Out of the ten health institutions, five have segregated the waste using blue buckets. The Navajeevan Hospital has used green buckets, while Badhiya has used red buckets. At Beladevipur, the segregation is done through digging, and another health institution in Geta uses a separate blue bucket.

Table 14: Colour of Bucket/Bag or Places where Liquid Waste are segregated.

Variables		Health Institution	Frequency
Colour of bucket/bag or places	Dig	Badhiya	1
	Blue	Navajeevan	1
	Red	Malakheti, Fulwari, Sudurpaschim	3
	Placenta pit	Padma, Urma, Badhiya, Geta,	4

As seen in Table 14, it reveals the color of the buckets/bags used to segregate liquid waste, as well as the location of the segregation in different health institutions. Out of the 10 institutions, four, namely Padma, Urma, Badhiya, and Geta, disposed of their liquid waste in a placenta pit. Three health institutions, Malakheti, Fulwari, and Sudurpaschim, used red buckets/bags for their liquid waste

segregation. Meanwhile, Navajeevan, utilized blue buckets/bags for their liquid waste segregation and one other institution, Beladevipur, disposed of it in a designated digging site.

Table 15: Colour of Bucket/Bag or Place where Recyclable Wastes are segregated

Variables		Health institution	Frequency
Colour of bucket/bag or places	Dig	Beladevipur	1
	Blue	Fulwari, Malakheti, Padma	3
	Green	Sudurpaschim, Badhiya, Urma	3
	Separate blue	Geta	1

As seen in Table 15, it indicates the color of the bucket or bag used for segregating recyclable waste and the location of segregation in different health institutions. Out of the 10 institutions, three of them, Fulwari, Malakheti, and Padma, use blue buckets for segregation. Another three institutions, Sudurpaschim, Badhiya, and Urma, use green buckets. There was a provision of dig in Beladevipur and another institution, Geta, has separate blue buckets for recyclable waste segregation.

Table 16: Place of Waste Segregation

Variables	Health Institution	Frequency
Respective department	Padma, Dharma, Navajeevan	3
Disposal Point	Navajeevan	1
At waste generation	Beladevipur, Fulwari, Malakheti, Navajeevan, Sudurpaschim, Geta, Badhiya, and Urma	8

As seen in Table 16, it demonstrates the implementation of waste segregation in health institutions. Out of the 10 health institutions, 8 (Beladevipur, Fulwari, Malkheti, Navajeevan, Sudurpaschim, Geta, Badhiya, and Urma) segregate their waste at the point of generation. Three health institutions (Padma, Dharma, and Navajevaan) have departments that also follow waste segregation practices. However, only Navajeevan hospital consistently implements waste segregation throughout all stages, including at the respective departments and disposal points, as well as at the point of generation.

Table 17: Label of Waste Containers

Variables	Health Institution	Frequency
Labeling	Padma, Urma, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari	8

As seen in Table 17, it demonstrates the utilization of labeling in the segregation containers. Out of the ten health institutions, eight of them applied labels on their waste collection containers, namely Padma, Urma, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, and Fulwari.

Table 18: Provisions of waste collection

Variables		Health Institution	Frequency
Provision of waste collection	Plastic bins	Padma, Badhiya, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, and Fulwari	8
	Both (plastic and metal)	Beladevipur, Urma	2

As seen in Table 18, it reveals the methods of waste collection used by health institutions. Eight out of ten health institutions utilized plastic bins for waste collection, including Padma, Badhiya, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, and Fulwari. Meanwhile, the remaining two health institutions (Beladevipur and Urma) employed both plastic and metal bins for waste collection.

Table 19: Covering of Container used in Waste Collection

Variables	Health Institution	Frequency
Covered	Padma, Urma, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, and Beladevipur	9

As seen in Table 19, it displas the utilization of covered or uncovered waste collection containers in health institutions. It was found that 9 out of the 10 health institutions employed covered waste collection containers.

Table 20: Waste Collection in a Day

Variables		Health institution	Frequency
Waste collection in a day	According to waste quantity	Beladevipur, Badhiya, Urma	3
	3 times	Navajeevan, Dharma, Sudurpaschim	3
	2 times	Padma	1
	1 time	Fulwari, Malakheti, Geta	3

As seen in Table 20, it displays the frequency of waste collection in a day at various health institutions. Out of the ten health institutions, three, namely Navajeevan, Dharma, and Sudurpaschim, collected waste three times a day. Another three institutions (Beladevipur, Badhiya and Urma) collected waste based on the volume of waste generated, with Fulwari, Malakheti, and Geta collecting once a day. Only Padma hospital collected waste twice a day.

Table 21: Types of Waste transportation facilities available at the health care institution

Variables	Frequency
Humans	10

As seen in Table 21, it displays the various methods and techniques utilized by healthcare institutions for the transportation of waste. It was noted that all ten healthcare facilities utilized human labor for the transportation of their waste.

Table 22: The type of facility for the waste storage system

Variables		Health Institution	Frequency
Waste storage system	Impermeable floor	Padma, Fulwari, and Malakheti	3
	Easy to clean surface readily accessible to staff	Padma, Badhiya, Navajeevan, Malakheti, and Fulwari	5
	Good lighting and ventilation	Given health institution	10
	Good drainage	Given health institution	10
	Convenient water supply	Given health institution	10
	Secured and lockable	Fulwari	1
	Proof against rodents, insects, and birds	Fulwari	1

	Needle proof containers	Given health institution	10

As shown in Table 22, it highlights the status of waste storage systems in healthcare facilities. All of the facilities in question had well-lit and ventilated storage systems, with adequate drainage and accessible water supplies. Additionally, they all had needle-proof containers for waste storage. Out of the ten facilities, five had waste storage systems that were easy to clean and easily accessible to staff members; these facilities were Padma, Navajeevan, Badhiya, Malakheti, and Fulwari. Three facilities (Padma, Fulwari, and Malakheti) had impermeable floors for waste storage. Only one facility, Fulwari, had a secure and lockable waste storage system that was also proof against rodents, insects, and bird waste.

Table 23: Duration of Waste Storage in Store Area

Variables	Hours	Health institution	Frequency
Duration of waste storage	6	Geta, Urma, Sudurpaschim, Dharma	4
	168	Malakheti and Beladevipur	2
	72	Fulwari and Badhiya	2
	96	Navajeevan	1
	12	Padma	1

As seen in Table 23, it displays the length of time waste was stored in the storage area of various health institutions. Four out of ten institutions kept their waste in the storage area for six hours, namely Geta, Urma, Sudurpaschim, and Dharma. Two institutions, Malakheti and Beladevipur, stored their waste for 168 hours. An additional two institutions, Fulwari and Badhiya, kept their waste for 72 hours. Only one institution, Navajeevan, had a storage duration of 96 hours, while the remaining institution, Padma, stored waste for a mere 12 hours.

Table 24: Waste treatment before disposal

Variables	Health institution	Frequency
Treatment before disposal	Padma, Urma, Badhiy a, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, and Beladevipur	9

As seen in Table 24, it indicates whether health institutions practice waste treatment methodologies prior to waste disposal. With the exception of Geta health post, 9 institutions (namely Padma, Urma, Badhiya, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, and Beladevipur) do practice waste treatment methodologies before disposing of waste.

Table 25: Methods applied for the treatment of waste

Variables		Health Institution	Frequency
Methods of treatment	Chemical disinfection	Padma, Urma, Badhiya, Sudurpaschim, Dharma, Navajeevan, Malakheti	7
	Burial	Beladevipur, Fulwari, Sudurpaschim, Badhiya, Urma, Malakheti	6
	Burning	Urma, Badhiya, Sudurpaschim, Malakheti, Fulwari	5
	Autoclaving, sterilization	Malakheti, Navajeevan, Dharma, Padma	4

Sanitary landfill	Fulwari	1

As seen in Table 25, waste treatment methods vary among health care institutions. Out of 10 institutions surveyed, 7 (namely Padma, Urma, Badhiya, Sudurpaschim, Dharma, Navajeevan, and Malakheti) used chemical disinfection as their primary waste treatment method, followed by burial which was used by 6 institutions (Beladevipur, Fulwari, Sudurpaschim, Badhiya, Urma, and Malakheti). Burning was the third most commonly used method, utilized by 5 institutions (Urma, Badhiya, Sudurpaschim, Malakheti, and Fulwari). Autoclaving for sterilization was used by 4 institutions (Malakheti, Navajeevan, Dharma, and Padma). Only 1 institution, Fulwari health post, used a sanitary landfill for waste treatment

Table 26: Present methodology of waste disposal in Health Care Institutions for General Waste

Variables		Health Institution	Frequency
Methodology for disposal of general waste	Burial	Beladevipur, Fulwari, Malakheti, Sudurpaschim, Urma, Badhiya, Geta	7
	Municipality land	Dharma, Padma	2
	Matribhumi Samaj Sewa	Navajeevan	1

As seen in Table 26, seven out of ten health institutions resorted to burial as the methodology for general waste disposal. These institutions include Beladevipur, Fulwari, Malakheti, Sudurpaschim, Urma, Badhiya, and Geta. Two institutions, Dharma and Padma Hospital, used municipality land for general waste disposal, while only one institution, Navajeevan, utilized the land of Matribhumi Samaj Sewa for general waste disposal.

Table 27: Present methodology of waste disposal in Health Care Institutions for Hazardous Waste

Variables		Health institution	Frequency
Methodology for disposal of hazardous waste	Burial	Urma, Badhiya, Fulwari	3
	Placenta pit	Geta, Navajeevan, Malakheti	3
	Municipality landfill	Padma, Dharma	2
	Burning	Sudurpaschim	1

As seen in Table 27, it presents the current methodology of waste disposal in health care institutions for hazardous waste. Out of the ten health institutions, three - Urma, Badhiya, and Fulwari - used burial as the disposal method for hazardous waste. Another three institutions, Geta, Navajeevan, and Malakheti, resorted to placenta pits for hazardous waste disposal. Two institutions, Padma and Dharma, used municipal land for disposal, while only one institution, Sudurpaschim, utilized burning as the disposal method for hazardous waste.

Table 28: Present methodology of waste disposal in Health Care Institution for Sharp

Variables		Health institution	Frequency
Methodology for disposal of sharp	Burial	Beladevipur, Fulwari, Geta, Badhiya, Urma	5
	Needle breaker	Malakheti, Sudurpaschim	2

	Municipality	Dharma, Padma	2
	Matribhumi Samaj Sewa	Navajeevan	1

As seen in Table 28, it depicts the current methodology of waste disposal in health care institutions for sharp objects. Out of the ten health institutions, five - Beladevipur, Urma, Geta, Fulwari, and Badhiya - utilized burial as the disposal method for sharp objects. Two institutions, Malakheti and Sudurpaschim, used needle breakers for sharp object disposal, while another two institutions, Dharma and Padma, sought support from their respective municipalities. Only one institution, Navajeevan, used the services of Matribhumi Samaj Sewa for sharp object disposal.

Table 29: Present methodology of waste disposal in Health Care Institution for Liquid Waste

Variables		Health Institution	Frequency
Methodology for disposal of liquid waste	Placenta pit	Padma, Urma, Badhiya, Geta, Dharma, Navajeevan, Malakheti, Fulwari	8
	Burial	Sudurpaschim	1

As seen in Table 29, it shows the present methodology of waste disposal in the Health Care Institution for liquid waste. 8 out of 10 health institutions used placenta pit for disposal of liquid waste and only 1 used burial for disposal of liquid waste (Sudurpaschim).

Table 30: Present methodology of waste disposal in Health Care Institution for Radioactive Waste

Variables		Health Institution	Frequency
Methodology for disposal of liquid waste	Burial	Malakheti, Fulwari	2
	Burning	Geta, Sudurpaschim	2
	Municipality	Padma, Dharma	2
	Matribhumi Samaj Sewa	Navajeevan	1

As seen in Table 30, it shows that 20% of health institutions used burial methodology for disposal of radioactive waste viz. Malakheti and Fulwari health post, another 20% used burning (Geta, Sudurpaschim) and another 20% used municipality support (Padma and Dharma) and only 10% used Matribhumi Samaj Sewa support for disposal of radioactive waste (Navajeevan).

Table 31: Present methodology of waste disposal in Health Care Institutions for Pharmaceutical Waste

Variables		Health institution	Frequency
Methodology for disposal of pharmaceutical waste	Burial	Urma, Fulwari	2
	Municipality	Dharma, Padma	2
	Burning	Sudurpaschim, Geta, Badhiya, Urma	4
	Matribhumi Samaj Sewa	Navajeevan	1

As seen in Table 31, it illustrates that the majority of health institutions, namely four out of ten - Sudurpaschim, Geta, Badhiya, and Urma - utilized burning as the disposal method for pharmaceutical waste. Two institutions, Urma and Fulwari, resorted to burial as a disposal method, while another two institutions, Dharma and Padma, sought support from their respective municipalities. Only one

institution, Navajeevan, employed the services of Matribhumi Samaj Sewa for the disposal of pharmaceutical waste.

Table 32: Final Disposal of Segregated Waste

Variables		Health Institution	Frequency
Final disposal	Buried on health institution ground	Urma, Badhiya, Geta, Sudurpaschim, Malakheti, Fulwari, Beladevipur	7
	Openly burned	Geta, Sudurpaschim, Beladevipur, Malakheti, Badhiya, Urma	6
	Municipality	Padma, Dharma	2
	Matribhumi Samaj Sewa	Navajeevan	1

As seen in Table 32, it displays the final disposal methods used for segregated waste in the health institutions. The majority of institutions, seven out of ten - Urma, Badhiya, Geta, Sudurpaschim, Malakheti, Fulwari, and Beladevipur - buried the waste on their own grounds. Six out of the ten - Geta, Sudurpaschim, Beladevipur, Malakheti, Fulwari, and Beladevipur - openly burned the waste, while two institutions, Padma and Dharma, sought the support of their municipality for disposal. Only one institution, Navajeevan, took the help of Matribhumi Samaj Sewa for the final disposal of waste.

Table 33: Responsibilities included in the job description of Hospital supervisory staff

Variables	Job Description	Health Institution	Frequency
Responsibilities included	Yes	Padma, Badhiya, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, Beladevipur	9

As seen in Table 33, it shows that, except for the Urma health post, all 9 of health institutions included responsibilities in the job description of hospital supervisory staff regarding healthcare waste management plans and policies.

Table 34: Training to newly hired waste management staff

Variables	Frequency
Training	10

As seen in Table 34, it shows that all of the health institutions provided training to newly hired waste management staff regarding health care waste management.

Table 35: The name of training given to the newly hired waste management staff

Variables		Health Institution	Frequency
Name of training	Health care waste management	Urma, Badhiya, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, Beladevipur	9
	Infection prevention	Padma	1

As seen in Table 35, it shows that 9 out of 10 health institutions provided health care waste management training viz. Urma, Badhiya, Geta, Sudurpaschim, Dharma, Navajeevan, Malakheti, Fulwari, and Beladevipur and remaining one i.e. Padma, provided Infection Prevention training to the newly hired waste management staff .

Table 36: Availability of Manual or Guideline document on Health Care Waste Management

Variables	Health institution	Frequency
Available manual or guideline document	Padma, Urma, Badhiya, Geta, Dharma, Navajeevan, Fulwari, Beladevipur	8

As seen in Table 36, it shows that, except Malakheti and Sudurpaschim hospital, all 8 of the health care institutions had a health care waste management manual or guideline in health institutions.

Table 37: The name of the available guideline document

Variables		Health Institution	Frequency
Name of guidelines document	Health care waste management guidelines	Padma, Urma, Badhiya, Geta, Dharma, Navajeevan, Fulwari	7
	Health care waste management direction	Beladevipur	1

As seen in table 37, it shows that, majority of health institution i.e. 7 out of 10 had health care waste management guidelines (Padma, Urma, Badhiya, Geta, Dharma, Navajeevan, Fulwari) while only 1 had health care waste management direction (Beladevipur).

Table 38: Own written document regarding HCWM available in health institution

Variables	Health Institution	Frequency
Own written document	Padma	1

As seen in Table 38, it shows that only 1 out of 10 health institutions namely Padma hospital had its own written document regarding health care waste management.

Table 39: Name of the own written document regarding HCWM

Variables		Health Institution	Frequency
Name of own written document regarding health care waste management	Health care waste management	Padma	1

As seen in Table 39, it shows that only Padma hospital had their own written document regarding health care waste management which was entitled as "Health care waste management".

Table 40: Health institutions having Waste Management plan

Variables	Health Institution	Frequency
Waste management plan	Dharma, Padma, Sudurpaschim, Beladevipur	4

As seen in Table 40, it shows that 4 out of 10 health institutions had waste management plan viz. Dharma, Padma, Sudurpaschim, and Beladevipur.

Table 41: Health institutions having Waste Management Team

Variables	Health Institution	Frequency
Waste Management Team	Malakheti, Navajeevan, Dharma, Sudurpaschim, Badhiya, Padma	6

As seen in Table 41, it shows that six out of the ten health institutions had waste management teams within their facilities. These institutions were Malakheti, Navajeevan, Dharma, Sudurpaschim, Badhiya, and Padma.

Table 42: Vaccine to waste handlers

Variables	Health Institution	Frequency
Vaccine to waste handlers	Padma, Geta, Sudurpaschim, Dharma, Navajeevan, Fulwari, Beladevipur	7

As seen in Table 42, it shows that 7 out of 10 health institutions provided vaccines to waste handlers in their health institutions namely Padma, Geta, Sudurpaschim, Dharma, Navajeevan, Fulwari, and Beladevipur.

Table 43: Total waste generation per day

Variables		Health Institution	Frequency
Total waste	Less than 1kg	Beladevipur, Geta, Badhiya, Urma	4
	Up to 5 kg	Fulwari, Malakheti, Dharma	3
	8-10kg	Sudurpaschim, Padma	2
	Above 50kg	Navajeevan	1

As seen in Table 43, it displays the daily total waste generation of the health care institutions. Among the ten institutions, four - Beladevipur, Geta, Badhiya, and Urma - generated less than 1kg of waste per day, while three - Fulwari, Malakheti, and Dharma - generated up to 5kg per day. Sudurpaschim and Padma hospital generated 8-10kg of waste per day, and Navajeevan hospital generated over 50kg of waste per day.

Table 44: Availability of Sufficient Personnel Protective Equipment materials

Variables	Frequency
Personal Protective Equipment materials	10

As seen in Table 44, it shows that all of the 10 health institutions had sufficient availability of Personnel Protective Equipment materials.

Table 45: The Personal Protective Equipment materials wear by waste handlers during handling the waste

Variables		Health Institution	Frequency
Personal Protective Equipment	Gloves	All given Health Institution	10
	Mask	All given Health Institution	10
	Boots	Navajeevan	1
	Head cover	Navajeevan	1

As seen in Table 45, waste handlers in all health institutions wore gloves and masks, but only at Navajeevan Hospital do staff members wore boots and head covers when handling the waste.

Table 46: Monitoring system regarding health care waste management

Variables	Health Institution	Frequency
Monitoring System	Navajeevan hospital	1

As seen in Table 46 shows that out of the ten health institutions, Navajeevan hospital was the only one that had a monitoring system for health care waste management**.**

Discussion

The management of healthcare waste remains a formidable challenge for developing nations, Nepal included. With a rise in the need for healthcare services, there is also a corresponding surge in the amount of waste generated by these facilities. The main objective of this study was to evaluate the management of healthcare waste in a number of healthcare institutions located in the Kailali district of Nepal. This assessment is expected to shed light on the current state of healthcare waste management (HCWM) in Nepal. According to the study's findings, it was observed that hospital waste represents a significant public health concern.

As per the national guidelines(Population, 2014), separate staff members are required for waste segregation, collection, transportation, treatment, and disposal. However, the study found that only one individual was responsible for all of these tasks, which is a primary reason for inadequate waste management and can lead to significant public health concerns. Similarly, in accordance with national guidelines, all bags must be labelled before removal, indicating the point of production, ward and hospital, as well as their contents. The study revealed that only eight out of ten healthcare facilities utilized labelling on their waste segregation containers. Additionally, any bags or containers that are removed must be promptly replaced with new ones of the same type. If a waste bag is removed from a container, the container must be thoroughly cleaned before a new bag is inserted.(Population, 2014)

Based on our study findings, we discovered that the majority of healthcare facilities (7) segregated general waste in green buckets, sharp waste in safety boxes, and four HCF segregated hazardous waste in red buckets, with another four using blue buckets. In addition, five health facilities segregated pharmaceutical waste in blue containers, four segregated liquid waste in placenta pits, three segregated recyclable waste in green containers, and another three utilized blue containers. However, none of the healthcare facilities segregated waste according to the standard guidelines of the World Health Organization(Organization, 2014), which specifies that general waste should be segregated in black containers, potentially infectious healthcare waste in yellow containers, rigid and leak-proof single-use containers suitable for used sharps in yellow containers, and plastic bags for general and potentially infectious waste.

Based on our recent research on the educational background of those involved in healthcare waste management, the majority of healthcare facility staff studied had completed education up to secondary level, accounting for 80% of the sample. However, at Padma hospital, some of their staff were found to be illiterate. Adequate training and education on healthcare waste management is crucial to ensure effective waste management in healthcare facilities. In the absence of proper knowledge on HCWM, waste management staff are at risk of contracting hospital-acquired diseases such as hepatitis, HIV/AIDS, trachoma, and others. Additionally, inadequate knowledge and skills can also pose a risk to hospital visitors and the environment.

The study indicates that eight out of ten healthcare facilities carried out waste segregation at the point of generation. In accordance with national guidelines, every healthcare institution should segregate their waste at the source, which could be in the ward, Operation Theater, laboratory, or any other room in the hospital where the waste is generated. The segregation should be done into three categories, namely sharps, hazardous, and general waste. If autoclaving is utilized to treat part of the waste, infectious waste must also be separated and autoclaved separately.(Population, 2014)

The study revealed that out of ten healthcare facilities, only eight utilized labelling at waste segregation containers. As per national guidelines, all bags must be labelled before removal, indicating the point of production, ward and hospital, and contents. Moreover, bags and containers that are removed should be immediately replaced with new ones of the same type, and if a waste bag is taken out from a container, the container must be thoroughly cleaned before fitting a new bag in it. The majority of healthcare facilities used covered waste collection containers. It is recommended that waste collection containers should be covered as much as possible, as this helps to minimize the spread of harmful chemicals and gases.(Population, 2014)

Out of ten healthcare facilities, only Padma Hospital collected health waste twice a day. As per national guidelines, waste should be collected at least once a day to ensure that the hospital area remains free of waste, pollution, and diseases. All healthcare facilities used human labor to transport the waste. However, as per National guidelines for on-site waste transportation, the waste collection trolley should be free of sharp edges, easy to load, unload, and clean. The trolley should be cleaned regularly, especially before any maintenance work is performed on it. The sealed plastic bags should be carefully loaded by hand onto the trolley to minimize the risk of punctures or tears. Additionally, yellow-bagged hazardous waste and black-bagged general waste should be collected on separate trolleys, which should be painted or marked in the corresponding colors (Population, 2014).

Four out of ten HCF stored waste for 6 hours and two out of ten HCF stored waste for 168 hours. National Guidelines state that no waste shall be stored at the central storage facility for more than 24 hours. The study also found that 7 out of 10 HCF used burial for disposal of general waste, 1 out of 10 HCF used burning for disposal of hazardous waste, and 5 out of 10 HCF used burial for disposal of sharp waste. Additionally, 8 out of 10 HCF used placenta pits for disposal of liquid waste. A similar study in government health centers in Addis Ababa, Ethiopia (Tadesse & Kumie, 2014) found that all health centers used safety boxes for collection of sharp wastes, and plastic buckets without lids for collection and transportation of healthcare waste. Pre-treatment of infectious wastes was not practiced by any of the health centers, and all health centers used incinerators and had placenta pits for disposal of pathological waste, but only seven out of ten pits had proper covering material. In our study, only one out of ten healthcare facilities had a secured and lockable storage system that was resistant to rodents, insects, and bird waste, according to the study. The National Guidelines(Population, 2014) recommend that the central storage facility should be located on the healthcare institution's premises near the incinerator, be easy to clean and disinfect, have adequate cleaning equipment, protective clothing, and waste bags and containers nearby, and be easily accessible to authorized staff and collection vehicles while being enclosed and secure from unauthorized access and inaccessible to animals, insects, and birds. It should also be large enough to hold all the hazardous waste produced by the health care institution and have spare capacity for collection and transfer for disposal.

In the study, it was found that only one HCF (Urma) did not include responsibilities related to healthcare waste management plan and policies in the job description of hospital supervisory staff. National Guidelines(Population, 2014) state that each healthcare institution should have a Waste Management Policy that clearly outlines the responsibilities and accountabilities of managers, employees, and staff. Also, National Guidelines states that each healthcare institution should establish a Waste Management Plan, which should be a comprehensive document outlining policies and procedures for the proper management of healthcare wastes. In our study, only 4 out of 10 healthcare institutions had a waste management plan. The study found that only one healthcare facility (Urma) did not include responsibilities related to healthcare waste management in the job description of hospital supervisory staff. National Guidelines(Population, 2014) mandate that a Waste Management Policy be established in every healthcare institution, outlining the responsibilities and accountabilities of managers, employees, and staff. Additionally, the study found that only Navajeevan had a monitoring system for healthcare waste management, which is essential for better planning and timely corrective actions to improve environmental performance. To enhance monitoring, a protocol should be established by the Ministry of Population and Environment in coordination with national, district, and local level institutions, as well as government line agencies.

Conclusion and Recommendations

The current state of healthcare waste management in health centers poses a significant threat to the health of healthcare workers, waste handlers, and the public. The lack of proper segregation and treatment of healthcare waste has resulted in an increased risk of infection and environmental contamination. It is crucial that measures be put in place to ensure that healthcare waste is handled safely and effectively. This includes the use of puncture and leak-proof containers, pretreatment of infectious and liquid waste, and the construction of appropriate waste disposal facilities. Furthermore, training for healthcare workers and waste handlers is critical to ensure that proper waste management practices are followed. Establishing healthcare waste management committees and developing national guidelines will also go a long way in improving healthcare waste management. Outsourcing healthcare waste to private partners is another viable option. Finally, further research on healthcare waste generation and management at different seasons is necessary to develop more effective strategies for healthcare waste management. By implementing these measures, we can ensure that healthcare waste is managed safely, effectively, and sustainably.

After conducting a thorough study and discussion, this study offers the following recommendations;

1. There is a shortage of adequate manpower in all hospitals, and there is no clear job description for waste management. Therefore, we recommend that hospitals recruit and increase the number of staff dedicated to waste management.
2. Health institutions should strictly adhere to the National Health Care Waste Management guidelines and manuals, and develop a comprehensive waste management package for long-term and effective waste management.
3. A training package and awareness program on waste management should be developed for all staff in health institutions, including sweepers, at regular intervals.

4. As far as possible, sufficient protective materials and vaccines for Hepatitis B and tetanus should be provided to the sweepers.
5. Regular supervision, monitoring, and documentation of waste management practices should be established.
6. An integrated waste management practice should be planned and implemented to ensure coordination and cooperation among every sector for sound healthcare waste management.

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Appendix

Approval letter from NHRC

Government of Nepal
Nepal Health Research Council (NHRC)
Estd. 1991

Ref. No.: 3590

12 July 2019

Ms. Prakriti Paudel
Principal Investigator
Little Buddha College of Health Science
Kathmandu

Ref: **Approval of thesis proposal** entitled **Health care waste management practices in selected Health Care institution of Kailali District**

Dear Ms. Paudel,

It is my pleasure to inform you that the above-mentioned proposal submitted on **21 June 2019 (Reg. no. 454/2019)** has been approved by Nepal Health Research Council (NHRC) National Ethical Guidelines for Health Research in Nepal, Standard Operating Procedures Section 'C' point no. 6.3 through Expedited Review Procedures.

As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol. Expiration date of this proposal is **October 2019.**

If the researcher requires transfer of the bio samples to other countries, the investigator should apply to the NHRC for the permission. The researchers will not be allowed to ship any raw/crude human biomaterial outside the country; only extracted and amplified samples can be taken to labs outside of Nepal for further study, as per the protocol submitted and approved by the NHRC. The remaining samples of the lab should be destroyed as per standard operating procedure, the process documented, and the NHRC informed.

Further, the researchers are directed to strictly abide by the National Ethical Guidelines published by NHRC during the implementation of their research proposal and **submit progress report in between and full or summary report upon completion.**

As per your thesis proposal, the total research budget is **Rs 43,500** and accordingly the processing fee amounts to **Rs 1,000.** It is acknowledged that the above-mentioned processing fee has been received at NHRC.

If you have any questions, please contact the Ethical Review M & E Section at NHRC.

Thanking you,

Prof. Dr. Anjani Kumar Jha
Executive Chairperson

Tel: +977 1 4254220, Fax: +977 1 4262469, Ramshah Path, PO Box: 7626, Kathmandu, Nepal
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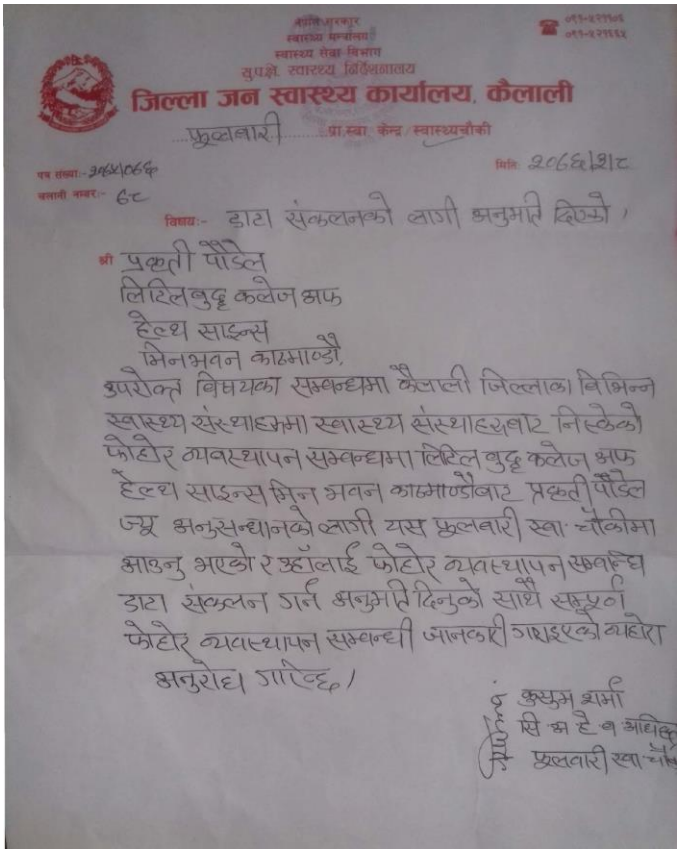
Approval letter from different health facility



नेपाल सरकार
स्वास्थ्य मन्त्रालय
स्वास्थ्य सेवा विभाग
उपक्षे. स्वास्थ्य निर्देशनालय

जिल्ला जन स्वास्थ्य कार्यालय, कैलाली

फुलवारी प्रा.स्वा. केन्द्र/स्वास्थ्यचौकी

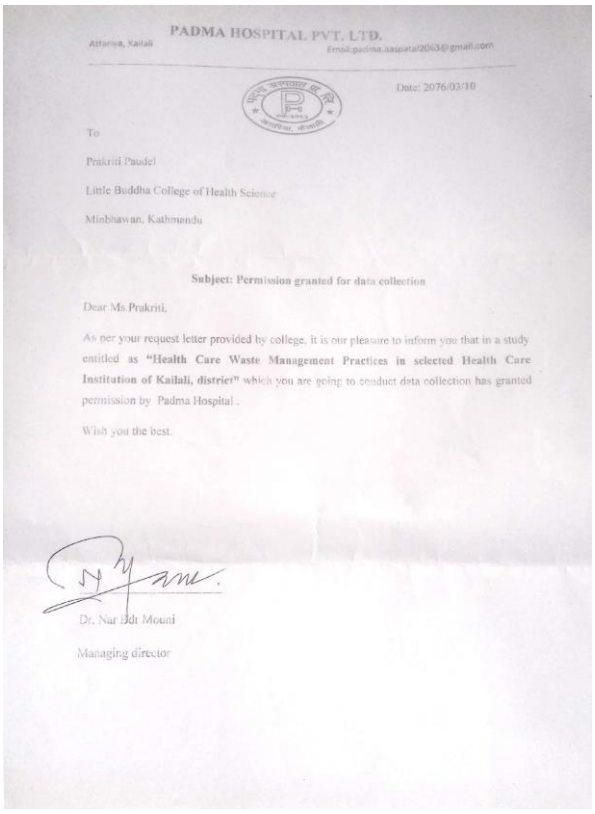
पत्र संख्या:- 2456/066
चलानी नम्बर:- 62
मिति: 2076/12/2

विषय:- डाटा संकलनको लागी अनुमति दिएको ।

श्री प्रकृती पौडेल
लिटिलबुद्ध कलेज अफ
हेल्थ साइन्स
मिनभवन काठमाण्डौं

उपरोक्त विषयका सम्बन्धमा कैलाली जिल्लाका विभिन्न स्वास्थ्य संस्थाहरुमा स्वास्थ्य संस्थाहरुबाट निस्केको फोहोर व्यवस्थापन सम्बन्धमा लिटिल बुद्ध कलेज अफ हेल्थ साइन्स मिन भवन काठमाण्डौंबाट प्रकृती पौडेल ज्यू अनुसन्धानको लागी यस फुलवारी स्वा. चौकीमा आउनु भएको र हाँलाई फोहोर व्यवस्थापन सम्बन्धि डाटा संकलन गर्न अनुमति दिनुको साथै सफल पूर्ण फोहोर व्यवस्थापन सम्बन्धी जानकारी गराइएको व्यहोरा अनुरोध गरिन्छ ।

कुसुम शर्मा
सि.अ.हे.व अधिकृत
फुलवारी स्वा.चौ



PADMA HOSPITAL PVT. LTD.
Attariya, Kailali
Email:padma.haspital2063@gmail.com

Date: 2076/03/10

To

Prakriti Paudel

Little Buddha College of Health Science

Minbhawan, Kathmandu

Subject: Permission granted for data collection

Dear Ms.Prakriti,

As per your request letter provided by college, it is our pleasure to inform you that in a study entitled as **"Health Care Waste Management Practices in selected Health Care Institution of Kailali, district"** which you are going to conduct data collection has granted permission by Padma Hospital .

Wish you the best.

Dr. Narendra Mouni

Managing director

Some pictures of visited health facility during study:


निःशुल्क प्रसुती सेवा
नवजीवन अस्पताल प्रा.लि.
डा. सञ्जय खड्की