PHARMACEUTICAL WASTE MANAGEMENT IN PRIVATE PHARMACIES OF KASKI DISTRICT, NEPAL

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December, 2017

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In Partial fulfillment of the requirement for the

Degree of Bachelor of Public Health (BPH)

A dissertation Submitted to:

Bachelor of public health program

School of health and allied sciences

Pokhara University

Kaski, Nepal

December, 2017

Declaration

To the best of my knowledge and belief I declare that this dissertation entitled **"***Pharmaceutical Waste Management in Private Pharmacies of Kaski District, Nepal***"** is the result of my own research and contains no material previously published by any other person except where due acknowledgement has been made. This dissertation report contains no material, which has been accepted for the award of any other degree or diploma in any university.

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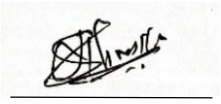
Signature: 

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Acknowledgment

It is indeed great pleasure to acknowledge and extend my sincere appreciation to all individuals and institution for their support that helped me to make my dissertation on the topic" **Pharmaceutical Waste Management in Private Pharmacies of Kaski District, Nepal** ." really fruitful and successful.

First and foremost, I would like to offer my sincere thanks to Bachelor of public Health program, School of Health and Allied Sciences, Pokhara University for providing me an opportunity to perform this research work.

It has been an immense pleasure and honor to work under the guidance of my dissertation supervisor, Dr. Eunhwa Choi and co supervisor Prof. Naveen Shrestha. My deepest appreciation is extended towards their necessary instructions and much appreciated guidance in every aspect, during the study.

I am thankful to the President of Nepal chemist and drug association (NCDA), Gandaki Zone branch, Mr. Ram Bahadur K.C. who granted permission and provided support to conduct my study. As the important part of this research I kindly thank Institutional review committee (IRC) who gave me permission to conduct this study.

This dissertation would not have been possible without support of Mr. Kiran Adhikari who helped me during data collection.

Finally, I am deeply indebted to my colleagues, seniors and family members who have helped me both directly and indirectly for their valuable support, input and continuous encouragement throughout the thesis work.

At but not the least, my immense gratitude is extended towards all the respondents for providing their valuable time and information.

Thank you.

Eknaran Paudel

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List of Acronyms

API	Active Pharmaceutical Ingredients
CMA	Community Medical Axillaries
CMME	Continuous medical measures education
CP	Community Pharmacy
DDA	Department of Drug Administration
HA	Health Assistant
HF	Health Facilities
IRC	Institutional Review Committee
NCDA	Nepal Chemist and Drug Association
PPB	Pharmacy and Poison Board
PPE	Personal Protective Equipment
POP	Persistent Organic Pollutants
PVC	Poly vinyl Chloride
PW	Pharmaceutical Waste
PWM	Pharmaceutical Waste Management
SPSS	Statistical Software for Social Sciences
UK	United Kingdom
USA	United States of America
WHO	World Health Organization

Abstract

Introduction: Expired products, dispensed drugs that are unwanted or discontinued, and contaminated medicines are known as pharmaceuticals wastes.[1] Pharmaceutical waste management is public health concern due to the various health and environmental risks posed by poorly managed pharmaceuticals wastes. Pharmaceutical waste management is the activities, administrative and operational, that are used in handling, packaging, treatment, conditioning, reducing, recycling, reusing, storage and disposal of pharmaceutical wastes. [2] **Objectives:** The main aim of the study is to know the current status of pharmaceutical waste management and its practices in the community pharmacy of Kaski district. **Methods:** The study design was cross-sectional study. The study population were the pharmacist of Kaski district who were running the private community pharmacies. All the municipalities were included in the study by the use of simple random sampling method. The sample size was 119 pharmacies. Structured questionnaire and observation checklist were used for the data collection. Observation method and interview method was the study technique. Collected data were entered in EPI-DATA version 3.2 and exported to Statistical Package for Social Sciences (SPSS version 22) for further analysis. Ethical approval was taken from institutional review committee (IRC), Pokhara University. The permission for the study was taken from Nepal chemist and drug association (NCDA) office. Informed consent was taken from the respondents both in verbal and written form. **Results:** Out of 119 respondents, majorities (71.4%) were male, 79% were owner of their business, almost equal percentage were below and above median age(34years) and 45.4% pharmacy experience above median experience(10 years). About 95% were trained in pharmacy profession with mostly trained on diploma and Community Medical Auxiliaries (CMA+Orientation). About 80.7% respondents regularly take continuous medical measures education and only 5% were enrolled in professional body other than NCDA. Among all the respondents same percentage i.e. 59.6% had adequate knowledge and practices of pharmaceutical waste management. About 95.8% percent had PW collecting container but only 28.6% had use color coding and labelling system for segregation of pharmaceutical waste. Only 15.1% had proper use of incinerator within their premises and 15.1% had their own burial pit without fence and liner for disposal of PW. Most of the pharmacies (93.8%) had access to municipal landfill for disposal of PW but only 76.5%had correct practices (only throw noninfectious) to the municipal

truck. **Conclusion:** The results showed that there was insufficient knowledge and practices of pharmaceutical waste management by the community pharmacists. The findings showed that knowledge on PWM had strong association with its practices. Improper methods of PW disposal such as discarding infectious waste mix with general waste or through informal waste collectors like scrap purchasers (Kabadis) were being practiced in some pharmacies. The disposal infrastructure like color coded or labelled PW collecting container, sharps incinerator was also absence in most of the pharmacies. Most of the pharmacists were unaware about the guidelines of proper pharmaceutical waste management. But the quality of practice of PWM can be improved by improving the knowledge of PWM among community pharmacist and access of PW disposal infrastructure.

Keywords: Pharmaceutical waste management, pharmaceutical waste, pharmacy, waste, expired medicines, knowledge, practices, disposal, Nepal

CHAPTER I: INTRODUCTION

1.1 Background of the study

The World Health Organization (WHO) definition of pharmaceutical waste includes pharmaceuticals that are expired or no longer needed and items containing pharmaceuticals.[3]

Expired products, dispensed drugs that are unwanted or discontinued, and contaminated medicines is known as pharmaceuticals wastes.[1] When the medicines are prescribed according to the illness of a patient ,the active ingredients of medicines is only metabolized but the non-metabolized parent compound as well as the metabolites enters the water system and harms the aquatic system and pollute the water system. Also the improper disposal of the unused medicines also causes the environmental pollution as well.[1]

Pharmaceutical products were not recognized as environmental pollutants until the 1980s. Inadequate disposal of unused pharmaceutical products results pollution which is very challenging issues since their structure consists of thousands of different active molecules that are parts of different therapeutical groups with different physico-chemical properties and chemical structures which behave differently in the environment and have different stability.[4] Since these components have been found in wastewaters, in the soil and in drinking water, they have become even bigger issues.[5] Pharmaceutical products have been used and produced in large amounts nowadays in diversified nature. The household medicine supplies can vary in different countries, but they can all become a potential source of poisoning, most often for children, and can also cause reactions like confusion in elderly persons.[6]

In South East Asian regions like Malaysia, Bangladesh, North India, South India, Western Nepal (Pokhara), Pakistan and Thailand have improper practice of pharmaceutical waste management where Nepal and Bangladesh does not have any official guideline for pharmaceutical waste management. So, urgent consideration is needed in the South East Asian Regions to reduce the problem of improper Pharmaceutical waste management.[7]

Researchers have considered many human and veterinary pharmaceutical compounds at high concentrations in drinking water resources contributes to environmental pollution. So, emphasis is also given on pharmacist role in proper disposal of unwanted

and expired medicine makes a significant impact on the environment as well as it prevents accident, poisoning and intentional violence , which will lead to the welfare of society and directs towards achieving goal of health for all.[6]

1.2 Problem Statement

Pharmaceutical compounds are being used for several beneficial purposes in our modern society. But the increasing number of the pharmacies haphazardly contributed to improper handling and management of pharmaceutical substances like drugs, vaccines etc.

Pharmaceutical compounds may enter the environment by different routes such as discharge of treated wastewater, seepage from landfills sites, sewer lines, runoff from animal wastes etc.[8, 9] Although various physical and biological processes occurring in aquatic system cause reduction of many pharmaceutical compounds but the trace concentrations of human and veterinary pharmaceutical compounds as well as their metabolites have been detected in different water bodies like surface water, groundwater which may cause adverse effects to the human and animals.[10-12] Waste disposal practice in most community pharmacies of Pokhara valley was not satisfactory. They lacked the space and infrastructure such as proper sanitary landfill, private or public burial site, well maintained incinerator etc. for the proper disposal of their medical waste.[13]

In context of Nepal, there is also poor management of pharmaceuticals wastes in different pharmacies, medicals and hospitals. Open-air burning of pharmaceutical waste carries risk to staff, communities, and the environment, it is not recommended by the WHO[14] but the practices is prevalent in the Nepal as well as in Pokhara also.[13]

The disposal of waste by community pharmacies in the municipal waste collection system in a haphazard and unsafe manner in Pokhara, and i.e. 52.36%.[13] In situations where no other options for the safe disposal of pharmaceutical waste are available, disposal in sanitary land-fills or municipal land-fill sites while taking precautions like use of Personal protective equipment(PPE) could be an acceptable option only for small quantities of pharmaceutical waste.[14, 15] Also US-Food and Drug Administration recommended that disposal of small quantities of pharmaceutical waste in a municipal waste disposal system can be accepted.[16] This method can be considered as a short-

term measure, which should be changed to attain ideal or real disposal practice methods in the future.[17]

For the proper disposal of pharmaceutical waste, the role of pharmacists is well recognized in developed countries.[18, 19] Nepal does not have official guidelines or practices to involve community pharmacies and pharmacists in the proper disposal of their pharmaceutical waste. Nepal have two proposed guidelines for health care waste management (i.e. National health care waste management guideline 2002 A.D and National guideline for health care waste management 2064 B.S) but not implemented properly. Also these guidelines doesn't focus on pharmaceutical wastes management separately[20, 21] In Nepal, the Solid Waste Management Act of 2011, the only act dealing with waste management, assigned legal and financial responsibility for the safe management of solid waste to the person or institution generating that waste.[22]

Recently on September 2017 DDA Nepal has prepared the proposed draft of pharmaceutical waste management guideline to establish proper management of pharmaceutical wastes throughout country in pharmacy level. This proposed guidelines is prepared according to the basis of WHO but it will take more time to implement and enact these policies.[23]

1.3 Rationale of the study

Pharmaceutical waste management is of public health concern due to the various health and environmental risks posed by poorly managed pharmaceutical wastes such as acute and chronic cell damages [24, 25], behavioral changes [26, 27], accumulation in tissues[28], reproductive damage[29] and inhibition of cell proliferation[30] and damaged to the aquatic life regarding their reproduction with toxicological effects.[31, 32] The risk of drug abuse and/or poisoning may result due to open dumps as well as from stored household pharmaceutical waste is another concern. The effect of long term low level exposure to active pharmaceutical ingredients (APIs) like Abiraterone acetate, Acamprosate Calcium Amoxicillin Trihydrate, Bosentan monohydrate, Nimesulide, Ramipril, Oxacillin Sodium etc.[33] from water sources through drinking or bathing is largely unknown but cannot be entirely ignored due to its toxic effects on the environment.[34] Incineration of pharmaceuticals waste, particularly waste containing polyvinyl chloride at low incineration temperature may cause the release of substances that are harmful to public health into the environment.[35]

In context of Nepal, there is also poor management of pharmaceuticals wastes in different community pharmacies due to lack of training knowledge and education about waste management. Absence of proper segregation, color coding and disposal is seen more in most of the community pharmacies. Open-air burning of health care waste carries risk to staff, communities, and the environment, it is not recommended by the WHO [14] but the practices is prevalent in the Nepal as well as in most of the community pharmacies of the Pokhara valley.[13] According to the study by Sudesh Gyawali and his team, proper and safe management of pharmaceuticals wastes in different community pharmacies is absence in Kaski district i.e.52.36% are doing improper practices of PWM. Kaski district includes largest metropolitan city where increasing urbanization along with the increased number of private pharmacies in high rate may lead to improper management of pharmaceutical waste. So, the research studies relating with such issues are important. Therefore, the particular causes of these problems should be find out to develop and improve the pharmaceutical waste management system of the area.

1.4 Research questions

What is the relationship between the knowledge and practices of PWM?

Do knowledge of PWM among pharmacists is associated with their qualification?

Do community pharmacies in Kaski district have access to infrastructure that support sound practice of PWM?

What is the proportion of community pharmacist with adequate knowledge and practices of PWM?

Hypothesis

H1. The knowledge of PWM among pharmacist is associated with their qualification.

H2. The practice of PWM in Community pharmacies is associated with knowledge of PWM among pharmacist.

H3. The practice of PWM in community pharmacies is associated with availability of infrastructure that supports sound PW disposal.

H4. The socio demographic factors of the pharmacist and community pharmacies is associated with the knowledge and practice of PWM.

1.5 Objectives

1.5.1 General

To describe the current status of knowledge, practices and associated factors regarding pharmaceutical waste management in Kaski district.

1.5.2 Specific:

To assess the knowledge and practice of pharmacist in pharmaceutical waste management.

To determine whether pharmacists were suitably qualified to practice sound PWM.

To examine the availability of infrastructures that support sound PWM.

CHAPTER II: LITERATURE REVIEW

2.1 Literature Search method and Strategy

Introduction

Most of the literature published on pharmaceuticals were related with the presence, concentration level and possible effects of active pharmaceuticals ingredients on human health and also towards environment. . Most of the studies had been carried out in USA and Europe which also mostly related with management of pharmaceutical waste in household level. Only a fewer literature were published which focuses on pharmaceutical waste management in pharmacy level.

In this literature review process, I reviewed and included various information from the published online articles related with the pharmaceutical waste management and its associating factors like qualification, socio demographic factors, knowledge and practices of pharmacist and disposal infrastructures availability in the community pharmacy.

Source of information

Information were retrieved by the use of online searching on the PUBMED database in END NOTE. Also for searching the published articles of various journal Google scholar is used and cited by using EndNote. In Endnote Software, Google and Google Scholar, article were collected by entering different keywords related with the title of the study. The literature search was started from 1st March 2017, 9:18(PM) and last search was done in 28th August 2017(9:19AM). Literature review process will goes up to end of the study and ends after the interpretation and discussion of the study results.

Search strategy

Following keywords were entered for retrieving the required articles in the research study:

Table 2.1 Keywords entered for literature search

Pharmaceutical waste management	Pharmaceutical waste	Pharmacy and waste
Pharmacy and waste and practices	Knowledge and Pharmaceutical waste management	Pharmacy and waste management
Nepal	Disposal	Expired Medicines

During literature review, number of documents/articles were retrieved from online database, PUBMED and Google Scholar periodically which is shown below:

Table 2.2 Date of retrieved documents

Date	No. of article/documents retrieved	Date	No. of article/documents retrieved
1-Mar-17	8	21-Jun-17	6
26-Apr-17	86	22-Jun-17	16
2-May-17	4	5-Jul-17	4
11-Jun-17	2	3-Aug-17	10
12-Jun-17	74	6-Aug-17	1
18-Jun-17	2	9-Aug-17	1
19-Jun-17	3	10-Aug-17	1
20-Jun-17	15	28-Aug-17	3
Total	236		

Article selection

For the selection of the articles, firstly 195 articles were retrieved from the End note using online search on PubMed database by inserting different keywords for search. After that the duplicated articles and articles in different language were removed then the articles matched with the articles were kept and others were eliminated. Similarly, from Google scholar also the matched article were downloaded with their full text pdf and some of the information were also retrieved from the online webpage documents.

The detailed information for the articles selection can be shown in flow chart as;

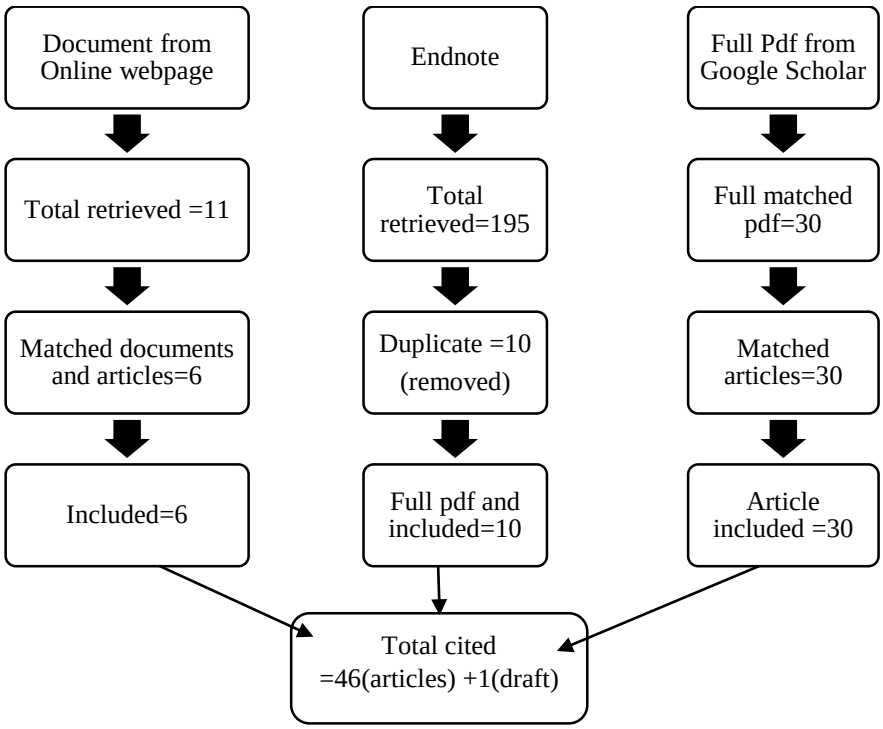

Figure 2.1 Flow chart of article selection

Total 46 articles were cited in this study. These articles were retrieved from Endnote software (PUBMED), Google scholar and online webpages. During the data analysis period, on 27th November 2017 one draft document related with pharmaceutical waste management guideline of Nepal was accessed, and which was also cited in this report. So all together 47 citation were used for this report.

2.2 Findings

2.2.1 WHO classification of Pharmaceutical wastes

a. Expired or unwanted pharmaceuticals

Pharmaceuticals that should never be used and should always considered as pharmaceutical waste are all expired pharmaceuticals, unsealed syrups or eye drops (expired or unexpired), cold chain damaged unexpired pharmaceuticals i.e. polypeptide hormones ,insulin, and vaccines but not loose tablets, capsules and all unsealed tubes of creams, ointments, etc. (expired or unexpired).[3]

The classification for pharmaceutical wastes according to the WHO guidelines are as follows[3]:

Table 2.3 WHO classification of Pharmaceutical waste on the basis of active ingredients

S .no	**Types**	**Examples**
1.	Controlled substances	Narcotics, psychotropic substances
2.	Anti-infective drugs	antibiotics, antifungals, anthelmintic
3.	Antineoplastic	cytotoxic-anti-cancer drugs, toxic drugs
4.	Disinfectants and Antiseptics	Ethanol, Chlorhexidine, povidone iodine

Table 2.4 WHO classification of Pharmaceutical waste on the basis of dosage form

S.no	Types	Examples
1.	Solids, semi-solids and powders	Tablets, capsules, granules, powders for injection, mixtures, creams, lotions, gels, suppositories
2	Liquids	Solutions, suspensions, syrups, etc.
3.	Aerosol canisters	including propellant-driven sprays and inhalers
4.	Ampoules	Glass or plastics vials

b. Recycled material

Waste paper, packing materials, clothes, gauze and wooden items, can be recycled, burned or disposed of as normal waste to a landfill. Plastic, metal and glass items can be reused (glassware can be given to laboratories, mechanical items given to scrap dealers), recycled (if facilities are available) or disposed of in a landfill. Depending on the type of material and its proposed reuse, appropriate treatment, such as cleaning or disinfection, may be needed. Other general rubbish can be disposed of in a landfill. If a recycling program exists for the reuse of such materials they can be separated from the pharmaceuticals prior to their disposal in the landfill.[3]

In this research study I will be concerned on all the types of pharmaceutical wastes expect aerosol canisters, ampoules and syringes. So the study doesn't study and observe these types of pharmaceutical wastes.

2.2.2 WHO guideline for disposal of pharmaceutical waste

Pharmaceutical waste management is the collection, segregation, recycling, storage, treatment and disposal of unwanted pharmaceutical wastes produced in the pharmacies and others health institutions. But the WHO focuses on the disposal part more deeply because it is the most important and necessary process in management of the pharmaceutical waste. The guidelines for the proper disposal of the pharmaceuticals can be summarized in the following table[3]:

Table 2.5 WHO guideline for disposal of pharmaceutical waste

Category	Disposal Method	Comments
Solids	Landfill	No more than 1% of the daily municipal waste should be disposed of daily in an untreated form (non-immobilized) to a landfill
Semi solids	Waste encapsulation	
Powders	Waste Inertization	
	Medium and high temperature incineration (cement kiln incinerator)	
Liquids	Sewer	Antineoplastic not to sewer
	High temperature incineration (cement kiln incinerator)	
Ampoules	Crush ampoules and flush diluted fluid to Sewer	Antineoplastic not to sewer.
Anti-infective drugs	Waste encapsulation	Liquid antibiotics may be diluted with water, left to stand for several weeks and discharged to a sewer
	Medium and high temperature incineration (cement kiln incinerator)	
	Return to donor or manufacturer No medium temperature incineration.	Not to landfill unless encapsulated
	Waste encapsulation	Not to sewer
	Waste inertization	No medium temperature incineration
	Medium and high temperature incineration (cement kiln incinerator) (chemical decomposition)	

Controlled Drugs	Waste encapsulation	Not to landfill unless encapsulated.
	Waste inertization	
	Medium and high temperature incineration (cement kiln incinerator)	
Aerosols Canisters	Landfill Waste encapsulation	Not to be burnt may explode.
Disinfectants	Use To sewer or fast-flowing watercourse: small quantities of diluted disinfectants (max. 50 liters per day under supervision)	No undiluted disinfectants to sewers or water courses. Maximum 50 liters per day diluted to sewer or fast-flowing watercourse. No disinfectants at all to slow moving or stagnant watercourses.
PVC plastic, Glass	Landfill	Not for burning in open containers.
Paper, Cardboard	Recycle, burn, landfill	

2.2.3 Socio demographic factors

In Kenya, a cross sectional study found that higher percentage of male i.e. 53% and less than 30 years of age are engaged in community pharmacies.[36] In Kuwait, similar results were obtained, where male are more in the community pharmacy profession but the mean age of participants was 34 years.[37]

Sudesh Gyawali and his team did cross sectional study for assessing injection practices in community pharmacies in Pokhara, Western Nepal where 87% male and 13% female are the supervisors/ proprietors of community pharmacies, ranging in age from 20 to 57 years, and with a mean age of 35.54 years. The mean work experience of the participants was 11.73 years.[13]

One of the survey showed the situation in Pakistan was more desperate with almost half of Community Pharmacy(CP) attendants (45%) being at various stages of secondary school .Only 9.5% had a pharmacy degree while another 16% had undergone a dispensing course. The result shows that the average age of pharmacy attendant lies between 21 and 30 years.[38]

In Saudi Arabia, a cross sectional survey showed virtually 100% of Community pharmacy managers were educated to degree level including B. Pharm., Pharm. D, MSc and even PhD.[39]

To practice pharmacy legally in Kenya, one must be duly registered with the Pharmacy and Poison Board (PPB). The PPB recognizes B. Pharm. degree (pharmacists) and

pharmacy diploma holders (pharmaceutical technologists). Pharmaceutical technologists were not being licensed to superintend pharmaceutical distribution business and were thus mainly restricted to CP.[36]

2.2.4 Knowledge on PWM

An experimental study demonstrated that knowledge of the possible environmental impact of improper disposal of pharmaceutical waste was low among US pharmacists. The study concluded that an educational intervention in the form of a newsletter was effective in improving knowledge of Pharmaceutical Waste Management among pharmacists. However, the response rate was low (below 50%). Furthermore, the authors acknowledged that other experiences or events might have accounted for the recorded improvement in knowledge and attitude. However, the study indicated a rather low percentage of respondents who were knowledgeable on pharmaceutical waste management (< 50%).[40]

2.2.5 Practice of PWM

A survey based research was conducted in Kuwait to assess the practice, awareness and opinion of pharmacists toward disposal of unwanted medications in Kuwait which show that 73% of the pharmacy throws the unwanted medications in the trash directly without any treatment and only 23 pharmacists disposed unwanted medicines according to the guidelines of Ministry of Health, Kuwait (MOH). However, about 82%are aware that improper disposal causes damage to the environment and 97% agree that it is their responsibility to protect the environment.[37]

A Study was conducted in New Zealand, to assess the disposal practices among community pharmacists, which shows that patients were routinely advised to return unused pharmaceuticals to pharmacies but there was no sufficient data on pharmacy disposal practices. According to the results, the most common disposal methods among the respondents were not environmentally sound.[41]

One of the critical review by Natalia Bellan and his co researcher concluded that reverse distribution companies in the US collected both reusable and waste pharmaceuticals where as hazardous waste handling companies in the UK collected only what was designated as waste and disposed of all the waste received. The system of returning unused and expired medicines have been established in developed countries such as Canada, Australia, Italy, France and Spain as in USA and UK.[42] In Australia, Government of New South Wales and several pharmaceutical industries mutually collects the unwanted pharmaceuticals wastes with their proper coordination.[43]

A study conducted in Kuwait, indicate that government pharmacies were required to send their pharmaceutical wastes to the central medical stores, which then performed disposal under the environmental agency's supervision.[37]

2.2.6 Infrastructures

Michael O. Harhay, Scott D. Halpern, Jason S. Harhay, Piero and L.Olliaro carried out a meta-analysis of available literature on health care waste management around the world. They reported that incinerators, where present, were nonoperational or dysfunctional in many cases, resulting in the disposal of health care waste into municipal waste, open burning or simply burying within hospital compounds.[44]

In Kenya, a government sponsored assessment in public and private Health facilities demonstrated a serious challenge with Health care waste disposal infrastructure. While the majority of health facilities relied exclusively on incinerators, about a quarter of them were dysfunctional; either under repair or in nonfunctional status. Only a handful of hospitals had alternative waste treatment infrastructure such as shredders. Since community pharmacies were not assessed, it was not known whether they had access to PW disposal infrastructure.[36]

In Tanzania, 40% of medical stores supervisors in government HFs in Dares-salaam cited lack of incinerators as one of the challenges facing pharmaceutical waste disposal resulting in accumulation. However, this survey was specific to government owned Institutions.[45]

The literature reviewed showed a generally poor conditions of pharmaceutical waste management in developing countries.[45, 46] Policy guidelines were lacking in many countries and where present, the guidelines are seldom followed.

2.3. Conceptual Framework

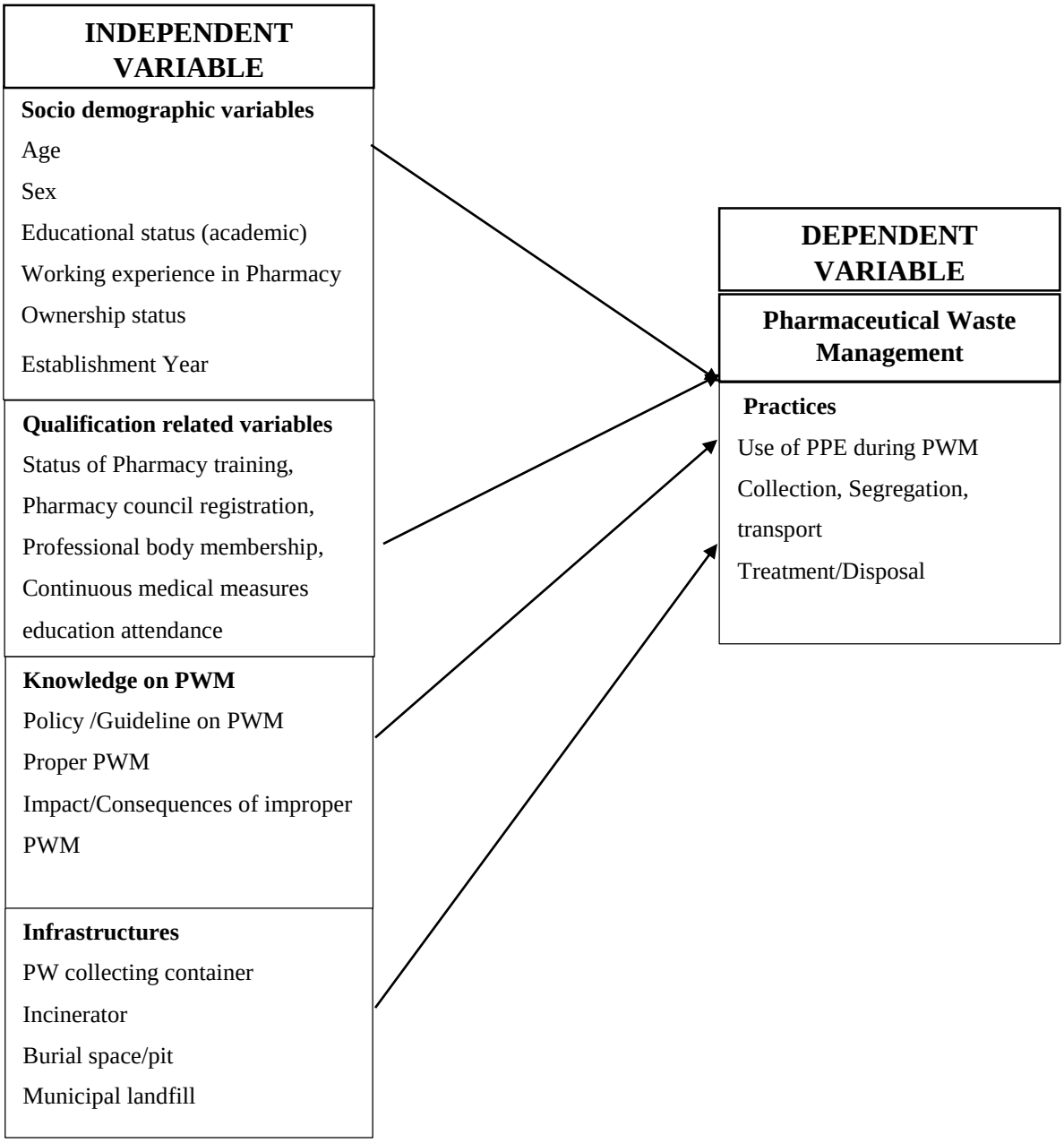

Figure 2.2 Conceptual framework of the study

The conceptual framework describes the relationship between the independent variables and the dependent variables. The independents variables are describe in the figure are socio demographic .qualification, knowledge on PWM and infrastructures. These independent variables influence the practices of PWM and ultimately determines the overall pharmaceutical waste management of the area.

2.4. Study variables

Dependent variables

Pharmaceutical waste management and its practices

Use of PPE during PWM

Collection, Segregation, transport

Treatment/Disposal

Independent variables

Socio-demographic

Age

Sex

Education (Academic) of pharmacist

Pharmacy working experience of pharmacist

Ownership status

Establishment Year

Qualification of Pharmacist

Pharmacist training status

Pharmacy Board registration status

Professional body membership status

Continuous medical measures education attendance status

Knowledge on PWM

Policy /Guideline on PWM

Impact/Consequences of improper PWM

Infrastructures

PW collecting container

Incinerator

Burial pit

Access to landfill (municipal level)

2.5. Operational definition

Community pharmacy: A community pharmacy is a privately owned, unique combination of service and business, where pharmaceuticals are sold (business), and information is provided about the use of medicines and the prevention and treatment of diseases (services).[47]

Encapsulation: Immobilization of waste by stuffing containers with the waste, adding an immobilizing material, and sealing the containers.[15]

Hazardous waste: Waste that poses a variety of environmental and/or health risks.[15]

Healthcare waste: Health-care waste includes all the waste generated within health-care facilities, research centers and laboratories related to medical procedures. In addition, it includes the same types of waste originating from minor and scattered sources, including waste produced in the course of health care undertaken in the home.[15]

Inertization: Immobilization of waste by mixing it with cement and other substances to make it stable and minimize migration of toxic substances into surface water or underground water.[15]

Pharmaceutical waste: Pharmaceutical waste includes pharmaceuticals that are expired or no longer needed and/or items contaminated by or containing pharmaceuticals.

Waste management: The activities, administrative and operational, that are used in handling, packaging, treatment, conditioning, reducing, recycling, reusing, storage and disposal of waste[2]

Knowledge: In this study, knowledge refers to the awareness of guidelines for pharmaceutical waste disposal & impacts and consequences of improper practices of pharmaceutical waste management and assessed as adequate knowledge(greater or equal to "18" score) and inadequate knowledge(less than "18" score).

Practices: In this study practice refers to application of rules, guidelines and knowledge that leads to action in pharmaceutical waste management and assessed as adequate practices (greater or equal to "18" score) and inadequate practices(less than "18" score).

Qualification: In this study four factors i.e. professional body membership, pharmacy board registration, and professional training status and continuous medical education was assessed the degree of qualification.

Incineration: Incineration means one of the process of PWM, where PW were inserted in the incinerator and treated with high heat temperature.

Burning: In this study the terminology "Burning" was used in practices of PWM was defined as the open air burning practices also especially who burned their all types of waste in open air regularly without using any incinerating devices.

Burial Pit: In this study, Burial pit was categorized as "burial pit with fence and liner" and another one was "burial pit without liner". The proper standardized design of health care burial pit recommended by WHO should have fence and liner compulsory**.**

Cleanliness of container: Cleanliness of container was checked through observation checklist. In this study, those pharmacies who regularly cleaned their PW containing container and inner occupied covering plastics after they had provided their wastes to municipal waste handlers or after proper disposal, were categorized into the group as "cleanliness of container-present" and who don't have these criteria are categorized into "cleanliness of container-absent".

Incinerator: This study was concerned with the private retailer pharmacies so the small incinerator useful in pharmacy level was observed. In our context of study, sharps incinerators was observed.

Disposal of ashes: The term **"**Disposal of ashes" is only associated with incineration in this study. After the use of incinerator, some of the PW turns into ashes during burning, so the proper disposal of that ashes also very essential during the pharmaceutical waste management process.

Access to municipal landfill: In this study, pharmacies who provide or throw their wastes to municipal truck are categorized as "presence of municipal landfill access" and those pharmacies who were unable to get this services were categorized as "absence of municipal landfill access".

Segregation of PW with color coding/labelling: In this study, those pharmacies who had separate container with their appropriate label, for collecting different types of PW such as bottles, glasses, syringes, infectious, cotton and gauze pad, general waste etc. are categorized as having "presence of segregation of PW with color coding/labelling".

CHAPTER III: METHODOLOGY

3.1 Study design

Primary data was collected at single point of time so the study design was cross sectional study design. Since the study observed the relationship between variables so the study was analytical.

3.2 Study method

Quantitative method was carried out in this study.

3.3 Study area

The study area was Kaski district of Nepal.

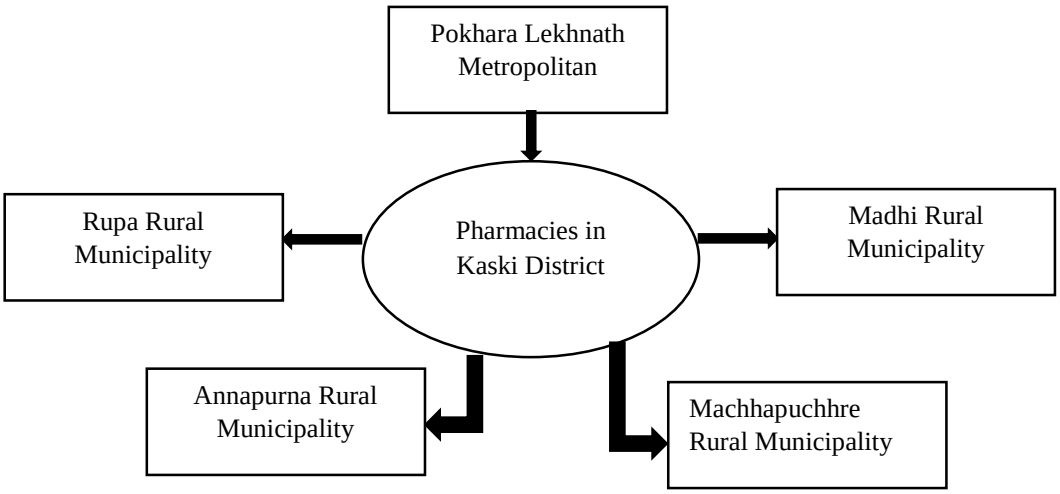

Figure 3.1 Study area of research

3.4 Study population

The study population was defined as a manager or an employee of Pharmacy located within Kaski district including Pokhara Metropolitan and Four other rural municipalities. For the purposes of this study, a pharmacy manager or employees were responsible for the day to day management of the pharmacy, regardless of their legal or educational status.

3.5 Inclusion and exclusion criteria

3.5.1 Inclusion criteria

Those pharmacies which were included in the study sample meet two criteria. The first was privately owned pharmacy providing retail pharmacy services to the community. The second was it should lies under the Kaski district.

3.5.2 Exclusion criteria

Those facility that met the inclusion criteria were excluded because the Pharmacy manager or employee disagree to take part and some of the pharmacy closed during the period of the study was also excluded. Those pharmacies which were not registered in the NCDA and DDA, Nepal was also excluded. Also hospital based pharmacies and employee who were recently recruited(less than one month) was also excluded in the study.

3.6 Study and sampling unit

Each private pharmacy of Kaski district providing retailer services was defined as the study unit in this research whereas individual pharmacist (employee or manager) in each pharmacy was known as sampling unit.

3.7 Sampling strategy

Total 119 Pharmacies (37% of total) were selected from different areas of Kaski district randomly. Simple random sampling was carried out to select these pharmacies from different areas. Sampling frame was the list of private pharmacies registered on Nepal chemist and drugs association (NCDA) from which required number of samples were drawn. This data was made from the office of NCDA, Gandaki Zone Branch, Kaski, and Pokhara (Accessed date: 2017 August 17, for detail see in ANNEX VI).

3.8 Sample size

The sample size was determined using the formula,

$$n = \frac{Z^2 pq}{d^2}$$

Where,

Z= standard normal variate, with value 1.96 at 95% confidence interval

d= allowable error with value 0.05

Sample size calculation:

Sample size can be calculated as:

n $= \frac{Z^2 pq}{d^2}$ for infinite population,

n $= \frac{1.96^2 * 0.52 * 0.48}{0.05^2}$

n = 383

Prevalence of improper pharmaceutical waste management in western Nepal was 52.36% and it was taken from the research article titled "Improper Management of Pharmaceutical Waste in South and South-East Asian Regions".[7]

Also,

Total number of private pharmacies (retailers) (N) = 174

Sample size for finite population (n) was calculated by using following formula

n= $\frac{n_0}{1+n_0/N}$

$= \frac{383}{1+\frac{383}{174}}$

=119

Sample Size for finite population was 119

3.9 Sampling techniques

The total number of pharmacies was around 320 (including wholesale pharmacies and pharmacies attached to nursing homes and hospitals) in the Kaski district, and all these pharmacies was registered in DDA and NCDA.

Around 83 Pharmacies were run as wholesaler's pharmacies and supplies drugs and medicines to their retailers. Also, according to the information from NCDA Kaski almost 63 pharmacies were nonfunctional, which was only registered and renewed their registration certificate annually but they didn't involve in buy and sells of pharmaceuticals. So, in this study these part of samples were excluded i.e. 174 were taken as total running community pharmacies providing retailer services in Kaski district.

For this purpose firstly different number was assigned to all the community pharmacy individually and then required random number (i.e. 120) was taken out by one using Random number table in MS excel. During the conditions when the randomly selected

pharmacies was non-functional or wholesaler, then the random numbers were drawn until the inclusion criteria was satisfied. The pharmacies were selected without considering their size, the number of people working in them, or the gender of the pharmacist.

3.10 Data collection techniques and Tools

The informed consent form was signed by the participant then the questionnaire was filled up by taking interview with the respondents. After filling complete questionnaire, observation checklist were used. Questionnaire and observation checklist was prepared by the help of different article reviewed and some modifications was done to make context matched.

Table 3.1 Data collection techniques and respective tools

S.no	Techniques	Tools
1	Interview Method	Structured Questionnaire
2	Observation Method	Observation Checklist

3.11 Pre-testing of tools

Pre-testing of data collecting tools was conducted in randomly selected Pharmacies from the list of Private pharmacies outside the study area. 10 % of the total units was be pretest. Pre testing of the study tools was done in Vyas Municipality, Damauli Tanahun District. After pretesting changes some changes were done as per need of objectives.

3.12 Validity and Reliability

Validity refers to correct measurement and reliability refers to consistency in measurement. For validity and reliability of our study, following measures were taken in consideration.

a) Pretesting of the tools was done.
b) Simple and understanding language was used as far as possible to get true response from the people.
c) Every filled questionnaire was rechecked and cross editing was done.

d) Guidance from supervisor and other teachers was taken continuously.
e) Corrections were made as per suggestions from teachers.
f) Operational definition was strictly implemented.

3.13 Data management and analysis

In this study information was collected through interview and observation method. Before collecting information, at first informed consent form was signed for taking permission from the respondents. Then after taking permission a set of structured questionnaire was filled up by asking questions. Structured questionnaire was used for pharmacy manager or employee in assessing all the information's. Observation checklist was used to assess the status of cleanliness, infrastructure, practices and waste management resources present in the pharmacy.

All collected data was managed and processed manually .Relationship among different study variables was studied analytically in EPI DATA Version 3.1 and these data was transferred to SPSS V.22 for further analysis.

Knowledge of PWM was measured through a test consisting of eleven questions (part II of questionnaire). Using an adaptation of the NMRQ tool, each correct response was allocated a score of 2 while other responses such as no or not sure was allocated as zero score. [36] The maximum score was 22 and the minimum score was 10. So the median knowledge score was "18". Hence, the score was categorized on the basis of median score. The score which were less than the median value was categorized into inadequate knowledge (score<18) and the score which were greater or equal to median value was categorized into adequate knowledge (score≥18). Similarly practices of PWM was measured through a test consisting of 12 questions (part III of questionnaire). Similar score system was applied, where maximum score was 24 and minimum score was 12. The median practices score was "18". Hence, the score was categorized on the basis of median score. The score which were less than the median value was categorized into inadequate practices (score<18) and the score which were greater or equal to median value was categorized into adequate practices (score≥18). The detailed questionnaire and expected correct responses of knowledge and practices sections were provided in appendix 2(part II & part III).

The questionnaire framework for scoring system regarding knowledge and practices parts was shown below:

Table 3.2 Questionnaire regarding knowledge and practices score

S.no	Questionnaire	Correct response`s score	Incorrect response`s score
	Knowledge on Pharmaceutical Waste Management	2	0
1	Are dumped pharmaceuticals environmentally hazardous?	2	0
2	Is it necessary to collect expired pharmaceuticals separately from sellable stock? If yes, then why?	2	0
3	Is there any relationship between development of resistance to anti-bacterial compounds and unsound management of pharmaceutical waste?	2	0
4	Is there any effect of pharmaceutical waste to effective sewage treatment in the environment?	2	0
5	Do you consider return of unsold pharmaceuticals to the suppliers a good way of minimizing pharmaceutical waste?	2	0
6	Does burying of pharmaceutical waste prevents pollution of water sources with pharmaceutical compounds?	2	0
7	Does burning of pharmaceutical waste may lead to production of harmful persistent organic pollutants (POPs)?	2	0
8	Is encapsulation of pharmaceutical waste is necessary before land filling during disposal process?	2	0
9	Does inertization reduce/delay the release of active pharmaceutical compounds into the aqueous environment?	2	0
10	How the supplier or manufacturer treat and dispose the returned pharmaceuticals?	2	0
11	Is personnel protective equipment (PPE) is necessary during Pharmaceutical waste handling? If yes then why/	2	0
	Practices on Pharmaceutical Waste Management		
1	Do you have any guideline/Policy regarding pharmaceutical waste management which every worker at the pharmacy follow?	2	0
2	Do you have a separate container for storage of expired or damaged pharmaceuticals in your pharmacy?	2	0
3	Practices of having color coded or labelled container for waste collection	2	0
4	Do you or your pharmacy regularly return unsold stocks to your suppliers?	2	0
5	Do you or your coworker usually treat of waste containing pharmaceuticals by burning it?	2	0
6	Practices of throwing PW on municipal truck(noninfectious)	2	0
7	Do you or your pharmacy regularly treat pharmaceutical waste by incinerating it?	2	0
8	Do you or your coworker regularly dispose of pharmaceutical waste by burying it?	2	0
9	Is your premises connected to municipal sewage system?	2	0
10	Is your premises connected to a septic tank?	2	0
11	Do you or your coworker dispose of liquid pharmaceutical waste by flushing it down the toilet?	2	0
12	Do you regularly wear Personnel protective equipment (PPE) i.e. gloves, mask etc. during Pharmaceutical waste handling?	2	0

Table 3.3 Data Analysis Plan

Variables	Causal relationship	Measurement	Univariate	Bivariate
Practice	Dependent	Ordinal	Percentage	CHI-SQUARE TEST/ OTHER TEST AS PER THE TYPES OF VARIABLE AND THEIR ASSOCIATION
Socio demographic				
Age grouping	Independent	Continuous	Percentage	
Sex				
Education status	Independent	Ordinal	Percentage	
Working Experience in Pharmacy	Independent	Continuous	Percentage	
Ownership Status	Independent	Nominal	Percentage	
Duration of establishment Year	Independent	Continuous	Percentage	
Qualification				
Training status	Independent	Nominal	Percentage	
Pharmacy council registration		Nominal	Percentage	
Professional body registration		Nominal	Percentage	
Continuous medical measures education status		Nominal	Percentage	
Knowledge				
Knowledge	Independent	Ordinal	Percentage	
Infrastructure				
Infrastructure	Independent	Ordinal	Percentage	

Questionnaire was properly pretested outside the Kaski district before doing research or applying in the study area. The everyday collected data was reviewed strictly and compulsory at the end of the data collection. By this process the day to day mistake was analyzed and corrected in the next day of data collection. The data entered in the EPI DATA version 3.2 was manually checked i.e. 10% of the data was randomly checked for minimizing error. After entering data if the error occur more than 1% then the data was reentered. Also when the errors occur 5% and more, then the entered data will be rechecked. For understanding association between variables chi square test, fisher-exact test was used and for Univariate analysis, percentage of different variables individually was calculated. During analysis, symmetric measures like Cramer`s value

was also used to understand the association between the variables. Tabular and graphical presentation of the data with its proper interpretation was done.

3.14 Ethical Consideration

Advanced permission was taken from selected pharmacies after getting approval from SHAS Pokhara University, Institutional Review Committee, IRC, Pokhara University and Nepal chemist and drugs association (NCDA), Gandaki Zone Branch Office.

This study was non-interventional and data collected did not expose the participants to any risk of harm. Also there existed no any harm to the community and the people. The study and its findings were beneficial to the communities and by contributing to improvement in pharmaceutical waste management. The participants was allow freely to participate without any pressure and force. Full Information about the nature of the study was provided to the participants including the title, introduction, objectives and expected benefits. . Informed consent was taken from participants by taking signature on the form before starting interview and filling up questionnaire. Confidentiality and privacy of pharmacy was maintained closed. No any personal information was taken and data was used only for the research purpose.

CHAPTER IV: RESULTS

This sections contains analysis and interpretation of the study findings. Data analysis was done after transferring the data entered in EPI DATA version 3.2 to SPSS version 20 as per the objectives. The data were presented using tables, figures, and statistical statements by each objective. All computations were based on 95% level of confidence. The response rate was 100%. Mainly Chi-square test was applied to check for the significant associations between the variables. Symmetric measures like Cramer`s value was also used to find out the strength of association. Sometimes Fisher-exact test was also used in the analysis procedure according to the conditions.

Socio-demographic characteristics

Table 4.1 Socio demographic characteristics of respondents

Variables	Frequency(N=119)	Percent (%)
Age category		
34 years and below	60	50.4
Above 34 years	59	49.6
Median=34years(max=67,min=18) ,IQR=14		
Gender		
Male	85	71.4
Female	34	28.6
Ownership		
Owner	94	79
Partner	2	1.7
Employee	23	19.3
Pharmacy working experience		
10 years and below	65	54.6
Above 10 years	54	45.4
Median=10(max=36min=0.15), IQR=11		
Years since establishment		
0-5 years	47	39.5
6-10 years	26	21.8
11-15 years	19	16
More years	27	22.7
Level of Schooling		
Secondary	24	20.2
Below Bachelor	48	40.3
Bachelor degree/above	47	39.5

Table 4.1 shows the socio-demographic characteristics of the respondents. This characteristics includes age category, sex, highest level of schooling, pharmacy working experience, years since establishment and pharmacy business ownership

status. Of the 119 respondents, 85(71.4%) were male and 34(28.6%) were female. Respondents were ranging age between 18 and 67 (median=34years), where 34 years and below aged were 60(50.4%) and 59(49.6%) were above 34 years of age.

Out of 119 participants, majorities of the respondents i.e. 94 (79%) owned the pharmacies in which they worked. Another 23 (19.3%) were employees while only 2(1.7%) were in partnership. So, this represents that, out of 119 pharmacies only two pharmacies were run in partnership.

About 54.6% respondents had 10 and below 10 years of experiences on pharmacy profession while remaining 45.4% had above 10 years of experiences(median=10years).

Among 119 pharmacies, 47(39.5%) pharmacies were established five or less than five years prior to the date of study conducted. Similarly 27(22.7%) pharmacies were established 15 years before, 26(21.8%) were started between 6-10 years and 19(16%) were started between 11-15 years before the study.

About 39.5% were schooled up to their bachelor degree and above whereas 40.3% were below bachelor and remaining 20.2 % attained their secondary level of schooling.

Qualification related factors of respondents

Table 4.2 Qualification factors of respondents

Variables	Frequency(N=119)	Percent (%)
Pharmacy training status		
Trained	113	95
Untrained	6	5
Level of Training		
Degree	7	5.9
Diploma	41	34.5
CMA+orientation	40	33.6
HA +orientation	15	12.6
Others	10	8.4
Untrained	6	5
Pharmacy Registered in DDA&NCDA	119	100
Registered	119	100
Unregistered	0	0
Regularity of continuous medical measures education		
Yes	96	80.7
No	23	19.3

Belonging to other professional body		
Yes	6	5
No	113	95

This parts presents the findings related with the qualification factors of respondents (pharmacists) which includes pharmacy training status, level of training, registration of pharmacy in DDA and NCDA, regularity of attaining continuous medical measures education and belonging to the professional body other than NCDA.

Out of 119 respondents, 113(95%) were trained in pharmacy profession while 6(5%) had no any pharmacy training .The untrained categories indicates staff nurses, medical lab technicians, and other normal people who were unaware of drug dispensing. Of the total respondents, majorities were trained in diploma pharmacy i.e. 41(34.5%), while 40(33.6) were trained in combine CMA and orientations. Similarly 15(12.6%) had their training on HA with orientation course for dispensing the medicines whereas 7(5.9%) were trained on Bachelor in pharmacy course and 10(8.4%) had trained on orientation courses only but the remaining 6(5%) were untrained in these profession.

Knowledge of pharmaceutical waste management

Table 4.3 Knowledge of pharmaceutical waste management

Knowledge	Frequency(N=119)	Percent (%)
Inadequate Knowledge	48	40.3
Adequate Knowledge	71	59.7

Knowledge of PWM was measured through eleven questions and scoring system was used, where each correct response was allocated a score of 2 while other responses such as no or not sure was allocated as zero score. The maximum score was 22 and the minimum score was 10. So the median knowledge score was "18" (IQR=6). Hence, the score was categorized on the basis of median score. The score which were less than the median value was categorized into inadequate knowledge (score<18) and the score which were greater or equal to median value was categorized into adequate knowledge (score≥18). Table 4.3 shows the level of knowledge regarding pharmaceutical waste management, where out of total 119 respondents, 71(59.7%) respondents have adequate knowledge and 48(40.3%) have inadequate knowledge.

Practices of pharmaceutical waste management

Table 4.4 Practices of pharmaceutical waste management

Practices	Frequency(N=119)	Percent (%)
Poor practices	48	40.3
Good practices	71	59.7

Similarly practices of PWM was measured through a test consisting of 12 questions (part III of questionnaire). Similar score system used in assessing knowledge was applied, where maximum score was 24 and minimum score was 12. The median practices score was "18" (IQR=4). Hence, the score was categorized on the basis of median score. The score which were less than the median value was categorized into inadequate practices (score<18) and the score which were greater or equal to median value was categorized into adequate practices (score≥18).

Table 4.4 shows the level of practices regarding pharmaceutical waste management. Out of total 119 respondents, 71(59.9%) were fall into the category of good practices and remaining 48(40.3%) were categorized as poor practices.

Table 4.4.1 Practices related aspects

	Frequency(N=119)	
Practices characteristics	**Yes**	**No**
Practices of regularly returning unsold pharmaceuticals to suppliers	112(94.1%)	7(5.9%)
Respondents who usually treat all PW by burning method	15(12.6%)	104(87.4%)
Respondents who usually treat all PW by burying method	7(5.9%)	112(94.1%)
Practices of treating PW by incineration method	44(37%)	75(63%)
Respondents who throw PW on municipal truck(noninfectious)	91(76.5%)	28(23.5%)
Respondents who dispose liquid PW by flushing it down the Toilet	6(5%)	113(95%)

Above table shows the main characteristics related with practices of PWM such as practices of returning unsold practices to suppliers, treating PW by burning, burying method and incineration, practices of throwing PW on municipal truck(for non-infectious waste) and practices of disposing liquid PW by flushing it down the toilet. Out of 119 respondents majorities of the pharmacists about 94.1 %(112) had practices of returning unsold and expired pharmaceuticals to the suppliers but few about 5.9 %(7) had absence of such practices. Only 76.5 %(91) pharmacies throw their noninfectious PW to municipal truck but remaining 23.5 %(28) throw all the types of PW also.

About 87.4 %(104) had responded that they usually didn't treat all the types of PW by burying method but remaining 12.6 %(15) had responded that they regularly use burning method for treating all the types of PW. Among 119 respondents, 5.9% regularly used burying method to treat all the types of PW whereas 94.1% didn't had practices of burying .Minimal percentage of pharmacies had practices of incineration method i.e. 37%, this includes incineration within the pharmacies as well as pharmacies who supplied their PW to the hospital for incineration. Over 63 % of pharmacies hadn't practices the method of incineration.

Similarly in the practices aspects, respondents were asked whether they had the practices of flushing liquid PW down the toilet or not, where about 95% responded that they didn't flush their liquid waste down the toilet. But some 5% responded that they had the practices of such methods as well.

Infrastructures used for pharmaceutical waste management

Table 4.5 Infrastructures used for pharmaceutical waste management

Variables	Frequency(N=119)	Percent (%)
Pharmaceutical waste collecting container		
Present	114	95.8
Absent	5	4.2
Cleanliness of container		
Present	114	95.8
Absent	5	4.2
Segregation of PW with color coding/labelling		
Present	34	28.6
Absent	85	71.4
Incinerator and disposal of ashes		
Present	18	15.1
Absent	101	84.9
Burial pit without liner		
Present	18	15.1
Absent	101	84.9
PPE use		
Present	114	95.8
Absent	5	4.2
Access to Landfill(Municipal level)		
Present	111	93.3
Absent	8	6.7

Table 4.5 shows the distribution of pharmacies according to their access of pharmaceutical waste disposal infrastructure. Infrastructure in pharmacy level includes

pharmaceutical waste collecting container with its cleanliness and color coding/labelling, incinerator and private burial pit. In municipal level, pharmacy should be access to their municipal landfill site.

Out of 119 pharmacies, most the pharmacies i.e. 114(95.8%) had pharmaceutical wastes collecting container and also had same percentage of cleanliness and PPE use. Although most of the pharmacies had waste collecting container, but only 34(28.6%) pharmacies had use the system of color coding and labelling for the segregation of waste.

Regarding incineration facilities and burial pit, only 18(15.1%) had access while 101(84.9%) had didn`t access to these facilities. The pharmacies who had reported the presence of private burial pit at their own premises didn't had fence and liner enclosed inside the pit. In municipal level most of the pharmacies i.e. 111(93.3%) had access to the landfill for pharmaceutical waste disposal.

Opinions regarding necessity of training/guidelines regarding PWM and positive attitude of suppliers

Table 4.6 Opinion regarding necessity of guidelines, training and supplier's attitude

Characteristics	Frequency(N=119)	Percent (%)
Necessity of providing related training/guideline at local level by GON		
Yes	114	95.8
No	5	4.2
Necessity of PWM guideline at Pharmacy level		
Yes	116	97.5
No	3	2.5
Necessity of positive attitude of suppliers for returning unsold items		
Yes	119	100
No	0	0

Table 4.6 shows opinions and views of all the 119 respondents regarding necessity of providing training or guidelines related with pharmaceutical waste management in local level as well as in pharmacy level by the government or (DDA) where 95.8%(114) says that there is necessity of guideline or training in local level and 97.21%(116) says that it is necessary in pharmacy level too. Lastly, all the respondents expressed their opinion that there is a necessity of positive attitude of suppliers while returning their unsold pharmaceuticals items.

Association between variables

This section presents associations in between various variables i.e. dependent and independent both the statistical test used was mainly Chi square test was used to understand the association between the variables but in case of any expected cell count less than five in 2*2 contingency tables Fisher-Exact test was also used to understand the association. Symmetric measures like Cramer's value was also used to determine the strength of association after testing through Chi square test. Cramer`s value categorized the strength of association into three groups i.e. mild (Cramer's value: 0.1 to .29), moderate (Cramer`s value: 0.3 to 0.49) and strong (Cramer`s value: 0.5 to above).

Association between socio demographic variables and level of knowledge

Table 4.7 Association between socio demographic variables and level of knowledge

Characteristics	Knowledge		Chi square(X^2)	P-Value
	Inadequate	Adequate		
Age category				
34 years and below 34	25(41.7%)	35(58.3%)	0.089	0.765
Above 34 years	23(39%)	36(61%)		
Gender				
Male	28(32.9%)	57(67.1%)	6.760	0.009*
Female	20(58.8)	14(41.2%)		Cramer`s V =0.238
Ownership				
Owner	34(36.2%)	60(63.8%)	6.059	0.048*
Partner	0(0%)	2(100%)		Cramer`s V =0.226
Employee	14(60.9%)	9(39.1%)		
Pharmacy working Experience				
10 years and below	29(44.6%)	36(55.4%)	1.090	0.296
Above 10 years	19(35.2%)	35(64.8%)		
Years since establishment				
0-5 years	22(46.8%)	25(53.2%)	3.274	0.351
6-10 years	7(26.9%)	19(73.1%)		
11-15 years	9(47.4%)	10(52.6%)		
More years	10(37%)	17(63%)		
Level of Schooling				
Secondary	16(66.7%)	8(33.3%)	14.611	0.001*
Below Bachelor	22(45.8%)	26(54.2%)		Cramer`s V =0.350
Bachelor degree/above	10(21.3%)	37(78.7%)		

** indicates having association i.e. P-value<0.05*

Table 4.7 shows the association between socio-demographic factors of respondents including age category, gender, and level of schooling, ownership of business, pharmacy working experiences and years since establishment with knowledge. The statistics showed no association between level of knowledge and respondent's age category (p=0.768). Similarly there was no association of knowledge and pharmacy working experiences (p=0.296) and also knowledge and years since establishment (p=0.351). But the knowledge was found to be associated with the level of schooling (p=0.001), gender (p=0.009) and ownership of pharmacy (p=0.048), where we had understand that "bachelor degree and above" qualified respondents had more percentage of adequate knowledge than others groups. Likewise, participants who were owner and partners had more score of knowledge on PWM than employees. While measuring the strength of association, level of schooling showed moderate association (Cramer's value=0.35) whereas ownership and gender showed mild association (Cramer`s value<0.3). Hence, the null hypothesis stated "there is no association between knowledge and socio demographic characteristics" was rejected.

Association between Socio demographic variables and level of practices

Table 4.8 Association between socio demographic variables and level of practices

Characteristics	Practices		Chi square value	P-Value
	Inadequate	Adequate		
Age category				
34 years and below 34	21(35%)	39(65%)	1.432	0.231
Above 34 years	27(45.8%)	32(54.2%)		
Gender				
Male	30(35.3%)	55(64.7%)	3.143	0.076
Female	18(52.9%)	16(47.1%)		
Ownership				
Owner	39(41.5%)	55(58.5%)	1.418	0.492
Partner	0	2(100%)		
Employee	9(39.1%)	14(60.9%)		
Pharmacy working				
10 years and below	25(38.5%)	40(61.5%)	0.209	0.647
Above 10 years	23(42.6%)	31(57.4%)		
Years since establishment				
0-5 years	19(40.4%)	28(59.6%)	4.380	0.223
6-10 years	7(26.9%)	19(73.1%)		
11-15 years	11(57.9%)	8(42.1%)		
More years	11(40.7%)	16(59.3%)		

Level of Schooling				
Secondary	16(66.7%)	8(33.3%)	10.064	0.007*
Below Bachelor	19(39.6%)	29(60.4%)		Cramer`s V =0.291
Bachelor degree/above	13(27.7%)	34(72.3%)		

** indicates having association i.e. P-value<0.05*

This parts describes the association between practice of PWM and the respondents' socio-demographic factors. Table 4.8 shows that only respondent`s "level of schooling" was associated with practice (p=0.007) and had mild association since the Cramer's value was less than 0.30. Others characteristics like age category (p=0.231), gender (p=0.076), ownership (p=0.492), years since establishment (p=0.223) and pharmacy working experiences (p=0.647) showed no any association with the practices since their value appeared greater than p=0.05.

Association between Qualification and level of knowledge

Table 4.9 Association between Qualification and level of knowledge

Characteristics	**Knowledge**		**Chi Square**	**P-Value**
	Inadequate	**Adequate**		
Pharmacy training status				
Trained	44(38.9%)	69(61.1%)	1.820	0.219#
Untrained	4(66.7%)	2(33.3%)		
Level of Training				
Degree	1(14.3%)	6(85.7%)	9.000	0.109
Diploma	11(26.8%)	30(73.2%)		
CMA+orientation	20(50%)	20(50%)		
HA +orientation	7(46.7%)	8(53.3%)		
Others	5(50%)	5(50%)		
Untrained	4(66.7%)	2(33.3%)		
Regularity of continuous medical measures education				
Yes	32(33.3%)	64(66.7%)	10.121	0.001*
No	16(69.6%)	7(30.4%)		Cramer`s V =0.292
Belonging to other professional body				
Yes	1(16.7%)	5(83.3%)	1.471	0.399#
No	47(41.6%)	66(58.4%)		

** indicates having association i.e. P-value<0.05*

 # indicates Fisher Exact test value in 2x2 contingency table (for expected cell count<5)

The qualification factors were pharmacy training status, level of training, regularity of continuous medical measures education and belonging to other professional body. Table 4.9 represents the association between qualification factors and knowledge of pharmaceutical waste management. It shows that the pharmacy training status (p=0.219), level of training (p=0.109) and belonging to other professional body

(p=0.399) were not associated with knowledge but the "regularity of continuous medical measures education" was associated with the level of knowledge (p-value=0.001) and the strength of association was mild (Cramer's value<0.29). Hence, the null hypothesis stated "there is no any association between qualification factors and knowledge" was rejected.

Association between qualification and level of practices

Table 4.10 Association between qualification and level of practices

Characteristics	Practices		Chi Square	P-Value
	Inadequate	Adequate		
Pharmacy training status				
Trained	45(39.8%)	68(60.2%)	0.245	0.684#
Untrained	3(50%)	3(50%)		
Level of Training				
Degree	1(14.3%)	6(85.7%)	17.64	0.003*
Diploma	10(24.4%)	31(75.6%)		Cramer`s V=0.385
CMA+orientation	19(47.5%)	21(52.5%)		
HA +orientation	12(80%)	3(20%)		
Others	3(30%)	7(70%)		
Untrained	3(50%)	3(50%)		
Regularity of CMME				
Yes	33(34.4%)	63(65.6%)	7.334	0.007*
No	15(65.2%)	8(34.8%)		Cramer's V=0.248
Belonging to other professional body				
Yes	1(16.7%)	5(83.3%)	1.471	0.399#
No	47(41.6%)	66(58.4%)		

**indicates having association i.e. P-value<0.05*

 # indicates Fisher Exact test value in 2x2 contingency table (for cell count<5).

The qualification factors were pharmacy training status, level of training, regularity of continuous medical measures education and belonging to other professional body. Table 4.10 represents the association between qualification factors and practices of pharmaceutical waste management. Statistics showed level of training (p=0.003) and regularity of continuous medical measures education (p=0.007) was associated with practices of pharmaceutical waste management. Symmetric measures indicated that level of training had moderate association (Cramer`s value<0.5) and regularity of continuous medical measures education had mild association (Cramer`s value<0.30) with the level of practices. Findings clears that pharmacist trained on degree level had adequate practices of PWM than low level training groups. Others remaining characteristics was not associated with the practices of pharmaceutical waste management since there p-value was greater than 0.05.

Association between infrastructures and level of practices

Table 4.11 Association between infrastructures and level of practices

Characteristics	Practices		Chi Square	P-Value
	Inadequate	Adequate		
Pharmaceutical waste collecting container				
Present	44(38.6%)	70(61.4%)	3.412	0.156#
Absent	4(80%)	1(20%)		
Cleanliness of container				
Present	44(38.6%)	70(61.4%)	3.412	0.156#
Absent	4(80%)	1(20%)		
Segregation of PW with color coding/labelling				
Present	5(14.7%)	29(85.3%)	12.993	0.000*
Absent	43(50.6%)	42(49.4%)		Cramer`s V=0.330
Incinerator and disposal of ashes				
Present	1(5.6%)	17(94.4%)	10.660	0.001*
Absent	47(46.5%)	54(53.5%)		Cramer`s V=0.299
Burial pit(without liner)				
Present	10(55.6%)	8(44.4%)	2.041	0.153
Absent	38(37.6%)	63(62.4%)		
Access to Landfill(Municipal level)				
Present	42(37.8%)	69(62.2%)	4.282	0.060#
Absent	6(75%)	2(25%)		

** indicates having association i.e. P-value<0.05*

 # indicates Fisher Exact test value in 2x2 contingency table (expected cell count<5)

Table 4.11 shows the summary of association between level of practices of PWM and infrastructures. The availability of color coded pharmaceutical waste collecting container was associated with the level of practices (p=0.000) where statistics showed that more percentage of adequate practices in the group of pharmacists who had color coded container. Incinerator and disposal of ashes was also associated with the level of practices (p=0.001). Pharmacies having incinerator and who disposed output ashes had more adequate percentage of PWM practices than that of pharmacies who didn't had incinerator. Others infrastructure such as burial pit access (p=0.153) and landfill in municipal level (p=0.060) were not associated with the level of practices. The null hypothesis stated that there is no association with availability of infrastructure and practices of PWM. Cross tabulation between availability of infrastructure and practices of PWM in table no.4.11 shows that there was association existed so the null hypothesis was rejected.

Association between level of knowledge and practices

Table 4.12 Association between level of knowledge and practices

Knowledge	Practices		Chi Square	P-Value
	Inadequate	Adequate		
Inadequate	38(79.2%)	10(20.8%)	X^2 = 50.405	0.000*
Adequate	10(14.1%)	61(85.9%)		Cramer`s V =0.651

** indicates having association i.e. P-value<0.05*

Table 4.12 shows the summary association between knowledge and practices of pharmaceutical waste management .Above table represented that there was strong association of level of knowledge with the level of practices. (P value=0.000) and the strength of association was also strong (Cramer`s value>0.50). Hence, the alternative hypothesis that there was association between knowledge and practices of PWM was accepted.

CHAPTER IV: DISCUSSION

The main objective of this study was to describe the current status of pharmaceutical waste management in Kaski district, Nepal. In this study, the overall pharmaceutical waste management was determined by socio demographic characteristics of pharmacists, qualification of pharmacists, access to infrastructure, and knowledge of PWM and practice of PWM. The discussions are presented into different sections according to the objectives of the study.

Socio demographic characteristics

Out of the 119 respondents, 71.4% were male and 28.6% were female. Similar results were shown by the study conducted by Sudesh Gyawali on "Pharmacy practice and injection use in community pharmacies in Pokhara city, Western Nepal". [13] In that study, 87% were male and 13% were female. Another study from Kenya and Kuwait also reported that more percentage of male were involved in the pharmacy profession than female. [36] [37] The study from Kenya also reported more percentage of male (84.1%) had adequate knowledge than in female (72.4%).[36] Similar results were obtained in our study where 67.1% male adequate knowledge and 41.2% female had adequate knowledge on PWM. Also while comparing male and female with considering same level of schooling education, male had more percentage of knowledge on PWM than female. Similarly while comparing male and female with same group of ownership and regularity of training, male respondents had more percentage of adequate knowledge than female respondents. This study reveals low percentage of female involvement in pharmacy business so the statistics showed low percentage of knowledge on PWM in female respondents.

The demographic characteristics of the present study revealed that only 39.5% of respondents were educated up to Bachelor degree education, whereas 40.3% diploma or higher secondary level and remaining 20.2% were educated up to secondary level of schooling. In Pakistan, 55% of Community pharmacist had only secondary school education while only 9.5% were educated to degree level. [38] A study on pharmaceutical waste management in Kenya also revealed low level of school education in the group of pharmacists i.e. only18.6% were schooled up to Degree education but 63.4% were educated up to diploma level. [36] So all these above discussed reported more percentage of diploma level education in the pharmacist as similar with

our study. But in Saudi Arabia the statistics were different, where 96% of community pharmacists had a Bachelor of Science degree; over 2% had Doctor of Pharmacy (Pharm. D), over 1% Master of Science and about 0.6% had Doctor of Philosophy degrees. [39] In our study, knowledge on PWM was found more on pharmacist educated up to "Bachelor and above" (78.7%) than comparison with the group educated "below bachelor" (54.2%) and up to secondary level (33.3%). Similar result was found on Kenya where 92.2% pharmacist with degree level schooling had adequate knowledge on PWM and 53.2 % pharmacist with below diploma level education had adequate knowledge on PWM. [36]

In this study about 72.3% of pharmacist with bachelor degree education adequate level of practices on PWM. Similar result was reported from the study of Kenya where 72.5% of degree level educated pharmacist had adequate practices on PWM. [36]

Qualification of the pharmacist

Among 119 pharmacists, most of them had adequate knowledge and practices of pharmaceutical waste management who were educated with degree level of pharmacy education than lower level groups i.e. diploma, CMA, HA. Out of total respondents 85.7% had adequate practices on PWM who were educated in degree. Also high percentage of adequate practices and knowledge was also seen in the pharmacists engaged on the professional body (83.3%).Similarly, around 65%of pharmacists attaining regular CMME had adequate practices and knowledge on PWM. Similar results was reported from the study of Kenya. [36] Continuous medical measures education as an intervention was found to improve the knowledge of pharmacists regarding PWM in the US. [40] It would be expected that regular CMEE with relevant content would be more fruitful as an educational intervention for increasing the level of knowledge and practices on PWM.

After analysis and comparing with these reports it can suggested that increasing the numbers of highly qualified pharmacists having characteristics like pharmacy degree, bachelor level of schooling, engaged in professional body and regularly attaining CMME can improve the status of PWM significantly.

Knowledge and practices on pharmaceutical waste management

In this study about 59% of the respondents demonstrated adequate knowledge on pharmaceutical waste management. In Nairobi, Kenya 79% of the pharmacist was demonstrated with 'adequate knowledge' of PWM. [36] Also this study of Kenya had almost same knowledge and practices assessing criteria (score, questionnaire, study population) with this study. This was similar to Kuwait where over 80% of public sector pharmacists were aware of the environmental impact of unsafe disposal of PW. [37] But the Kuwait study was differ with the current study in consideration of study population. In contrast, both the discussed area Nairobi and our study area represents the developing countries but their level of knowledge on PWM was found significantly different.

In this study, over 90% of the respondents are aware of "environmentally hazardous dumped pharmaceutical wastes", "separation of expired drugs", "impact of mixing unwanted pharmaceuticals on effective sewage treatment" and "harmful effects of persistent organic pollutants produced during open burning of pharmaceutical waste". About 60% had incorrectly answered that burying PW could prevent pollution of water sources and around 70% correctly answered that need of encapsulation and inertization before landfill for reducing pollution of water sources. All the respondents answered correctly about the uses and benefits of personnel protective equipment during handling of pharmaceutical wastes.

About 59% of participating pharmacies were categorized as having 'adequate practice' of PWM. Among 119 pharmacies nearly 13% of respondents burned their PW usually as compared to New Zealand where less that 1% of community pharmacies burned their PW. [41] In Tanzania, 31% usually burned their PW in open air. In context to Nairobi, Kenya, where 66% had good practices of PWM and 36% had open burning practices for PW treatment. [45]This suggests that the open burning method is practiced more commonly in low socio economic countries.

Similarly, in this present study, 76.5% gave PW to municipal garbage truck but they didn't gave expired medicine and infected wastes to them. Whereas out of remaining 23.5% respondents, some discard infectious wastes and expired medicines into municipal garbage truck by mixing with general waste and some respondents simply discarded all types of PW into the garbage dump available around their premises. In Kenya 21% of pharmacist discarded PW into garbage dumps while 23% gave it to informal waste collectors. [36] A similar results was reported in Tanzania where about

two thirds of private pharmacies in Dar es Salaam either dumped PW or drained it through the sink. [45] But in context with New Zealand where 3.9% and 24.6% disposed of solid and semi-solid PW respectively with regular rubbish as like other household waste. [41]

This study reported only 16.3% of pharmacists in Kaski district (Nepal), were aware about guideline of PWM and very few were using color coded system for segregation of PW (29.4%).

A survey based research was conducted in Kuwait to assess the practice, awareness and opinion of pharmacists toward disposal of unwanted medications in Kuwait which show that 73% of the pharmacy throws the unwanted medications in the trash directly without any treatment and only 23 pharmacists (out of 144), disposed their unwanted medicines according to the guidelines of Ministry of Health, Kuwait. [37]

The system of returning unused and expired medicines have been established in developed countries such as Canada, Australia, Italy, France and Spain as in USA and UK. [42] About 94.1 % respondents had practices of returning back of their unsold items regularly to the suppliers but they repeatedly reported that some items were refused to return back due to various reasons like ”halved used packets”, “broken items”, “medicines very near to expiry date” etc.

Infrastructures

In primary phase of PWM, returning unusable drugs for safe disposal by the suppliers or manufacturer is an important aspects. In this study all the respondents were retailer and reported that they were directly interact with suppliers groups only. So the private retailer pharmacies returns their unusable drugs to the suppliers and suppliers finally return back that expired or unusable drugs to manufacture company for the safe disposal. The practices of returning unusable pharmaceutical items was seen in 94.1% pharmacies.

In the current study, only about 15.1% of the respondents had access to incinerator at their own pharmacies but the practices of incineration was seen in 37% of pharmacies. This is because, some of the pharmacists who work in the hospital or pharmacies located nearer to the hospital sites, provide their PW for incineration. Most of the pharmacies had sharps incinerator at their own premises for treating sharps items. There was absence of municipal level of incineration facilities for treating PW in Kaski

district. This study found that only landfill facilities was provided by the Pokhara Lekhnath Metropolitan to collect and dispose general (non-infectious) wastes from the community pharmacies but some pharmacies provide infectious wastes by mixing with general wastes. In Tanzania 46% of government health facilities in Dar es Salaam cited lack of incinerators. [45] Similar case were reported in Nairobi, Kenya where 45% of pharmacies had no access to incinerators. [36]

In Tanzania, 72% of public health facilities in Dar es Salaam buried their PW at the city's public dumpsite due to the lack of sanitary landfills. [45] Similar case was seen in our study area, as over 90% of respondents had access to municipal landfill operated by Pokhara Lekhnath Metropolitan for disposing general wastes only but there is an absence of separate sanitary landfill site for medical waste disposal. Due to absence of separate sanitary landfill site for medical waste disposal some pharmacies provide their all kinds of pharmaceutical wastes including antibiotics, toxic and infectious waste to the municipal garbage truck where only general waste were collected .This causes mixing of general and other kinds of pharmaceutical wastes in same place by which transmission of infection from scavengers may occurred. Some respondents also had access to private burial pit (15%) for the disposal of pharmaceutical waste but the respondents who had reported presence of burial pit didn't had liner inside that pit.

About 60 % of pharmacies had contracted waste handlers, an alternatives mode which was more popular in New Zealand, where over 80% of solid PW and over 60% of liquid PW from community pharmacies was disposed of by this method. [41] The same mode was widely used in the US and others countries like Canada, Australia, Italy, France and Spain. [42] But in our study area there was no any provision of contracted waste collectors or associations responsible for treatment and disposal of PW.

In this present study, pharmacies having proper facilities of infrastructures had practice pharmaceutical waste management in proper way in comparison with the pharmacies who doesn't have adequate infrastructure. Pharmacies alone cannot be able to have access of various infrastructures. So government should develop policy for the adequate availability of infrastructures in cooperation with municipality and other stakeholders. The availability of infrastructures plays an important role in creating improved PWM so necessity of infrastructures should be take into account while opening new

pharmacies and municipal level infrastructures should also be introduced to treat PW separately in large scale.

Limitations of the study

Some factors had create obstacles on the study to achieve its required objectives. The study fails to get required functional list of retailer pharmacies. So, sometimes the randomly selected pharmacies were wholesaler or non-functional. Some pharmacy managers were unavailable during the data collection period while a few others declined to take part, a factor which may have caused selection bias, possibly affecting the representativeness of the final sample. Some pharmacies were closed during the duration of data collection. Mostly rural municipalities' pharmacies were not registered in NCDA and DDA so they were unable to include in the study which may create problem in generalization of the study results. Similarly, it is possible that the potential participants who declined to take part were more likely to have inadequate knowledge of PWM, poor practice of PWM or r both.

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The results showed that there was insufficient knowledge and practices of pharmaceutical waste management by the community pharmacists. Only 59% of pharmacist had adequate knowledge and practices of waste management. The findings showed that knowledge on PWM had strong association with its practices.

Knowledge of PWM was associated with the level of schooling and continuous medical measures education of respondents. Level of knowledge and practices were strongly associated with each other which clarifies that respondents who had adequate knowledge on PWM had adequate practices of PWM.

Practices of PWM was associated with the main characteristics of pharmacist`s qualification which were pharmacy training status and continuous medical measures education status. Also it was found associated with the level of schooling of the respondent`s. Most of the pharmacies around 94.6% practices returning or take back system of expired pharmaceuticals and also improper methods of PW disposal such as discarding with municipal waste or through informal waste collectors like scrap purchasers (Kabadis) were being practiced in some pharmacies.

The disposal infrastructure like color coded PW collecting containers, small incinerator, was also absence in most of the pharmacies. Only 15% of pharmacies had their own sharps incinerator in their own premises. About 15% respondents reported that they had their own private burial pit but their pit were absence of fence and liner. Color coded and labelling method of segregation was also absent in 70% of the pharmacies. Most of the pharmacists didn't have documented guidelines of pharmaceutical waste management and also unaware about that aspects. So, infrastructures like incinerator, burial pit (with liner and fence), sanitary landfill site for medical waste disposal, medical waste collecting vehicles are necessary in municipal level.

In conclusion, the practices of PWM is not satisfactory in the Kaski district .It can be considered as public health and environmental health issues because the poor practices may lead to the negative impact on the environment and public health . So, quality of practice of PWM should be improved by improving the knowledge of PWM among community pharmacists, adequate access of PW disposal infrastructure inside and

outside the pharmacy premises and providing effective guidelines for PWM in proper way.

6.2 Recommendations

The following are recommended for establishing proper pharmaceutical management throughout the district as well in the country too;

1. The DDA should enhance law enforcement to ensure that only suitably qualified pharmacists can worked in the pharmacy business. Mostly pharmacy owner recruit employee who were untrained in pharmacy profession and some of them were unaware about dispensing of medicines. So periodic inspection and supervision should be done by the DDA and environmental organizations on these issues. The professional association should also be equally responsible for carrying out these activities.
2. DDA had previously developed "Good pharmacy practice policy" which should be periodically updated according to the increasing standard of health facilities.
3. Government should emphasized in the development of infrastructures like incinerator, burial place (with liner and fence) and other large scale disposal infrastructures.
4. The NCDA and DDA should provide ways of encouraging suitably qualified pharmacy managers for improving learning opportunities for them. Secondly, they should focus to organize CMME with PWM content for their members on a regular basis.
5. Recently on September 2017, DDA had developed a draft guidelines for the proper pharmaceutical waste management in Nepal with the coordination from the WHO guidelines standard. So, it is recommended that the guidelines should be enact as possible as sooner for eliminating the different issues/challenges which were existed in pharmaceutical waste management.
6. Government should encourage national study or research to demonstrate the magnitude of improper pharmaceutical waste management throughout the country.
7. Comparative research study should be carried out between private and public pharmacies and health facilities for updating and reforming the guidelines and policies regarding PWM.

8. Pharmaceutical waste management policy and guidelines should be prepare not only for the health facilities but also for public citizens to aware them about the effect and disposal of expired medicines.

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APPENDICES

Appendix I: Ethical Approval

पोखरा विश्वविद्यालय

POKHARA UNIVERSITY

Kaski, Nepal

चलानी नं. /Ref.No. 87/074175

10/23/2017

Mr. Eknaran Paudel
Principal Investigator
School of Health and Allied Sciences
Faculty of Health Sciences
Pokhara University

Ref: **Ethical Approval of Research Proposal** entitled ***"Pharmaceutical waste management in Private Pharmacies of Kaski District"***

Dear Mr. Eknaran Paudel

It is my pleasure to inform you that the above mentioned proposal has been approved by Pokhara University Research Center (PURC) and Institutional Review Committee (IRC).

As per IRC rules and regulations, the investigator has to strictly follow the protocol mentioned in the proposal. Any change in objective(s), problem statement, research questioner 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 center. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol.

Further, the researchers are directed to strictly abide by the IRC during the implementation of their research proposal and submit progress report and full copy of summary report upon completion.

If you have any questions, please contact the IRC Section at PURC.

Thank You.

GMKhan

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Appendix II: Inform consent

Pharmaceutical Waste Management in Private Pharamacies of Kaski District

Form no:

Date of Data collection:

Address:

Namaste!

I am Eknaran Paudel, a student of BPH 4th year from **Pokhara University** is undertaking research for partial fulfillment of Bachelor degree in Public Health (BPH). I am interested to assess the pharmaceutical waste management practices, knowledge and situation in private pharmacies of Kaski District

During participating my study, you will be asked to answer some questions. There will be no physical risk associated with the study. All the information will be confidential and your identity will not appear in any of the report. Unauthorized people will not have access to your information. There is no intention to upset you. However, if interview causes you any distress it will be discontinued. You are free to withdraw your consent to participate in the research without any penalty in any time during interview. This will not affect you now or in future.

With regards,

Eknaran Paudel

Would you like to participate as a respondent in this research study?

Yes [ ] No [ ]

Signature of Participants……. Signature of Data collector……....

Appendix III: Questionnaire

Part I (Socio Demographic and Qualification)

1. Please indicate your age. ☐

2. Please indicate your gender.

a. Male ☐ b. Female ☐

3. Are you in the ownership structure of your pharmacy?

a. Owner ☐ b. Partner ☐ c. Employee ☐

4. How many years ago was your pharmacy established?

a. 0-5 ☐ b. 6-10 ☐ c. 11-15 ☐ d. More years ☐

5. For how many years have you worked in a pharmacy? ☐

6. Are you trained in the pharmacy profession?

a. Yes ☐ b. No ☐

7. If the answer to 6 is yes, please indicate your level of training.

a. Pharmacy degree ☐ b. 3years pharmacy diploma ☐

c. HA+Oreintation ☐ d. CMA+Oreintation ☐ e.Others……

8. What is your highest level of schooling?

a. Degree ☐ b.diploma ☐ c. Certificate ☐ d. Secondary ☐ e.Higher secondary ☐

f. Others ☐

9. Are you registered or enrolled as a pharmacy professional with the Nepal Chemist and Drug Association?

a. Yes ☐ b. No ☐

10. Do you regularly attend education for medical measures?

a. Yes ☐ b. No ☐

11. Do you belong to other professional body?

a. Yes ☐ b. No ☐

12. Please indicate that professional body? (Specify) _____

Part II (Knowledge)

1. Are dumped pharmaceuticals environmentally hazardous?

Yes ☐ No ☐ not sure ☐ (correct response: Yes)

2. Is it necessary to collect expired pharmaceuticals separately from sellable stock?

Yes ☐ No ☐ not sure ☐ If yes then, why?

(Correct response: Yes, prevents misuse, may be sold out which causes negative effect to patient)

3. Is there any relationship between development of resistance to anti-bacterial compounds and unsound management of pharmaceutical waste?

Yes, it increases ☐ No relation ☐ Decreases ☐ (correct response: yes)

4. Is there any effect of pharmaceutical waste to effective sewage treatment in the environment?

No effect ☐ Yes, it's a threat ☐ don't know ☐ (correct response: yes)

5. Do you consider return of unsold pharmaceuticals to the suppliers a good way of minimizing pharmaceutical waste? Yes ☐ No ☐ not sure ☐ (correct response: yes)

6. Does burying of pharmaceutical waste prevents pollution of water sources with pharmaceutical compounds. Yes ☐ No ☐ not sure ☐ (correct response: no)

7. Does burning of pharmaceutical waste may lead to production of harmful persistent organic pollutants (POPs)? Yes ☐ No ☐ not sure ☐ (correct response: yes)

8. Is encapsulation of pharmaceutical waste is necessary before land filling during disposal process? Yes ☐ No ☐ not sure ☐ (correct response: yes)

9. Does inertization reduce/delay the release of active pharmaceutical compounds into the aqueous environment? Yes ☐ No ☐ not sure ☐ (correct response: yes)

10. How the supplier or manufacturer treat and dispose the returned pharmaceuticals?

(Correct response: according to PWM protocol they treat and dispose)

11. Is personnel protective equipment (PPE) i.e. gloves, mask etc. is necessary during Pharmaceutical waste handling? Yes ☐ No ☐ If yes then why? (Correct response: yes, protection, prevention from infection, transmission and injuries)

Part III (Practices)

1. Do you have any guideline/Policy regarding pharmaceutical waste management which every worker at the pharmacy follow? Yes ☐ No ☐ No idea ☐ (correct response: yes)

2. Do you have a separate container for storage of expired or damaged pharmaceuticals in your pharmacy?

Yes ☐ No ☐ (correct response: yes)

3. Do you have color coding system for separating the types of pharmaceutical wastes at the pharmacy?

Yes ☐ No ☐ (correct response: yes)

4. Do you or your pharmacy regularly return unsold stocks to your suppliers?

Yes ☐ No ☐ (correct response: yes)

Are your suppliers willing to get the unsold stocks back?

Yes ☐ No ☐ no idea ☐ (correct response: yes)

5. Do you usually treat of waste containing pharmaceuticals by burning it?

Yes ☐ No ☐ (correct response: no)

Does your coworker treat waste containing pharmaceuticals by burning it?

Yes ☐ No ☐ (correct response: no)

6. Do you or your coworker usually throw of pharmaceutical waste in a garbage dump?

Yes ☐ No ☐ (correct response: no)

Do you or your coworker throw pharmaceutical waste in municipal garbage truck?

If yes, then enlist the types of wastes? Yes ☐ No ☐ (correct response: yes, only noninfectious or nonhazardous and providing to the biometric truck also regarded as correct practices)

7. Do you or your pharmacy regularly treat pharmaceutical waste by incinerating it?

Yes ☐ No ☐ (correct response: yes)

8. Do your regularly dispose of pharmaceutical waste by burying it?

Yes ☐ No ☐ (correct response: no)

Does your coworker regularly dispose of pharmaceutical waste by burying it?

Yes ☐ No ☐ (correct response: no)

9. Is your premises connected to a municipal sewerage system? Yes ☐ No ☐ No idea ☐

(Correct response: yes)

10. Is your premises connected to a septic tank?

Yes ☐ No ☐ No idea ☐ (correct response: yes)

11. Do you dispose of liquid pharmaceutical waste by flushing it down the toilet?

Yes ☐ No ☐ (correct response: no)

Does your coworker dispose of liquid pharmaceutical waste by flushing it down the toilet?

Yes ☐ No ☐ (correct response: no)

12. Do you regularly wear Personnel protective equipment (PPE) i.e. gloves, mask etc. during Pharmaceutical waste handling? Yes ☐ No ☐ (correct response: yes)

Part IV (Others).

1. Do you think PWM guideline or related training is necessary at local or central governmental level?
   Yes ☐ No ☐ No idea ☐
2. Do you think PWM guideline or principle is necessary at pharmacy level?
   Yes ☐ No ☐ No idea ☐
3. Do you think more positive attitude towards PW collection by supplier is necessary?
   Yes ☐ No ☐ No idea ☐

OBSERVATION CHECK LIST

Observation	Status	
	Present	Absent
In Pharmacy level		
Cleanliness of container		
Pharmaceutical waste collecting container		
PPE use (Gloves ,mask)		
Segregation of PW with color code/labelling		
Incinerator and Disposal of Ashes		
Private Burial Pit		
With liner		
Without liner		
In Municipal level		
Access to landfill		

Appendix IV: List of community pharmacies, Kaski

S.no	Pharmacy name	Manager	Address
1	Jivan medical hall	Jivan Adhikari	Aarmala 1
2	Fewa medical hall	Mek bdr khatri	baidam 6
3	Baglung upakar pharma	Asuna kumar shrestha	Fulbari 11
4	Bastola Medical hall	Balram bastola	Hemja 8
5	Kaligandaki medico pharma	Bishnu Prasad paudel	Mahendrapool
6	Charchita medical hall	Bil kumari kumal	Pokhara 5 shantinagar
7	Aashish Medical hall	Balaram Bhandari	Pokhara 15
8	Aayu medico pharma	Aai bahadur gurung	Begnas
9	Baral Medical hall	Hemchandra Baral	Aargau lekhnath
10	Tulsi Pharmacy	Tulsiram Baral	Pumdi bhumdi
11	Tejawsi Pharmacy	Ganga Paudel	Pokhara 10
12	Rima Pharma	Rima Tulachan	Nadipur
13	Birgha Pharmacy	Humkala Thapa	Budhha chowk
14	Kiran Medical Services	Dev Bdr Gurung	Rambazar
15	Komal Pharmacy	kolan Singh Grg	Rambazar
16	Kuwar medical Service	Jagat Kunwar	Lakeside 6
17	Thaman Pharmacy	Thaman Singh Pui GRg	Rambazar
18	Narahari Medical Services	Naraheru Paneru	Rambazar
19	Parbaat Pharmacy	yam Kumari Nepali	Amarsingh
20	Srijana Medical Hall	Lava Kumar Rana mgr	Amarsingh
21	Arjun Medical Hall	Arjun Bdr Khatri	Baglung Buspark
22	Dipendra Medical Services	Dipendra P Timilsina	Baglung Buspark
23	Ramba Medical Hall	Naresh Pandey	Lakeside 6
24	Goma Medical Hall	Goma Subedi	Lakeside 6
25	Annapurna Medico Pharma	Bikram Panta	Mahendrapool
26	Younes drugs distributers	Khageswor kafle	Mahendrapool
27	Life medical hall	Kasinath Kaflr	Mahendrapool
28	Syanja Aausadhi Pasal	kedar P Pokhrel	Mahendrapool
29	Khadka Medico Pharma	Mangala Khadka	Mahendrapool
30	Khadka Medicine Suppliers	Indra B Khadka	Mahendrapool
31	Niraj Pharma	Jhapat B Kunwar	Mahendrapool
32	Sanjivini Medico Pharma	Ganga Kunwar	Mahendrapool
33	Sudhar Pokhara Pharmacy	Sundar Rana	Mahendrapool
34	Indus Pharma	Indu lal Sharma	Mahendrapool
35	Himshree Pharma	Prajwol Bhaydaya	Mahendrapool
36	Himadri Pharma	Anil Baidhya	Mahendrapool
37	Sujal Medical Hall	Sita Gywwali	Birauta 17
38	Puspa Medical Hall	Laxmi Rawat	Himali tole 17
39	Daulagiri medical hall	Ramesh Dhungana	Gharipatan 17
40	Shanti medical hall	Mohan Kumar sunwar	Bagar 1
41	Aarniko Pharmacy	Amrita Joshi	Bagar 1
42	Kafle Medical Hall	Megh nath Kafle	Bagar 1

43	Sayapatri Medical hall	Lal b Kunwar	Lakeside 6
44	Safal Medical Concern	Grisma Mohan Bhattarai	Ramkrishna tole 4
45	Vijaypur medical hall	Saraswati Adhikari Thapa	Sabagriha chowk
46	Aasirbaad Medical Hall	Khadananda Paudel	Sabagriha chowk
47	Padam Medical Hall	Padam Singh Grg	Baglung Buspark
48	Chandra Medical Hall	Hom Nath Lamichhane	Miruwa 2
49	Saujanya Pharmacy	Kuldeep Subedhi	Gairapatan
50	Bardan medical Hall	Sushila Shrestha	Rastra Bank chowk
51	Nilgiri Pharmacy	Bal Singh Grg	Aarva 2
52	Durga Pharma	Durga Thapa	Batulechwor
53	Gino Pharmacy	ramesh bohora	Pokhara 1
54	parichhya medi care	laxmi p grg	Lekhnath 3
55	Palikhe medico Pharma	Nandi kumar Palikhe	Ranipauwa
56	Mohini medical Hall	Mohini Shrestha	Pokhara 13
57	Aamar Ayurvedic Aausadhalaya	Aamar bahadur Badhya	Tersapatti
58	Mohan Medico Pharma	Mohan B Karki	Prasyang 5
59	Samman Medico pharma	Jahalak B karki	Rambazar
60	Jivan Pharmacy	Jivan B adhikari	Sabagriha chowk
61	Chandra Global Medico Pharma	Rupak Paudel	Bagar 1
62	Aatal Pharmacy	Ygya raj Subedi	Gairapatan
63	R K medicine Distributers	Rudra Narayan Malla	nayabazar
64	Shining medical hall	Prem Kumari rai	Palikhechowk
65	Bandana Medicine Distributors	Laxminarayan Parajuli	Mahendrapool
66	Aayu Pharmacy	Prakash Kumar Grg	Prithivi Chowk
67	Sonia Pharmacy	Manju Grg	Bhandadik
68	Janasewa Medical Hall	Yamnath Paudel	Prithivi Chowk
69	Janajyoti Medico Pharma	Kesav P Regmi	Mahendrapool
70	Samikshya Medisells	Sambhu Parajuli	Pokhara 5
71	Pukar Medisells	Shreeram Parajuli	Pokhara 9
72	Aakash Drug House	Eklal Giri	Pokhara 8 srijana Chowk
73	Parajuli medical Hall	Mahendra P Parajuli	Pokhara 4 himali tole
74	Bindu Pharma	Krishna Bdr Karki	Pokhara 9 nayabazar
75	Aashu Medical hall	Jitendra raj subedhi	Lekhnath 8
76	Rusha Pharma Enterprises PVT LTD	Tanka P Adhikari	Mahendrapool
77	Upakar Medical Hall	Sanak Raj Lamichhane	Lekhnath 8
78	Shrestha Medico Pharma	tritha man Shrestha	Pokhara 13
79	Pooja Medical Hall	Kumar Shrestha	Pokhara 17 himalitole
80	Namrata Medical Hall	Nanibabu Dhakal	Pokhara 17 Chhorepatan
81	Chirayu Medical Services	Megh nath Kafle	Pokhara 1 Bagar
82	Area Medical Hall	Ishwori p Kafle	Pokhara 1 Bagar
83	Deurali Pharmaceuticals	Chet Nath Sharma	Chipledhunga
84	Madhawi Medico Pharma	Bhagwat Nepal	Sidhhartha chowk

85	Unique Medical hall	Balkrishna Lammichhane	Lekhanath 12
86	Aavi Pharmacy	Dhakaram Bastakoti	Pokhara 8
87	Sachetana Medical Center	Hareram Parajuli	Pokhara 1 Bagar
88	Deurali Pharma	Yagya P Sharma	Janpriya marga
89	Multimedico Pharma	Krishna P Paudel	Pokhara 1 Bagar
90	Himchuli Medico Pharma	kamala Bhandari	Pokhara 17 birauta
91	Pratikshya Medical Hall	Padam Padi Sharma	Pokhara 4 baglung buspark
92	Mayur Pharmacy	Madav P Pokhrel	Pokhara 17 birauta
93	Gandaki Medisells	Puspa devi Shrestha	Mahendrapool
94	Aadhikhola Medical Hall	Ram B K.C	Rambazar
95	Standard Drug Distributers	Jhalak Sharma	Mahendrapool
96	Fujel Ayurbed Pharma	Kesari P Tiwari	nayabazar
97	Sagarmatha Medicine Distributers	Urmila Paudel	nayabazar
98	Shrish Medical Hall	Dil B Shrish Magar	Matepani
99	Janata Pharmacy	Lekhnath Regmi	Pokhara 9
100	Pandey Medical Hall	Chet Narayan Pandey	Lakeside 6
101	Lamichhane medical Hall	Ambika P Lammichhane	Bharatpokhara 5
102	Aashish Medical hall	Suvadra Pariyar	Nadipur
103	Yemi Pharmacy	Arjun Karki	Pokhara 10
104	Shahi Medical Hall	Tanka B shahi	Pokhara 13
105	New Shahi Medical hall	Indra Kumari Shahi	Pokhara 4
106	Shovit Medical Hall	Mahesh Jyasi	Pokhara 16
107	Panta Pharmacy	Narayan Raj Panta	Pokhara 12
108	Nadipur Medical Hall	Rudra nath Paudel	Pokhara 3
109	Paropakar Medical Hall	Danda Padi Sharma	Mahendrapool
110	Gorkha Medical Hall	Ram b Balkuti	Mahendrapool
111	Biva Pharmacy	Urmila koirala	Pokhara 8
112	Prari Drug House	Bishnu P Baral	Pokhara 10
113	Raj Pharmaccy	Shree ram Bharati	Birauta 17
114	Pokhara Pharma	Pravin kayestha	Pokhara 6
115	Kafle Medical Hall	Rudranath Kaflr	Begnas
116	Binayak Medico pharma	Narayaan P baral	Pokhara 13
117	Birat Medicine distributers	Khadak Singh Dhami	Pokhara 9
118	Polite Medine House	Dinesh Shrestha	Pokhara 8 Sarakot chowk
119	Tallchowk Aausadhi Pasal	Saraswati sapkota	Tallchowk
120	Gautam Aayurved Aausadhalaya	Ramesh Gautam	Bhadaure 5
121	Chetan Pharmacy	Chet B Grg	Lekhnath 1 sisuwa
122	Swostika Medical Center	Devendra Paudel	nayabazar
123	Bisesh Pharmacy	Srisak Sharma	Pokhar 2
124	R P Pharama	Hari P Dahal	Mahendrapool
125	Rusha Surgimed	Surendra Kumar Agrwal	Mahendrapool
126	Dev Medical Hall	Dev Bdr Rana Bhat	Majhthaha 3

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127	Dhorbarahi Pharmacy	Aasha Ale Magar	Mahendrapool
128	Sancho Mediico Pharma	Krishna P Pandey	O KM
129	Mandip Phaaarmacy	Shivaraj paudel	Chorepatan 17
130	Prativa Medical Hall	Govinda P Sharma Paudel	Pokhara 12
131	Anup Pharmacy	Prem Bdr Bhujel	Pokhara 16
132	Brighter Pharmacy	Bhuwani Shankar Paudel	Pokhara 9
133	Western medisells	Pradip Ghimire	Sabagriha chowk
134	Dennys Medico Pharma	Dipak Lamichhane	Pokhara
135	Bagawati Pharma	Hutananda Pandey	Pokhara 5
136	Adhikari medicine Suppliers PVT LTD	Durga P Adhikari	Mahendrapool
137	Asia Medisales	Rajani Baral	nayabazar 8
138	Charak Memorial Pharmacy	Ramchandra Regmi	Naybazar 8
139	Shiva Swarnim pharma	Maheswor Pokhrel	Mahendrapool
140	Sulav medical hall	Gyanendra Tajya	Pokhara 11
141	Nepali Medical Hall	Bimal Nepali	O KM 5
142	Concept Medicine concern	Gopal Adhikari	Mahendrapool 9
143	Gandaki Medical College Pharmacy UNIT		Prithivi Chowk
144	Shardikhola Policlinic	Lalitman Tamrakar	Pokhara 1 Bagar
145	Kangaroo medical hall	Govinda P Paudel	baidam 6
146	Sewa Medical Pharma	Gundh P Pandey	Pokhara 17
147	Devisfall Medical Hall	Rajendra Bdr Thapa	Chhorepatan 17
148	Suvatara Pharmacy	Dil B thapa	Pokhara 8
149	Laxmi Pharmacy	Laxmi P Paudel	Bhadaure Tamagi 5
150	Saino Medical Hall	Dharmaraj Khadka	Pokhara 7
151	kamana Medical Concern	Kaladhar Bhandari	Pokhara 1 Bagar
152	Aadarsatkar Pharmacy	Satkarbabu Paudel	Pokhara 10
153	Nischal Medical Hall	Yadav Gautam	Pokhara 1 Bagar
154	Namaste Pharmacia	Hiramani Neupane	Pokhara 11
155	Pasimanchal Pharmacy	Rupak Bhandari	Newroad 8
156	Acharya Medical Hall	Toyanath Acharya	Pokhara 1 Bagar
157	Krishna Medical Pharma	Surya Bdr Sapkota	Hemja 8
158	Aatis Mediko pharma	Sunita Baral	Pokhara 5
159	Aanurag mediko Pharma	Megha Dhakal	Pokhara 16
160	Mount Annapurna Pharmacy	Shamvu Panta	Birauta 17
161	Kumar medical hall	Rum Bdr Grg	Aaudigik Chetra
162	Shuva Pravat Pharmacy	Hevraj Baral	Birauta 17
163	Namuna Pharmacy	santosh Pandit	Pokhara 18
164	Mamata Pharmacy	Mahendra P Sigdel	Lekhnath 18 Moharia
165	Satauchandi Medical hall	Bishnu Pokhrel	Pokhara 4
166	Nims Pharmacy	Bikramraj Pahari	Pokhara 8
167	Swyechha Pharma	Sunita kafle	Bharatpokhara 4
168	Nitiniyam Medical Hall	Dhurba Sharma	Prithivi Chowk

169	Birauta Medico Pharma	Ravi P Baral	Birauta 17
170	Lumbini medical Hall	Laxman adhikari	Pokhara 5
171	Sakxam Pharmacy	Bishnu bahadur thapa	pokhara 8
172	Sahayog Medicine Concern	Tikaram Sharma	Pokhara 8
173	MetroCity Pharmacy	Kajibabu Shrestha	Shreejana Chowk
174	Kaskeli Pharmacy	Madhu Giri	Pokhara 2 Bindabasini
175	Aasmani Pharmacy	Sajiv Devkota	nayabazar
176	Resunga medico Pharma	saradha Pandey	Gharipatan 17
177	Shivam Pharmacy	Chiranjivi Timilsina	Pokhara 16 Dip
178	Anis Medical Center	Durgadatta Adhikari	Pokhara 16 Mahendragufa
179	Sharmila Medical Hall	Sundhar Thapa	Pokhara 16 Batulechor
180	Sunaina Medical Hall	Surendra Pradhan	Amarsingh
181	Srijan Medicine Distributers	Chhabiraj Subedhi	Mahendrapool
182	Aadarsa Aausadhi Pasal	Hari Bdr Thapa	Mahendrapool
183	Paneru Medicine Suppliers	Teknath Paneru	Mahendrapool
184	Himal Medico Pharma	Devaki Sharma	Mahendrapool
185	Om Pharmacy	Om Prakash Grg	Mahendrapool
186	Bigya Pharmacy	Shanti Bastakoti	Pokhara14
187	Mangal Pharmacy	Samjhana grg	Damside 17
188	Aayush Pharmacy	lal Kumari grg	Mahendrapool
189	Sarwa Pharmacy	sarwajit adhikari	Fewacity Hospital
190	Tapaiko Aausadhi Pasal	Baburam Paudel	Nayabazar
191	Anamol Medicine Suppliers	Pramodh Kumar Dwa	Nayabazar
192	Pasimanchal Medicine Suppliers	Suwarna Man kayastha	Mahendrapool
193	Pokhara Medical Hall	Niru devi kayastha	MahendraPool
194	Pokhara Pharmaceuticals	bishnu Kayastha	Mahendrapool
195	Suswasthya Pharma	Rahul Bhujel	Prithivi Chowk
196	TalBarahi Pharmacy	Ramesh Lamsal	Gairapatan
197	My Surgicam Pharma	Sudip Basnet	Pokhara 4
198	Babina Surgimed	Bir B Thapa	Gairapatan
199	babina Pharma	Santosh B Adhikari	Gairapatan
200	Dyanamic MediSales	Hari P Sharma	Gairapatan
201	Pranisha Medicine Concern	Nita Sharma	Gairapatan
202	Ripesh Medical Hall	Ishwari Paudel	Prithivi Chowk
203	Sumi Pharmacy	Narayan P Parajuli	Pokhara 10
204	Dwa Medical Hall	Nabin Kumar Dwa	Gairapatan
205	Shivaji Medical Hall	Shivaji Banstola	hemja
206	Ishwor Medical Hall	ram P Paudel	Newroad
207	Ishwor Medico Pharma	Ishwari P Pandey	Sahantinagar Chowk
208	Shivani Pharma	Namaraj Pandey	Lakeside 6
209	Chhatra Medical Hall	Ganesh P Banjade	Malepatan
210	Star Medico Pharma Pvt Ltd	Krishna P pandey	Pokhara 8
211	Megha Medicine Distributers	Ishwor Paudel	BanstolaThar

212	Subekshya Medical Hall	Narahari Paudel	Prithivi Chowk
213	Abhi Pharmacy	Chhatra kumari Roka	Fulbari 12
214	Ram Medical hall	Shreemaya Sigdel	Manipal
215	Sushan Medical Hall	Madhumaya Paudel	Lekhnath
216	Light Pharmacy	Ramchandra Adhikari	Nagdhunga
217	Shreena Pharmacy	Muna K C	Pokhara 10
218	Rupa Pharmacy	Pradip Ojha	Talchowk
219	Dobhan Pharma	Nirmala Tiwari	Pokhara 11
220	Rajesh Medical Hall	Shesh Mani Tripathi	Hemja
221	Kalash Pharmacy	Nawaraj Banstola	Lekhnath 8
222	Nauli Pharmacy	Roshan Tiwari	Lakeside 6
223	Magic Medico Concern	Suwarnaraj Panta	Ratnachowk
224	DipJyoti Medical Hall	Dipa Pokhrel	Prithivi Chowk
225	Sunrise Medico Pharma	Gir Bdr Khatri	Prithivi Chowk
226	Dipa Medicine Suppliers	Krishna B Khadka	Pokhara 4
227	Paudel Pharmacy	Parbati Dhungana	Nagdhunga
228	Civil Pharmacy	Nirajan Regmi	Newroad
229	Ananda Pharma	Ram Kumar karki	Mahendrapool
230	Smriti Medical Hall	Om Kumari Bhujel	Lakeside
231	Krishna Machhpuchre Medical Hall	Krishna B Mali	Hospital chowk
232	Yeti Med Concern	Rajendra P Adhikari	Hospital chowk
233	Rakshya Pharmcy	Bimala Adhikari	Hospital chowk
234	Raju Vai Pharmacy	Budhhisagar Acharya	Birauta
235	Biswash Medical Hall	Dev Bdr Rana	Pokhara 9
236	Jaljal Medico Pharma	Suman Tiwari	Pokhara 9
237	Sandesh Medical hall	Ramraj Koirala	Pokhara 4
238	Milap Pharmacy	Ganesh P Baral	Baidam
239	Surakshya Medical Hall	Gita Kumari Khadka	Pokhara 18
240	Bhattarai Pharmacy	Nilakantha Bhattarai	Pokhara 18
241	Dipendra Medico Pharma	Laxman Baniya Chhetri	Baglung Buspark
242	Dev Pharmacy	Dev K Sunar	Birauta
243	Puspanjali Medical Hall	Ramnath Sapkota	Prithivi Chowk
244	Sabyata Pharmacy	Basudev Koirala	Pokhara 12
245	Lotus medicine distributers	Duga P Kafle	Ranipauwa
246	Dakshya Pharmacy	Ganesh Gurung	Kajipokhari
247	Amrit Kalash Pharmacy	Mahesh Raj Panthi	Lakeside
248	Medicare Pharma	Bishnu P Bhandari	Hospital chowk
249	Baglung Namuna Pharmacy	Rita Dwadi	Pokhara10
250	Niruta Medico Pharma	Ekdev Devkota	Pokhara 3
251	Sagun Pharmacy	Bhuim Kumari grg	Pokhara 15
252	Advanced Medicine Service	Naresh Paudel	Pokhara 13
253	Gaurishankar Medical Suppliers	Diraj Gautam	Pokhara 9
254	Lake Pharmacy	Gitaraj Chalise	Lakeside

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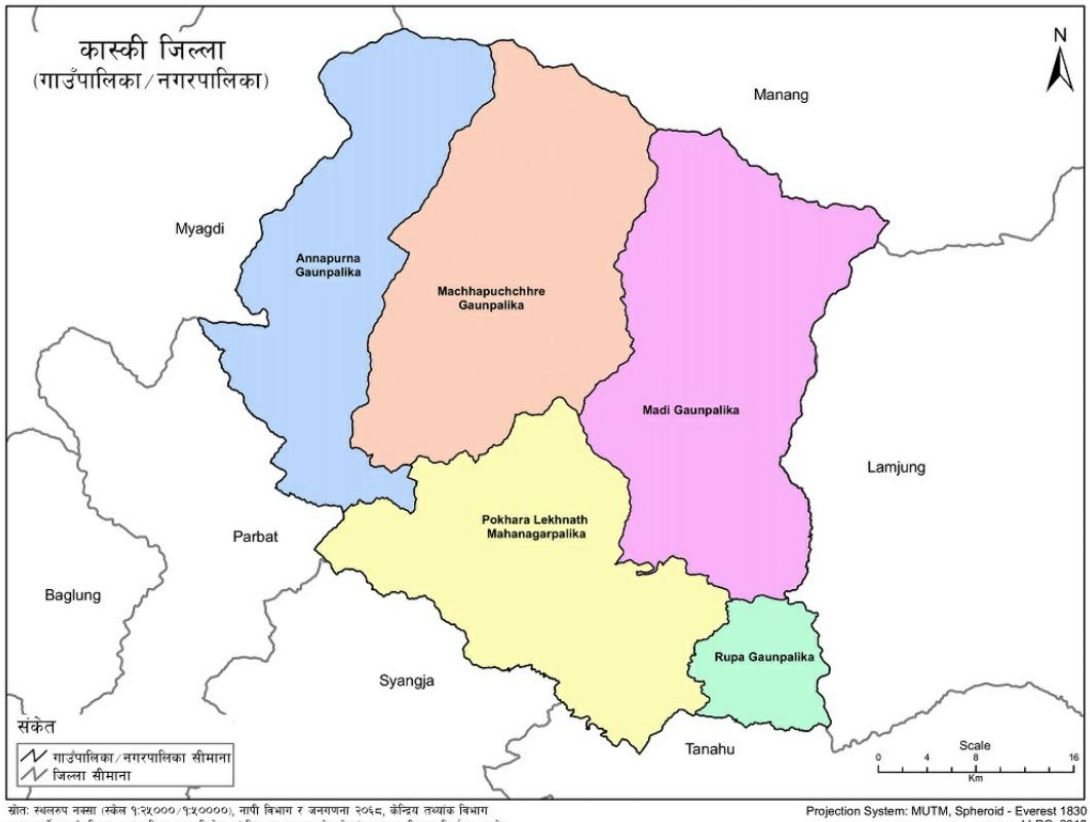
255	Shrijan Pharmacy	Milan Shrestha	Prithivi Chowk
256	Chirag Pharmacy	Dipak Panta	Ranipauwa
257	Chunchun Pharmacy	Purna Basnet	Ramghat
258	Ramlaxman Pharmacy	Ram Paudel	Gairapatan
259	Khusi Aayurbed Bhawan	Nabin Kiran Bhusal	Prithivi Chowk
260	National Pharmacy	Shusil Tiwari	Prithivi Chowk
261	New Bahari Medico Pharma	Jagat Khadka	Newroad
262	Samata Pharmacy	Dolraj Thapa	Mustangchowk
263	Ajay Pharmacy	Ajaya Babu Bhattrai	Lekhnath Talchowk
264	Newroad Pharmacy	sarita Pokhrel	Newroad
265	Grand Medicine Nepal Pvt Ltd	Sukraraj Kadel	Pokhara 9
266	Aarohan kamana Medisales	Kamal P Dahal	Pokhara 9
267	Hemja Medical Hall	Bishnu Kumari Parajuli	Hemja
268	Martshanti medical hall	Laxmi devi Martshani	Pokhara 11
269	Laxmi Aausadhi Pasal	MP Acharya	Lekhnath 3
270	Himsagar Medico Pharma Pvt Ltd	Himlal kafle	Prithivi Chowk
271	Sarnim Pharmacy	Nabin Regmi	Mahendrapool
272	Pasture Pharmacy	Sarmila Wasti	Newroad
273	Rajan Pharma	Rojina Piya Shrestha	Nayabazar
274	Satish Pharma	Basanta Keshav Banstola	Pokhara 2
275	Pariwartan Pharmacy	Rabindra Aryal	sisuwa
276	Jesan Medical hall	Karuna Dhakal	Pokhara 15
277	Sampurna Pharma	Ram P Ghimire	Lekhnath 3
278	Modern Medical Hall	Krishna k Lamichhane	Pokhara 10
279	Health and Life clinic PVT ltd	Nima Devi Baral	Pokhara 11
280	Ashmi Pharmacy	Shayam Sundhar Thapa	Pokhara9
281	PharmaCare Aausadhi Pasal	Giriraj Kc	Pokhara 10
282	Ramakanta Pharmacy	Parbati Kumar Sharma	Pokhara3
283	Rachana Medico Pharma	Durga P Sharma	Pokhara 8
284	National Drug House	Roma Sharma Gywali	Pokhara 8
285	Yusika Medical hall	Kabita Sharma Tiwri	Pokhara 17
286	Ashok Medical Hall	Kunti Pariyar	Nadipur
287	Monika Pharma	Mohan K Ranjitkar	Ranipauwa
288	Smiriti Medical hall	Om Kumari Bhujel	Lakeside
289	N R T medicsales	Sundhar Adhikari	Newroad
290	Himsagar Medico Pharma	Tilak P Shrestha	Prithivi Chowk
291	INF pharmacy	Shushil Tripathi	Hariyokharka
292	Pokhrel Pharmacy	Devi Kumari Pkhrel	Newroad
293	Swikirti Pharma	Anita Baral	Lekhnath
294	Nirdesh Pharma	Brinda Parajuli	Pokhara 6
295	The Subham Pharmaceutical	Nirajan Bikram rana	Pokhra 6
296	National Bathrog Centre	Krishna Raj Dhakal	Mustang chowk
297	Afanta Pharmacy	Suresh Acharya	Fulbari 11
298	Avinash Pharma	Badri P Paudel	Pokhara 9

299	Raj Bhandari Pharmaceuticals	Shekharraj Bhandari	Ratnachowk
300	Chitwan Aayurbed Pharma Pvt ltd	Fadindra Tiwari	Nayabazar
301	Kripa Aayurbed Aausadhi Pasal	Pawan Adhikari	Tersapatti
302	Milan Medical Hall	Pitambar Regmi	Nayapool
303	New Deurali Pharmaceuticals	Subash Sharma	Chipledhunga
304	Leo Pharmacy	Bijaya Kafle	Pokhara 5
305	Janapriya Pharmacy	Kushma Raj Paudel	Pokhara 5
306	Fistail Medisales	jamuna Paudel	pokhara 8
307	Satya Sahi Drug Distributers	Pramodh Pokhrel	Pokhara 9
308	Balika Pharma	Kishor Koirala	Pokhara 9
309	rejuma Pharmacy	Rabin Thapa	Pokhara 9
310	Dajubhai Pharmacy	Bharat Acharya	pokhara16
311	lamichane Medical Hall	Bodhrajlamichhane	Lekhnath
312	Sagun Mediacal Hall	Budhhibikash regmi	Nalamukh
313	Saket Medical Hall	Budhhi P Paudel	Pokhra 11
314	Ujyalo Pharmacy	Prakash Sharma	Pokhara 18
315	Parichit Medical hall	sumnita Aryal	Pokhara 4
316	Bagar Pharmacy	Samundra Paudel	Pokhara 15
317	Sachin Pharmacy	Minadevi Baral	Pokhara 11
318	Renu Medical hall	Toyanath paudel	Pokhara 2
319	Suhana pharma	Sudharshan Dhakal	Pokhara 17
320	Suyagya Pharma	Suwarna Paudel	Pokhara 4

Appendix V: Map of study area



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Appendix VI: Request letter to NCDA

Pokhara University
SCHOOL OF HEALTH AND ALLIED SCIENCES
Lekhnath, Kaski

Ref. No.: ९६६१०६८१०६५

मिति: २०७४/०५/३०

श्री प्रमुखज्यू,

नेपाल औषधी व्यवसायी संघ (NCDA)
ठाडकी अञ्चल, कास्की, नेपाल

विषयः आवश्यक सहयोग गरिदिने बारे ।

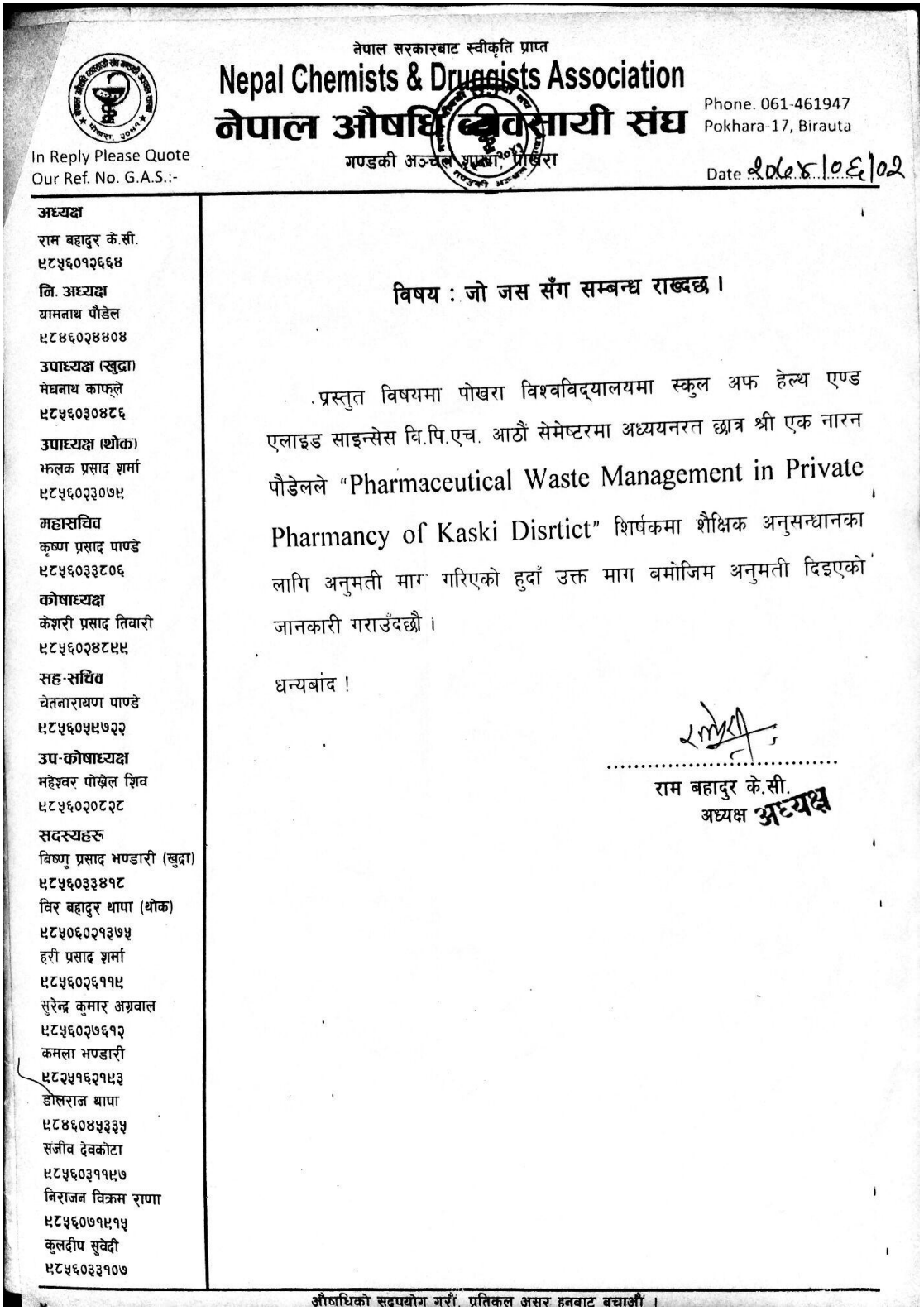
उपरोक्त सम्बन्धमा स्कुल अफ हेल्थ एण्ड एलाइड साइन्सेज, बि.पि.एच. आठौ सेमेष्टरमा अध्ययनरत विद्यार्थी पाठयक्रममा आधारित शैक्षिक अनुसन्धान कार्यको लागि PHARMACEUTICAL WASTE MANAGEMENT IN KASKI DISTRICT मा तथ्याङ्क सकलनका लागि श्री एकनारन पौडेल त्यस संस्थामा आउने भएकोले आवश्यक सहयोग गरिदिनुहुन जानकारीका साथ अनुरोध गर्दछु ।

डा. डमरु प्रसाद पनेरु

स्कूल निर्देशक ।

बोधार्थः- श्री कार्यक्रम संयोजक,बि.पि.एच. कार्यक्रम, पो.वि.।

Appendix VII: Approval from NCDA



नेपाल सरकारबाट स्वीकृति प्राप्त

Nepal Chemists & Druggists Association

नेपाल औषधि व्यवसायी संघ

गण्डकी अञ्चल शाखा, पोखरा

Phone. 061-461947
Pokhara-17, Birauta

In Reply Please Quote
Our Ref. No. G.A.S.:-

Date २०६८।०६।०२

अध्यक्ष
राम बहादुर के.सी.
९८५६०१२६६४

नि. अध्यक्ष
यामनाथ पौडेल
९८४६०२४४०४

उपाध्यक्ष (खुद्रा)
मेघनाथ काफ्ले
९८५६०३०४८६

उपाध्यक्ष (थोक)
भलक प्रसाद शर्मा
९८५६०२३०७५

महासचिव
कृष्ण प्रसाद पाण्डे
९८५६०३३८०६

कोषाध्यक्ष
केशरी प्रसाद तिवारी
९८५६०२४८५५

सह-सचिव
चेतनारायण पाण्डे
९८५६०५५७२२

उप-कोषाध्यक्ष
महेश्वर पोखेल शिव
९८५६०२०८२८

सदस्यहरु
बिष्णु प्रसाद भण्डारी (खुद्रा)
९८५६०३३४१८
विर बहादुर थापा (थोक)
९८५०६०२९३७५
हरी प्रसाद शर्मा
९८५६०२६११५
सुरेन्द्र कुमार अग्रवाल
९८५६०२७६१२
कमला भण्डारी
९८२५१६२१५३
डोलराज थापा
९८४६०४५३३५
संजीव देवकोटा
९८५६०३११५७
निराजन विक्रम राणा
९८५६०७१५१५
कुलदीप सुवेदी
९८५६०३३१०७

विषय : जो जस सँग सम्बन्ध राख्दछ ।

प्रस्तुत विषयमा पोखरा विश्वविद्यालयमा स्कुल अफ हेल्थ एण्ड एलाइड साइन्सेस वि.पि.एच. आठौं सेमेष्टरमा अध्ययनरत छात्र श्री एक नारन पौडेलले "Pharmaceutical Waste Management in Private Pharmancy of Kaski Disrtict" शिर्षकमा शैक्षिक अनुसन्धानका लागि अनुमती माग गरिएको हुदाँ उक्त माग बमोजिम अनुमती दिइएको जानकारी गराउँदछौं ।

धन्यबांद !

.....
राम बहादुर के.सी.
अध्यक्ष अध्यक्ष

औषधिको सदपयोग गरौं, प्रतिकल असर हनबाट बचाऔं ।