

**Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal From One Health Perspectives**



**Kosh Bilash Bagale**

**A Dissertation for the Degree of Doctor of Philosophy in Health Education**

**Submitted to**

**Graduate School of Education  
Office of the Dean  
Faculty of Education  
Tribhuvan University  
Kritipur, Kathmandu, Nepal**

**February, 2024**

**Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal From One Health Perspectives**



**Kosh Bilash Bagale**

Roll No. 13/2073 (Mphil Leading to PhD Programme)

TU Registration No. 6784/94

A Dissertation for the Degree of Doctor of Philosophy in Health Education

Supervisor

Professor Ramesh Adhikari (PhD)

Faculty of Education Tribhuvan University, Nepal

Co-supervisor

Assistant Professor Devaraj Acharya (PhD)

Research Centre for Educational Innovation and Development [CERID]

Submitted to

Graduate School of Education

Faculty of Education

Tribhuvan University

Kathmandu, Nepal

February, 2024

## Abstract



Majority of Nepalese people are involved in agriculture. Vulnerabilities among farmers to zoonoses are conspicuously present because such diseases are neglected. The study intended to assess the risks of zoonoses among livestock farmers against their existing zoonoses-related knowledge, threat perception, and preventive practices. It employed a QUAN + qual convergent parallel research design, guided by Health Belief Model and One Health approach along with post-positivist philosophical foundation. Livestock farmers, health post and veterinary in-charges, and concerned co-operative members were the population. A total of 380 samples were taken for quantitative data while 14 interviews and discussions [8 KII, 6 FGD] were conducted for qualitative information. This study revealed that the respondents exhibited good knowledge on zoonotic swine flu (23.4%), rabies (19.5%), and bird flu (5.3%). However, only a small percentage of the respondents had good knowledge of bovine tuberculosis (1.6%) and brucellosis (0.3%). From ecological perspective, the respondents in Tanahun had good knowledge about swine flu (25.0%) and bird flu (8.5%). On the other hand, in Nawalpur, good knowledge was observed regarding rabies, bovine tuberculosis, and brucellosis (39.5%, 2.3%, and 0.58% respectively). Regarding zoonosis preventive practices, nearly 40 percent of the respondents did not wash their hands with soap and water regularly.

Inadequate preventive practice, including personal protective equipment was noticed. From socio-cultural perspective, the respondents valued the livestock highly, but they were not mindful of zoonoses and their fatal consequences. Additionally, the farmers' strong perception of the threat posed by zoonoses did not necessarily align with their preventive practices, probably because of their socio-economic factors or social desirability bias. Furthermore, education has strong association and effect on the knowledge and preventive practices against zoonoses ( $p < 0.05$ ). For instance, the respondents having higher education were nearly four times more likely to be knowledgeable about rabies (OR=3.8; 95%CI: 1.4-7.7), and had nearly 12 times more chances to follow hand washing practices with soap-water on regular basis than the respondents with lower education (OR=10.9; 95%CI: 6.3-18.7). In conclusion, inadequate preventive practices of farmers against zoonoses, influenced by a low level of knowledge and sociocultural practices such as worshipping, sacrificing, and consuming products from sick animals or raw animal products, pose a high risk of zoonoses. Education could be crucial in addressing such issues, necessitating targeted interventions, especially among vulnerable groups. Therefore, education, training, and sensitization on zoonoses, following the One Health approach, could extend beyond the school premises effectively.

**Copyright Statement**



© Dean's Office, Faculty of Education, Tribhuvan University


2024

All rights reserved

**Declaration**

I hereby declare that this dissertation entitled *Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal From One Health Perspectives*, is my original work and it has not been submitted for candidature any other degree. I have given due credit for all the scholars and writers cited in the dissertation.

I understand that my dissertation will become a part of the permanent collection of Tribhuvan University Library. My signature below authorizes my dissertation to any readers upon request.



.....

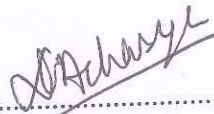
Kosh Bilash Bagale

PhD Candidate

February, 2024

### Recommendation Letter

We undersigned certify that Mr. Kosh Bilash Bagale, a PhD candidate has prepared the dissertation entitled *Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal From One Health Perspectives*, for the partial fulfilment of requirements for the Degree of Doctor of Philosophy in Health Education under our guidance and supervision. He has completed all necessary requirements and revisions according to the comments and suggestions by experts and reviewers. We are satisfied with his work and recommend the dissertation for final evaluation for the Degree of Doctor of Philosophy in Health Education.



.....  
Devraj Acharya, PhD  
Co-supervisor  
February, 2024



.....  
Prof. Ramesh Adhikari, PhD  
Supervisor  
February, 2024

We certify that we approved the dissertation entitled, *Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal From One Health Perspectives*, presented by Kosh Bilash Bagale to the Faculty of Education for the Degree of Doctor of Philosophy in Health Education has been approved.

**Prof. Ramesh Adhikari, PhD**



Tribhuvan University, Nepal

Supervisor

**Prof. Hum Bahadur Baruwal, PhD**



Tribhuvan University, Nepal

External Examiner

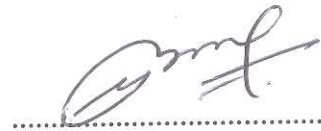
**Prof. Bed Raj Acharya, PhD**



Director, Graduate School of Education

Member, Research Committee, FoE, TU

**Prof. Chitra Bahadur Budhathoki, PhD**



The Chair, Research Committee, and

Dean, Faculty of Education, Tribhuvan University

Date: 29 February, 2024

## Acknowledgements

For the completion of this study, it was almost impossible without the support and encouragement of many individuals as well as organizations from the beginning to the end of the study. Firstly, I would like to express sincere gratitude to my respected supervisor **Prof. Dr. Ramesh Adhikari** and Co-supervisor **Dr. Devaraj Acharya** for their remarkable guidance, continuous encouragement, and vigorous efforts to make complete this work without which it would not be possible to complete the study. I am grateful to **Prof. Dr. Chitra Bahadur Budhathoki**, Dean, Faculty of Education, for his motivation and support to finalize the work. Likewise, I am grateful to Prof. Dr. Bed Raj Acharya, Director, Graduate School of Education for his valuable support. My sincere thanks go to external examiners Prof. Dr. Hum Bahadur Baruwal (Tribhuvan University, Nepal) and Associated Prof. Dr. Ernesto R. Gregorio (University of the Philippines, Manila). Similarly, respected Prof. Dr. Bhimsen Devkota, Prof. Dr. Surendra Giri, Prof. Dr. Shyam Krishna Maharjan, Prof. Dr. Krishna Prasad Gautam, Dr. Ganesh Sing Thakuri, and Prof. Dr. Binod Dhakal for their invaluable support and inspiration. I am also obliged to research committee members, Assistant Dean Prof. Dr. Shobhakhar Kandel and Deputy Director Dr. Rabindra Shiwakoti of GSE, TU.

I would like to thank to University Grand Commission, Nepal for providing partial support for PhD fellowship. I would also like to thank Mr. Gyanendra Poudel, Mr. Rama Nanda Mahato for their valuable support during data collection in Manang and Nawalpur (Nawalparasi- East) districts. Similarly, my heartfelt gratitude goes to Mr. Suresh Shrestha, the participants from Manang, Tanahun, and Nawalparasi-East districts, who generously shared their time and insights, and to my esteemed

colleagues, the dedicated staff of the Dean Office, and the GSE team, your unwavering support illuminated my path. Lastly, I owe a lot to my pillars of strength, my wife Mrs. Sangita Bagale, and my sons Mr. Gaurav Bagale and Mr. Pawan Bagale, whose love and encouragement fuelled my perseverance, and many others who supported me directly and/or indirectly in the journey of my PhD research.

## Table of Contents

<b>Content</b>	<b>Page</b>
Abstract .....	iii
Copyright Statement.....	v
Declaration .....	vi
Recommendation Letter .....	vii
Approval Letter .....	viii
Acknowledgements .....	ix
Table of Contents .....	xi
List of Table .....	xviii
List of Figure .....	xx
Abbreviations/Acronyms .....	xxi
<b>CHAPTER I</b> .....	<b>1</b>
Introduction.....	1
Background of the Study .....	1
Statement of the Problem.....	4
Motivation for the Research.....	7
Rationale of the Study.....	8
Objectives of the Study.....	10
Research Questions.....	11
Significance of the Study .....	11
Limitations of the Study.....	12
Operational Definition of the Terms Used.....	13

Organization of the Dissertation .....	16
CHAPTER II .....	18
Review of the Relevant Literature .....	18
Review of the Theoretical Literature .....	18
Brief History of Zoonoses .....	20
Theoretical Aspect of Health and Behaviour Change .....	21
Review of Studied Zoonoses .....	30
One Health as a Theoretical Perspective .....	35
Review of Empirical Literature .....	36
Knowledge, Practices, and Perception Towards Zoonoses .....	37
Zoonoses Risk for Livestock Farmers .....	38
Prevalence of Zoonoses .....	40
Educational Intervention for Zoonoses Control .....	43
Review of National Health Policies of Nepal .....	46
Review of National Livestock Health Policy of Nepal .....	48
One Health Strategy in Nepal .....	49
Zoonoses Control Program in SAARC .....	50
Curriculum Review .....	51
Research Gap .....	54
Conceptual Framework .....	56
Implication of the Review for the Research .....	58

CHAPTER III.....	60
Methods and Procedures .....	60
Philosophical Understanding .....	60
Methods of the Study .....	63
Research Design.....	64
Convergent Parallel Mixed Method .....	65
Population, Sample Size, and Sampling Procedure .....	66
Population.....	66
Sample Size .....	66
Sampling Procedure .....	67
Study Area .....	70
Research Tools.....	70
Validity and Reliability of the Tools.....	71
Data Collection Procedure .....	74
Data Quality Management and Analysis Procedures.....	77
Quantitative Data Management and Analysis.....	78
Qualitative Data Management and Analysis.....	80
Methodological Analysis .....	81
Key Aspects of the Methodological Analysis.....	82
Data Triangulation .....	84
Ethical Considerations .....	85

CHAPTER IV .....	86
Analysis and Interpretation of Data .....	86
Socio Demographic Characteristics of the Respondents .....	86
Background Characteristics of the Respondents.....	87
Category of Keeping Livestock Bases in Ecological Zone .....	89
Information on Zoonoses and Sources of the Information .....	90
Knowledge on Zoonoses Based on Ecological Zone.....	91
Knowledge of Zoonotic Rabies.....	91
Knowledge of Zoonotic Brucellosis.....	94
Knowledge on the Zoonotic Swine Flu.....	95
Knowledge on Zoonotic Bird Flu.....	97
Knowledge of Zoonotic Tapeworm .....	100
Knowledge on Zoonotic Tuberculosis .....	102
Perception Towards the Zoonoses .....	105
Zoonoses Preventive Practices.....	108
Farm and Household Sanitation Practices.....	111
Livestock Caring, Consumption and Waste Management Practices.....	112
Health Care Seeking Behavior of Livestock Farmers.....	114
Subjective Reflection on Health Care Seeking Behaviour.....	116
Activities Based on One Health Approach .....	117
Association; Sociodemographic Variables and Zoonoses Preventive Practices.....	118

Mask Wearing Practices by Sociodemographic Variables.....	120
Gloves Using Practices by Sociodemographic Variables .....	122
Boots Wearing Practices by Sociodemographic Variables.....	123
Sick Animal Consuming Practices by Sociodemographic Variables.....	124
Children Exposure to Livestock by Sociodemographic Variables.....	125
Pregnant Women Exposure to Livestock by Sociodemographic Variables.....	127
Pre-exposure Vaccination to Livestock by Sociodemographic Variables .....	128
Caring Practices During Parturition by Sociodemographic Variables.....	130
Association: Knowledge and Perception with Existing Education.....	131
Education and Zoonotic Related Knowledge.....	131
Education and Threat Perceptions towards the Zoonoses.....	137
Multivariate Analysis [Logistic Regression Analysis] .....	142
Educational Effect in Knowledge on Zoonotic Rabies .....	142
Educational Effect in Knowledge on Zoonotic Swine Flu.....	143
Educational Effect on Hand Washing Practices.....	144
Educational Effect on the Practices of Children Exposure to Livestock .....	145
Educational Effect on Practices of Pregnant Women Exposure to Livestock .....	146
Educational Effect on Vaccination Practices to Livestock .....	147
Educational Effect on Caring Practices During Livestock Parturition.....	148
Provision of Health Care Facilities in Study Areas .....	149
Cultural Attachment and Farmers' Reflection on Livestock.....	150

CHAPTER V .....	159
Findings and Discussion.....	159
Knowledge of Zoonoses Based on Ecological Zones.....	159
Perception Towards the Zoonoses in Farming Communities .....	165
Association: Sociodemographic Variables and Zoonoses Preventive Practices.....	170
Farm and Household Sanitation in Farming Communities.....	173
Livestock Caring, Waste Management and Production Consumption Practices ..	174
Health Care Seeking Behavior of the Respondents .....	178
Reflection Towards One Health Approach.....	180
Association: Education and Zoonotic Knowledge.....	181
Health Education and Zoonoses in Curriculum .....	185
Cultural Values of Livestock .....	187
Chapter VI.....	191
Conclusions, Implications, and Recommendations.....	191
Conclusions.....	191
Implications.....	193
Pedagogical Implications .....	194
Policy Implications.....	194
Research Implications .....	195
Theoretical Implications.....	196
References .....	197
Appendices.....	216

Appendix I .....	216
Livestock Status of Nepal .....	216
Appendix II .....	217
Research Tools .....	217
Appendix III.....	229
Letter from GSE, TU.....	229
Appendix IV.....	230
Letter from Bhanu Municipality, Tanahun .....	230
Appendix V .....	231
Letter from Kawasoti Municipality, Nawalpur .....	231
Appendix VI.....	232
Letter form Nasong Rural Municipality, Manang.....	232
Appendix VII .....	233
Prioritized Zoonotic Diseases in Nepal.....	233
Appendix VIII.....	234
Published Articles as a First Author.....	234
Appendix IX.....	235
Plagiarism Test Report .....	235

## List of Table

<b>Table 1.</b> <i>School-Level Health Education Curriculum in Nepal</i> .....	53
<b>Table 2.</b> <i>Sampling and Sample Size</i> .....	69
<b>Table 3.</b> <i>Data Collection Tools</i> .....	71
<b>Table 4.</b> <i>Pre-test of Interview Schedule</i> .....	73
<b>Table 5.</b> <i>Variables Description and their Measurement Scale</i> .....	79
<b>Table 6.</b> <i>Socio-demographic Characteristics of the Respondents</i> .....	87
<b>Table 7.</b> <i>Background Characteristics of the Respondents</i> .....	88
<b>Table 8.</b> <i>Category of keeping livestock in household based by the eco-belt</i> .....	90
<b>Table 9.</b> <i>Information on Zoonoses and Sources of Information</i> .....	90
<b>Table 10.</b> <i>Rabies; Knowledge According to the Ecological Zone</i> .....	92
<b>Table 11.</b> <i>Brucellosis; Knowledge According to Ecological Zone</i> .....	94
<b>Table 12.</b> <i>Swine Flu; Knowledge According to Ecological Zone</i> .....	96
<b>Table 13.</b> <i>Bird Flu; Knowledge According to Ecological Zone</i> .....	98
<b>Table 14.</b> <i>Neurocysticercosis; Knowledge According to the Ecological Zone</i> .....	101
<b>Table 15.</b> <i>Bovine Tuberculosis; Knowledge According to Ecological Zone</i> .....	103
<b>Table 16.</b> <i>Farmer's Perception towards Zoonoses</i> .....	105
<b>Table 17.</b> <i>Practices of Personal Protective Equipment's to Prevent from Zoonoses</i>	109
<b>Table 18.</b> <i>Farm and Households Sanitation Base on Ecological Zone</i> .....	111
<b>Table 19.</b> <i>Livestock Related Common Practices in Farming Communities</i> .....	113
<b>Table 20.</b> <i>Health Care Seeking Behaviour of Livestock Farmers</i> .....	115
<b>Table 21.</b> <i>Hand Washing Practices by Sociodemographic Variables</i> .....	119
<b>Table 22.</b> <i>Mask Wearing Practices by Sociodemographic Variables</i> .....	121
<b>Table 23.</b> <i>Gloves Wearing Practices by Sociodemographic Variables</i> .....	122

<b>Table 24.</b> <i>Boots Wearing Practices by Sociodemographic Variables</i> .....	124
<b>Table 25.</b> <i>Sick Animal Consuming Practices by Sociodemographic Variables</i> .....	125
<b>Table 26.</b> <i>Children Exposure to Livestock by Sociodemographic Variables</i> .....	126
<b>Table 27.</b> <i>Pregnant Women Exposure to Livestock by Sociodemographic Variables</i> .....	127
<b>Table 28.</b> <i>Preexposure Vaccination Practices by Sociodemographic Variables</i> .....	129
<b>Table 29.</b> <i>Caring Practices during Parturition by Sociodemographic Variables</i> ....	130
<b>Table 30.</b> <i>Association: Education and Knowledge on Studied Zoonotic Diseases</i> ...	132
<b>Table 31.</b> <i>Association: Perception towards Zoonoses based on Level of Education</i>	138
<b>Table 32.</b> <i>Education Status and Knowledge on Zoonotic Rabies</i> .....	143
<b>Table 33.</b> <i>Education Status and Knowledge on Zoonotic Swine flu</i> .....	144
<b>Table 34.</b> <i>Education Status and Hand Washing Practices</i> .....	145
<b>Table 35.</b> <i>Education Status and Practices of Children Exposure to Livestock</i> .....	146
<b>Table 36.</b> <i>Education Status and Pregnant Women exposure to Livestock</i> .....	147
<b>Table 37.</b> <i>Education Status and Vaccination Practices to Livestock</i> .....	148
<b>Table 38.</b> <i>Education Status and Caring Practices During Parturition of Livestock</i>	149
<b>Table 39.</b> <i>Traditional and Cultural Values of Livestock in Farming Communities</i> ..	151
<b>Table 40.</b> <i>Livelihood, Religion and Cultural Perspective of Livestock</i> .....	153
<b>Table 41.</b> <i>Zoonoses Preventive Practices and Life Experience with Livestock</i> .....	155
<b>Table 42.</b> <i>Perception towards Zoonoses</i> .....	156
<b>Table 43.</b> <i>Demand for an Interventional Programme</i> .....	157

**List of Figure**

<b>Figure 1.</b> <i>Epidemiological Triad of Zoonoses</i> .....	19
<b>Figure 2.</b> <i>The Component of Health Belief Model</i> .....	29
<b>Figure 3.</b> <i>Concept of One Health Approach</i> .....	36
<b>Figure 4.</b> <i>Conceptual Framework</i> .....	57
<b>Figure 5.</b> <i>Philosophical Understanding of the Research</i> .....	63
<b>Figure 6.</b> <i>Schematic Representation of the Convergent Parallel Mixed Method</i> .....	65
<b>Figure 7.</b> <i>Study Area</i> .....	70

### **Abbreviations/Acronyms**

AOR	: Adjusted Odds Ratio
ARV	: Anti Rabies Vaccine
BTB	: Bovine Tuberculosis
CBS	: Central Bureau of Statistics
CDC	: Centre for Disease Control and Prevention
CLTS	: Community Leading Total Sanitation
EDCC	: Education Development Coordination Committee
FCHV	: Female Community Health Volunteer
FAO	: Food and Agricultural Organization
GoN	: Government of Nepal
GARC	: Global Alliance for Rabies Control
HBM	: Health Belief Model
HH	: Households
HSP	: Health Service Provider
INGO	: International Non-Governmental Organization
IS	: Interview Schedule
n.d.	: No Date
NCC	: Neurocysticercosis

NDHS	: Nepal Demographic and Health Survey
NGO	: Non-Governmental Organization
OH	: One Health
OIE	: World Organisation for Animal Health
OR	: Odds Ratio
PEP	: Post-Exposure Prophylaxis
PPE	: Personal Protective Equipment
PHC	: Primary Health Centre
SAARC	: South Asian Association for Regional Cooperation
SDG	: Sustainable Development Goal
SLTS	: School Leading Total Sanitation
SPSS	: Statistical Package for Social Sciences
TPB	: Theory of Planned Behaviour
TTM	: Trans theoretical Model
UNICEF	: United Nations Children Fund
WASH	: Water Sanitation and Hygiene
WHO	: World Health Organization

## **CHAPTER I**

### **Introduction**

The introduction section encompasses the background, statement of the problem, research objectives, research questions, significance, limitations, operational definition of the terms utilized in the study, and the chapter outline of the dissertation.

#### **Background of the Study**

Nepal is a pluralistic society with diverse sociocultural, ethnic, linguistic, and religious communities, along with geographical, ecological, and biological diversity and varied agroclimatic characteristics. When it comes to the political system, Nepal is a republican democracy, and is a religiously secular country where 29164578 people live with a 0.92 percent population growth rate. It is a developing country where 32.81 percent of the population lives in rural areas (Central Bureau of Statistics [CBS], 2021), and most of them adopt one or the other types of farming profession. In rural Nepal, most households keep single or mixed types of livestock (including cows and poultry), which is one of the main sources of food, nutrition and income. The Food and Agriculture Organization (FAO, 2021) states that farming families earn mainly from marketing dairy product such as milk, cheese, ghee, as well as from the sale of meat, eggs, and live animals and poultry.

One of the special characteristics of farming in Nepal is that farmers are involved in the farming of mixed crops and keep different livestock according to their family needs. Livestock farmers in the mountains usually raise Yak (*Chauri*) and sheep, while farmers in the Hills keep cows, sheep, goats and poultry, and in Terai buffalos, cows, goats and poultry are major domesticated animals (Bagale, Adhikari, & Acharya, 2023). Commercial farming, for example, poultry, is an emerging

enterprise in the Hills and Terai regions. Due to poverty, illiteracy, and different sociocultural malpractices, livestock farmers follow several traditional practices related to livestock, making them vulnerable to zoonoses that are transmitted to them from livestock. According to the World Health Organization (World Health Organization, 2020), zoonosis is an infectious disease that can jump from animals to humans. Zoonotic pathogens may be bacterial, viral, or parasitic and can be transmitted to humans through direct contact, food, water, or the environment. Several emerging and re-emerging diseases are zoonotic in origin, indicating that the illness has originated from an animal source and crossed the species barrier to infect humans (World Health Organization, 2014).

People in developing countries such as Nepal live in close contact with livestock, influenced by ethno-cultural and religious values (Bagale et al., 2021). Livestock are used as means of transportation, fuel and energy, clothing, a source of protein, etc. They are sold for cash; they are, above all, close friends of humans. However, due to poor health literacy, this relationship can lead to a serious public health threat with enormous economic consequences. Zoonoses are therefore not only biologically determined but also shaped and transmitted through community behaviour.

Numerous zoonotic pathogens, including bacteria, viruses, and protozoa, possess complex life cycles. Given conducive conditions, they enter susceptible hosts through various routes. Taylor et al. (2001) reported that approximately 61% of all human pathogens come from an animal source, known as zoonoses. Their recurrent presence in human beings is defined as reemerging zoonosis. In the history of human civilization, many people were victimized by zoonoses, and these are still threatening the people with several emerging and reemerging species such as COVID-19. People

who are engaged in livestock, or their production without proper protective measures are highly vulnerable when it comes to acquiring zoonotic infections. Similarly, people in developing countries such as Nepal still follow several traditional malpractices related to livestock, which may be responsible for zoonoses transmission. Until a decade and a half ago, infectious diseases led to 70% of both morbidity and mortality, but because of various preventive measures implemented by government and nongovernmental agencies, they have been seen in a declining trend (Rai, 2018).

Several studies showed that simple preventive measures such as hand washing and the use of a single-dose vaccine can prevent people from catching such terrifying diseases. Many developed countries have achieved the elimination of several such fatal infectious diseases simply due to well vaccination coverage. In contrast, in Nepal, individuals are still dying from diseases that could be prevented by vaccines (Bagale & Adhikari, 2019). In addition, to our great disappointment, the school-level curriculum does not include content on zoonoses and their prevention, although most of the population are agrarian in the country (FAO, 2021).

However, the implementation by the government of mass campaigns such as Community Lead Total Sanitation (CLTS) and School Lead Total Sanitation (SLTS) with the collaboration of different organizations to control several communicable diseases to achieve the Sustainable Development Goals (SDG), is worth mentioning (Ministry of Water Supply, 2020). These campaigns focus on stopping open defecation and indirectly contribute to the control of zoonoses in communities. Such campaigns should be continuously advocated for sustainable outcomes for the benefit of communities. In this context, therefore, conveying the message through different health education interventional approaches might bring a positive health outcome for farming communities.

As health educators, we should focus on the factors that create the health problems in societies and learn about how people perceive health-related issues. Similarly, our concern is how people can easily adopt and maintain their health-related behaviour. To do this, we need to follow effective and trustworthy existing theories, or it might be necessary on our part to develop a new one that will contribute to the field of health education and health promotion. Additionally, it is important to collaborate with stakeholders to control and manage the zoonotic problems in societies by embracing approaches such as the One Health (OH) approach (emphasis on inter-sectoral collaboration between human health, animal health, and environmental sector). Therefore, the study seeks to evaluate knowledge, perception of threats, and preventive practices related to zoonoses among livestock farmers, and the research findings can contribute to the design of interventional programs to control zoonoses in farming communities.

### **Statement of the Problem**

Nepal, an agricultural country, has approximately sixty-six percent of its population engaged in agriculture and livestock farming (FAO, 2021). Livestock is an integral part of the Nepalese people. Although livestock are an integral part of human existence, awareness of their potential role in transmitting fatal zoonoses seems lacking in them. Public health and veterinary policies seemed to have mainly focused on reactive programs than proactive ones (DoHS, 2019; MoALD, 2021). Furthermore, health education and zoonotic related issues in school curriculum of Nepal have not been properly addressed and it is neglected (Curriculum Development Center [CDC], 2019).

In human society, microorganisms of zoonotic origin can spread diseases that appear in various forms such as sporadic, endemic, or epidemic, and they may become pandemic under favorable conditions. Nepal has faced a sporadic and endemic distribution of different communicable diseases (Thapa, 2013). Because of traditional animal management and unhygienic practices, people live under the threat of multiple zoonoses. The literature shows that every year in Nepal, approximately 100 to 150 individuals die from rabies (Pant et al., 2013), with dogs being the primary source. Brucellosis poses a notable public health concern in Nepal, with a significant prevalence rate (Acharya et al., 2016). The occurrence of bird flu is widespread in Nepal, with a record in Kavre district in March 2018 of one human death (Shrestha, 2019). Similarly, swine flu (H1N1), is endemic in Nepal, with 172 reported cases and two fatalities in 2009 (Adhikari et al., 2011). Salmonellosis is a chronic health problem caused by animal sources. These are some pieces of evidence for the prevalence of zoonoses in Nepal. The sources of COVID-19 are not precisely determined by epidemiologists. However, available evidence suggests that this is of an animal origin. This evidence suggests that due to occupational exposure, livestock farmers are highly vulnerable to zoonoses as they keep livestock.

If people become aware of zoonotic diseases, their transmission chains, and their consequences, they can improve their farming patterns and become more aware of the health of both animals and humans. This ultimately plays a significant role in enhancing the health status of both livestock and human beings, which can be achieved through a health education curriculum as an easy and cost-effective interventional approach.

However, Nepales livestock farmers have followed traditional animal management practices with many cultural influences. For the limited study till date, the knowledge of livestock related zoonoses among livestock farmers is not well measured in Nepal. Some available studies focused only on single zoonoses (e.g, bovine tuberculosis) showed that livestock farmers had a low knowledge of zoonoses and poor preventive practices (Pandey et al., 2012). Therefore, this may indicate that farmers are not aware that 'livestock can serve as a source of zoonoses, and some of them can act as amplifier hosts for various lethal pathogens, and transmit infections even if they appear healthy or act as carriers asymptomatic.

Disease outbreaks with human fatalities might be by-products of negligence at the individual, community, or policy level. If any zoonoses have a sporadic or endemic presence in the community and people have a low level of knowledge about it or poor health practices, zoonoses can cause adverse health problems at any time in the community, resulting in massive human and economic losses. In the modern era, livestock productions are undergoing rapid proliferation, but people focus only on economic development. The health implications of this advancement are uncertain (Liverani et al., 2013). Nepal is also facing similar types of manifestations.

Furthermore, in the context of Nepal where the episodes of outbreaks and magnitude of such diseases are not properly recorded while generally we still depend on the data available only on the Health Management Information System, and Chugh's (2008) suggesting that due to several factors like globalization, industrialization, global warming, and environmental pollution, many zoonotic diseases are emerging and re-emerging in the world; as a health professional, it is essential for the researcher to understand the realities of livestock farmers' knowledge,

perception, and preventive practices related to zoonoses, as they are at risk for zoonoses from their livestock. Moreover, it is crucial to explore how the government responds to zoonotic issues through its policies and educational curriculum.

Additionally, in order to assess the implementation situation at the community level of One Health programs as an emerging approach, this study will be providing a baseline source and relevant guideline for further planning regarding zoonoses issues in Nepal.

### **Motivation for the Research**

When I was a child, almost all villagers kept buffaloes, goats, chickens, dogs, or cats for their income, food and security. During the holidays, as children, we used to play with newly born goats, dogs and cats, and at that moment we used to have a feeling of attachment to them. Due to the low knowledge, we had no idea about all the diseases that we would have received from animals. I still remember a terrifying moment of my childhood when I saw a woman suddenly become sick and, after a day, start to bite and scream at people close to her. We were not allowed to go near her, and after a few days, she died. People said she was bitten by a rabid dog. I witnessed another farmer's bull bitten by a mongoose and died with symptoms of rabies.

Furthermore, during my adulthood, while visiting numerous farming communities in Nepal, I noted a distinct lack of precaution among people who exhibit an intimate connection to livestock. Livestock is intricately woven into every facet of their lives, with practices associated with livestock exhibiting unique variations rooted in geography, religion, ethnicity, and the economic status of individuals. I observed specific livestock-related events, including the consumption of raw yak blood by people in mountainous regions, practices involving the consumption of sick animals, the act of caring for livestock during parturition or abortion without the use of gloves,

and the practice of cohabitation where humans and animals share the same dwelling for lodging and sustenance.

People in farming communities are still following several risky practices related to zoonoses when they handle their livestock. Close exposure without any safety and low vaccination coverage to their livestock, raw milk and meat consumption practices, and values of traditional healing practices during their sickness are common practices in farming communities. Therefore, as a research scholar in the field of health education, I have been motivated to find out why these are happening in farming communities in Nepal. What are the major influencing factors for that? How do livestock farmers perceive such types of phenomena? This is how I became interested in these areas and issues through this research.

### **Rationale of the Study**

About 60 percent of pathogenic organisms that cause human illness are zoonotic in nature (Niroula, 2016). Among them, taeniasis/cysticercosis, brucellosis, neurocysticercosis, hydatidosis, leptospirosis, toxoplasmosis, and avian influenza are priorities zoonoses in Nepal (Department of Health Service [DoHS], 2017a). Similarly, based on passive surveillance on district reporting system, eleven zoonotic diseases were listed as prioritized in Nepal, which are echinococcosis, leptospirosis, rabies, bovine cysticercosis, bovine TB, procaine cysticercosis, toxoplasmosis, brucellosis, botulinum, salmonellosis, Japanese encephalitis, avian influenza, swine flu and anthrax (Asia Network for Sustainable Agriculture and Bioresources [ANSAB], 2015). The three recent worldwide viral outbreaks, namely SARS (severe acute respiratory syndromes), bird flu (H5N1) and swine flu (H1N1), all represent instances of infections contracted by humans from animals.

People who are close to animals and have an inadequate knowledge about zoonoses are more susceptible to zoonotic diseases. Given the frequency of direct contact with animals in their occupation, livestock farmers are potentially having a higher risk for exposure to zoonoses than the general population. Likewise, children with close proximity to their pets face a heightened risk of zoonotic diseases. Moreover, individuals residing in areas adjacent to the human-wildlife interface, such as buffer zones surrounding protected regions, also face an elevated risk of zoonotic transmission (Niroula, 2016). The outbreaks of the Ebola virus in West African countries (2014 -2016) are vivid examples of such transmission.

Due to globalization, industrialization, and commercialization, the paradigm has been shifting from traditional farming practice to commercial farming in the field of livestock in Nepal. This shift can contribute to promoting their socio-economic status and poverty eradication. However, the questions remain: Are livestock farmers knowledgeable and skilled in zoonoses prevention? Follow proper protective measures against zoonoses while caring for livestock? These are some crucial questions in the field of livestock farming in Nepal.

Because of the limited studies on the occurrence and frequency of zoonotic diseases, a clear picture of them cannot be drawn in Nepal. Awasthi et al. mention that "Nepal does not have a structured, comprehensive mass media campaign as an intervention of malaria and other zoonotic disease" (Awasthi et al., 2017, p. 3). Awasthi and others also explore that school curricula of Nepal do not adequately provide life skills information about zoonoses. Conversely, the presence of diverse ethnicities, cultures, religions, and traditional customs increases our vulnerability to zoonotic diseases. For instance, practices such as consuming fresh yak blood during

certain Himalayan rituals and drinking cow urine in Hindu religious ceremonies are examples of how individuals are exposed to zoonoses (Niroula, 2016).

One of the rationales of the study is to bring to light how knowledgeable livestock farmers who live very closely with domesticated animals are about zoonoses, how they perceive the zoonoses related threats, and how they are following the zoonotic preventive practices. Secondly, this study will be a solid source for revising school level health education curriculum that needs to be seriously addressing the issues of zoonoses. Finally, since little research in Nepal has been conducted to my knowledge on zoonoses and their various dimensions in terms of livestock farmers, this study will prove to be a stepping stone for the upcoming research on the same topic.

### **Objectives of the Study**

The main objective of this study was to assess the risk of zoonoses in livestock farmers based on their existing zoonoses related knowledge, threats perception and preventive practices. The specific objectives were as follows:

1. To describe knowledge, perceived threats, and preventive practices related to zoonoses among livestock farmers in different ecological zones of Nepal.
2. To examine the association between preventive practices on zoonoses and socio-demographic variables such as age, sex, education, aim of farming, and type of farming occupation.
3. To determine the association and effect between the level of education of the respondents and their knowledge and perception towards zoonoses.
4. To explore the cultural and traditional values of livestock in the life of farmers.

## **Research Questions**

The research questions of the study were as follows:

1. What are the perceptions and practices of livestock farmers on safety precautions during exposure to livestock?
2. What are the gaps and variations between knowledge and current practices of the farmers regarding zoonoses according to ecological zones?
3. How do healthcare providers integrate One Health approach into health programs within their facilities?
4. What are the roles of education and training on the part of the livestock farmers to prevent zoonoses?
5. How are the sociocultural and traditional practices of livestock farmers close to livestock?

## **Significance of the Study**

The study has been based on field-based evidence on knowledge, threats perception and zoonoses preventive practices of livestock farmers. The major significances of this study are listed as follows:

1. The findings of the study will be useful to livestock farmers in Nepal and in the other agrarian countries of the globe.
2. The results will be helpful for stakeholders, concerned experts, and policymakers to develop interventional plans at the local, provincial, and national level in government and nongovernmental organizations.
3. It will be useful for curriculum designers who develop different formal and informal curriculums on health education, public health, and veterinary health for different settings.

4. It will be useful as a guide for people interested in studying and working in the field of livestock farming and zoonoses, and will be beneficial to researchers who want to engage and sharpen their knowledge in this field.

### **Limitations of the Study**

This study sought to assess the knowledge, perception of threats, and preventive practices of livestock farmers toward zoonoses. While exploring the real situation of livestock farmers towards zoonoses, I confined the research to the following aspects.

First, from a methodological perspective, the use of the cross-sectional survey research design in this investigation may not capture the changes in respondents' behaviors, perception, and practices regarding zoonoses over time, and may not determine the actual causal relationship between the variables. Second, since there is only one district in the Terai region within the Gandaki province, the researcher selected one district from both the hilly and mountainous regions of the same province to ensure data reliability. Third, due to the COVID-19 pandemic, the situation was quite frightening. The researcher found it difficult to meet the respondents in person because they were not willing to do so. As a result, the researcher felt a bit of difficulty in collecting qualitative data. Finally, the findings could not be generalized to all parts of Nepal, which was considered a major limitation of the study.

In the same way, among numerous zoonoses, the researcher delimited the study only to rabies, avian influenza, swine flu, brucellosis, bovine tuberculosis, and neurocysticercosis. These are common zoonotic diseases related to livestock and poultry in the context of Nepal (ANSAB, 2015).

## **Operational Definition of the Terms Used**

In this section, I define key operational and conceptual terms discussed in the dissertation, serving as a quick reference within the study's confines.

**Aakhikutu.** The cultural ceremony celebrated by Gurung communities in Manang involves the worship of nature, including large ponds, rivers, mountains, and trees. The ceremony also includes the sacrifice of animals such as goats and sheep.

**Age.** The respondents' ages at the time of the survey were categorized into three groups to analyze the correlation between their knowledge, perception, and practices related to zoonotic diseases. This categorization was implemented to ensure consistency across intervals.

**Boot-wearing practices.** The use of protective boots by farmers during exposure to livestock and sheds. This was assessed by asking them, after which the boots availability in household was observed. It was verified that livestock farmers were using the boots in reality after a stock of such boots in used situation had been observed.

**Close exposure.** Frequent contact with livestock for various purpose i.e., for feeding, milking, grazing (as a caretaker) or playing with pets.

**Culture.** Traditional practices and beliefs that are followed by livestock farmers in their families and societies and have great value for them (e.g, Hindus worship the cow).

**Education.** The educational status of the respondents were classified into three categories: illiterate (unable to read and write), basic level (formal education up to

grade eight, with the ability to read and write without formal schooling), and secondary and higher levels (respondents with education from grade 9 and above).

**Gloves wearing practices.** The appropriate use of protective gloves during various activities related to livestock farming. To assess these practices, the respondents were initially asked about the practice. Later, their gloves were observed to confirm the practices. If they were available in used condition, it was verified that livestock farmers were using gloves in reality during exposure.

**Hand washing practices.** Cleaning hands with soap and water before and after participating in tasks related to handling livestock such as feeding, milking, or cleaning the livestock. To assess these practices, the respondents were initially asked about the practice. Later, their hand washing stations were observed to confirm the availability of soap and water. If soap and water were present in used condition, it was verified that livestock farmers were using them in reality.

**Health care seeking behaviour.** Health awareness, healing, and caring practices during the illness of livestock farmers and their livestock in the study area.

**Indigenous knowledge.** Knowledge learned by livestock farmers from their society or ethnicity is passed down from generation to generation.

**Knowledge.** Understanding and information on zoonotic diseases. It was measured based on the correct answers by the respondents regarding the studied diseases. The questions included areas such as causes, symptoms, mode of transmission, and preventive measures of zoonoses.

**Livestock.** Those domestic animals that are kept by livestock farmers in their houses for livelihood or commercial purpose (e.g., cattle, goats, sheep, and pigs). In this research, livestock also includes poultry and buffaloes.

**Mask-wearing practices.** The use of protective face masks by respondents during exposure to livestock and sheds. This was assessed by asking the livestock farmers, after which the mask availability in household was observed. If there was a stock of such masks in used situation, it was verified that livestock farmers were using the mask in reality.

**One Health Approach.** A collaborative, multisectoral, and transdisciplinary approach is employed across local, regional, and global levels, aiming to attain optimal health outcomes while acknowledging the interconnectedness of humans, animals, plants, and their shared environment.

**Perceived threat.** The process of the respondents' responding to the threats related to zoonotic diseases while handling livestock. It was measured by Likert-type Scale.

**Regional variation.** Geographical differences in knowledge, practices and perception of livestock farmers in Mountain, Hill and Terai region about zoonosis.

**Training.** Livestock care and zoonoses prevention related short-term (3- 30 days) or long-term (30 days to 18 months, in duration) vocational training.

**Zoonoses.** Diseases that are transmitted between (vertebrate animals) livestock and (human) farming families. (e.g., Rabies, Brucellosis, Bovine TB, Bird flu etc.).

## **Organization of the Dissertation**

The first chapter of the dissertation consists of the background of the study, statement of the problems, rationale of the study, objectives and research questions, significance of the study, limitations of the study, and definition of the used terms. In this chapter, the researcher tried to justify the worthiness of the research and by exploring the zoonoses related knowledge, threats perception and preventive practices among livestock farmers through the research objectives and research questions.

Chapter two covered an overview of available literature related to the study. It consists of different sub-topics. Under the theoretical review, the researcher described some theories of diseases and theories of behaviour change in the field of health education and health promotion. Trans Theoretical Model, Theory of Planned Behaviour, Health Belief Model (HBM) and One Health (OH) approach. However, the researcher particularly used HBM in the study where the OH approach also supported to determine the multisectoral collaboration in study areas to control the zoonoses. Under empirical literature review, the researcher reviewed and discussed some experience related to livestock farming in different parts of the globe. Review of national health policies of Nepal, zoonoses control programme in SAARC, and school level health education curriculum supported to identify the ground reality indicating significant gaps in terms of policy, school level curriculum, knowledge and practices. The researcher also presented a conceptual framework at the end of this chapter.

Chapter three is related to methods and procedure of the study. In the beginning of the chapter researcher discussed with post positivist paradigm which was the philosophical foundation of this study. Population of the study, sampling

procedure and sample size, validation of the tools, data collection process and ethical consideration of the study have been mentioned in this chapter.

In chapter four, the researcher analysed quantitative data by applying the SPSS -20 version, and cultural significance of livestock and their zoonoses hazards was analysed under the thematic analysis process. Then came in interpretation the research data related to knowledge, threats perception and preventive practices of zoonoses. In this chapter, the researcher sought to determine the impacts of sociodemographic variables on knowledge, perceived threats and preventive practices of zoonoses.

Chapter five includes finding and discussion which were based on research objectives of the study. Knowledge on zoonoses at the level of ecological zone, and the association of sociodemographic variables with zoonoses related perception and preventive practices of the farming communities were discussed in the initial part. Health care seeking behaviours in different ecological zones and perception towards OH activities were then discussed. Similarly, cultural values of livestock in farming communities were discussed by the researcher. Discussion on educational association with zoonotic related knowledge and practices were continued. Comparing and contrasting of similar issues across the globe was done. Finally, in the chapter, the researcher discussed health education scenario and zoonoses related contents in existing school level curriculum in Nepal.

Finally, Chapter six covered conclusion and implications parts of the study. Conclusion of the study was formulated based on research findings of the study. The researcher suggested the pedagogical implication, policy implication, research implication and theoretical implication of the study which may also fulfil the research gaps in the livestock related field in Nepal.

## CHAPTER II

### Review of the Relevant Literature

The review of the literature is perhaps the most important part of a research, as it informs the researcher of the existing dialogue and hermeneutics of the study being carried out. The review of the research related literature allows the researcher not only to spot the research gap, but also to find a clear-cut direction for the research. In this review, most of the literature were from journal articles and some review was done based on available dissertation reports, books, and institutional reports. Some grey literature was also made use of by the researcher. The literature review in the following is ordered in the sequence: theoretical, empirical, policy, and curriculum review.

#### Review of the Theoretical Literature

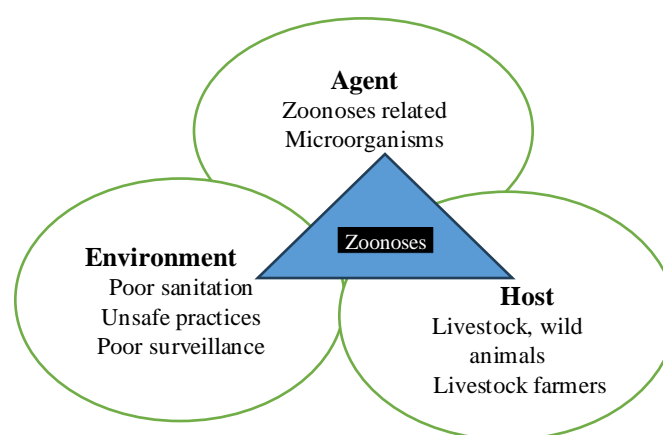
*Disease from an ancient perspective:* Since ancient times, people have perceived suffering from diseases differently. In those days, health and illness were interpreted from cosmological and anthropological perspectives. Health problems were dominated by magical and religious beliefs. That was an integral part of ancient cultures and human civilizations. Henry E. Sigerist, a medical historian, has stated that every culture had developed a system of medicine and that medical history is one aspect of culture (Park, 2009). Due perhaps to meagre knowledge, primitive man attributed disease and in fact all human sufferings and other calamities to the wrath of gods and the invasion of the body by "evil spirits". Park also mentions that people of ancient times believed in a supernatural theory of disease. The Chinese still believe that human health is determined by Yang and Yin, which is the balance of two opposing forces in the human body. Balance means good health. The Egyptians

believed that the disease was due to the absorption of harmful substances from the intestine, leading to putrefaction of blood and formation of pus (Park, 2009).

Hippocrates, the Greek physician, is known as the father of medicine and was the first epidemiologist. He sought logic for sickness, and he is the first person known to have examined the relationships between the occurrence of disease and environmental influences (Merrill, 2017). He believed that sickness in the human body was caused by the disequilibrium of the body fluids. The germ theory of disease mentioned by Louis Pasteur is that several diseases are caused by microorganisms. These small organisms invade humans, animals, and other living hosts through various routes. Their growth and development in the host can cause diseases (Garcia, 2018).

The Epidemiological Triad theory developed by Rothman in 1976 mentions that an external agent can cause diseases on a susceptible host when there is a favorable environment. Based on this theory, agent, host and environment are known as ‘necessary’ factors. The epidemiological triad can be applied to noninfectious diseases as well where the hosts could have unhealthy behaviour, unsafe practices, or unintended exposures to hazardous substances (Park, 2009).

**Figure 1.** *Epidemiological Triad of Zoonoses*



### ***Brief History of Zoonoses***

Zoonotic diseases, which transfer from animals to humans (World Health Organization, 2014), have historically caused substantial impacts. The bubonic plague, carried by rat fleas, devastated 14th century in Europe, leading to mass deaths and far-reaching consequences. Influenza viruses from birds and pigs triggered pandemics, including the lethal 1918 Spanish flu and subsequent outbreaks. HIV/AIDS emerged from primates, causing a global pandemic and ongoing health effects. Ebola, transmitted by animal and human contact, causes severe fever, primarily in Central and West Africa. Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) were caused by bat coronaviruses, causing significant outbreaks. COVID-19, likely the result of bats, spread worldwide, causing illness, death, and disruption (Dharmarajan et al., 2022), are some adverse historic evidences related to zoonoses.

Human activities have adversely impacted the environment and ecosystems, leading to outbreaks of diseases with epidemic and pandemic characteristics. Zoonotic infections, transmitted between animals and humans, underscore this link. Pathogens such as bacteria, viruses, and parasites play a role in zoonoses. The rise and recurrence of zoonotic diseases are linked to ecosystem elements such as reduced biodiversity, degraded habitats, and climate change. Therefore, to protect mankind from the recurrent arrival of epidemics and pandemics, it is important to conserve the ecosystem (Mishra et al., 2021). The comprehensive One Health approach offers promise by recognizing these complex connections and fostering collaborative efforts across disciplines.

Similarly, in the context of Nepal, a range of sociocultural practices significantly contribute to zoonoses transmission. These encompass practices like unrestricted livestock movement, consumption of uncooked meat and unpasteurized milk, utilization of ailing animals for consumption, and the practice of co-farming. These customs are ingrained in local culture, fostering close human-animal interactions and subsequently increasing the potential for transmission of zoonotic disease (Bagale et al., 2021). It is imperative to address these practices in Nepal to curb the proliferation of zoonotic diseases, while respecting the cultural importance attached to these traditions.

Based on the above concepts and theories, we can understand that diseases are not only related to biological sources but also associated with people's beliefs, perceptions, and behaviours. Many social scientists and psychologists have developed several behaviour change theories in the fields of health education and health promotion. However, to adopt a healthy behaviour, we need to provide cost-effective appropriate education or intervention to vulnerable communities by applying appropriate techniques.

### ***Theoretical Aspect of Health and Behaviour Change***

We discuss the multifaceted role of livestock. Most people in the world, basically in underdeveloped and developing countries, depend on livestock for their livelihood. They can use livestock for various purposes. In this context, many people keep them as a pet in their households and as a good source of protein, sources of energy or as a fertilizer, and in some societies, animals are used for religious, cultural, and ethno-medical purposes (Bagale et al., 2021). Animals have flexible and ambiguous roles in human society; we both worship and sacrifice them, make them

our friends and kill them, love to watch them and eat them (Berger, 1980). Another aspect of livestock, which is rarely discussed in communities, is that livestock may be responsible for a possible host to several lethal pathogens, called zoonoses, that threaten human societies.

In these modern times, as a health educator, it is our responsibility to discuss and strongly advocate for various intervention programmes against zoonoses in order to help farmers internationally. Those types of effort may contribute as a milestone to controlling several zoonoses that terrify people all over the world by different names like COVID -19. So, equipped with specific behaviour change theories, we need strong commitment and multisectoral collaboration, which can contribute to positive change in livestock farmers in terms of safety during the exposure to livestock and other related vulnerable situation. There are several theories related to behaviour change in the field of health education and health promotion. Some of them are mentioned here.

***Trans -theoretical Model [TTM]:*** The Trans-theoretical Model (TTM), also known as ‘stages of change theory’ is a well-known behavioural change framework developed by James O. Prochaska, Carlo C. DiClemente, and other colleagues in 1977, with subsequent enhancements. According to literature, Prochaska, DiClemente and Norcross officially formulated TTM in 1992 and first applied in the field of diabetes management in 1993 (Hill et al., 2008). TTM primarily assesses an individual’s readiness to adopt healthy behaviors, providing both approaches and processes for personal change. The model comprises five key constructs: stages of change, processes of change, decision balance, self-efficacy and level of change (Prochaska & Diclemente, 2005).

Change is a continuous process. However; people generally do not want to change due to fear or low awareness (Acharya, 2020). People might not be prepared for change in the precontemplation stage, but they get ready at the contemplation stage. Positive feelings toward change lead to readiness for action. Once satisfied with the results, the behaviour becomes sustained. If otherwise, they may relapse to the previous stage, which is called 'termination' (Kidd et al., 2003). TTM is mainly used to assess the individual's readiness to behaviour change. However, since in this study I tried to assess the existing level of threat perception of livestock farmers related to zoonoses, I did not feel comfortable applying the theory to my research.

***Theory of Planned Behaviour [TPB]:*** TPB is one of the most commonly applied theories in the field of health education and health promotion. It helps to describe or predict the health behaviour of the people based on their belief and its relation to behaviour. It was developed by Icek Ajzen in 1985 and revised later by Icek Ajzen and Martin Fishbein in 1980 (Montaño & Kasprzyk, 2008). TPB focuses on individuals' motivational factors as determinants for their intended health behaviour. TPB outlines the factors that determine an individual's decision to follow a particular behaviour. This theory is itself an extension of the widely applied theory of reasoned action (Conner & Norman, 2006).

The Theory of Planned Behavior (TPB) comprises three fundamental variables: attitude, subjective norms, and perceived behavioural control (PBC). Attitude signifies an individual's positive or negative assessment of a behavior, while subjective norms involve the perceived social pressure to either adopt or abstain from the behavior. Likewise, perceived behavioural control (PBC) is related to an individual's perception of the level of difficulty associated with performing the

behavior (Hayden, 2019). This theory proves highly beneficial by employing constructs such as beliefs, attitudes, intentions, and behaviors across diverse domains, including health campaigns, healthcare sustainability, and public service announcements. At its core, the theory posits that individuals' attitudes and beliefs play a pivotal role in elucidating behavior, with intention being the outcome of a synthesis of attitudes toward the behavior (Morris et al., 2012). Since the theory is broad and vague in the way concepts are dealt with, I did not use the theory in my study.

***Health Belief Model [HBM]:*** HBM was introduced in 1950s by a group of social psychologists (Hochbaum 1958; & Rosenstock 1966) at the U.S. public health service to explain failure of people to participate in programs to prevent or to detect disease. It remains one of the best known and widely used theories in health behaviour related field (Janz & Becker, 2016). In essence, the health belief model (HBM) posits that individuals are more likely to adopt healthy behaviours if they perceive a threat to their health or anticipate positive outcomes from adopting a recommended action (Conner & Norman, 2006). However, they must require basic knowledge about the nature of the disease.

Health belief model (HBM) consists of four key components: perceived susceptibility, severity, benefits, and barrier and later other constructs (cues to action and self-efficacy) have been added by Rosenstock, Strecher, and Becker in 1988 to make HBM more predictable (Champion & Skinner, 2008, p. 49). At first the theory was developed as a systematic method to explain and predict preventive health behaviour which focused on the relationship of health behaviour, practices and utilization of health services. The theory has later been revised to include general

health motivation for the purpose of distinguishing illness and sickness behaviour from health behaviour. The six constructs of HBM unfold in the following:

**Perceived Susceptibility:** Perceived susceptibility refers to an individual assessment or subjective feelings of risk about the health problem. The HBM argues that people will change their existing behaviours when they believe those behaviours are risky for them. People who perceive that they are susceptible to a particular health problem will engage in behaviours to reduce their risk of developing the health problem (Acharya, 2020). However, people with low perceived susceptibility may deny that they are at risk of contracting a specific illness. People who believe they are at low risk of developing an illness are more likely to be involve in unhealthy, or risky, behaviours. For example, people will consume raw milk unless they have information about bovine TB or brucellosis. Without proper knowledge, nobody perceives any threats either this is life-threatening, or not. Weinstein 1988 as cited by (Conner & Norman, 2006, p. 47) mentions that belief about susceptibility should be characterized in terms of three stages. These are: (a) awareness of health threats, (b) determination of how dangerous the threats are, or how many people are likely to be affected, and (c) time when the threats have been personalized.

This personal account of risk perception implies that susceptibility levels are likely to change over time as populations are influenced by health and education and that consequently the point at which susceptibility is measured may determine the strength of its association with subsequent health behaviour (Conner & Norman, 2006, p. 47). So, susceptibility is like a borderline which is equidistant from both safe zone and risk zone, which can tilt on either side depending on people's health

behaviour. Perceived susceptibility increases the chances of avoiding many vulnerabilities.

**Perceived Severity:** It is noted that perceived severity in the health belief model refers to how individuals subjectively evaluate the seriousness of a health issue and its potential outcomes. According to HBM, people who perceive a health problem as significant are more inclined to take action to prevent it or minimize its impact. Perceived severity encompasses views on the disease's nature (e.g., whether it is life-threatening or may cause disability or pain) as well as broader effects on work and social aspects. In general, perceived severity starts from the end point of susceptibility. The combination of susceptibility and severity has been labelled as perceived threats (Champion & Skinner, 2008, p. 47). With a proper knowledge about threats or possible outcomes, they try to change their previous behaviours, but it depends on how serious the consequences. Severity has been conceptualized as a multidimensional construct involving both the medical severity of a disease (pain, complications, etc.) and its psychosocial severity (Conner & Norman, 2006, p. 49).

**Perceived Benefits:** Perceived benefits refer to an individual's assessment of the value or efficacy of engaging in a health-promoting behaviour to decrease risk of disease (Acharya, 2020). It is very difficult for people to give up unhealthy behaviour in a normal situation. If somebody is convinced of the risk of their existing behaviours or they perceive they will get rewarded, under those conditions people are likely to change their behaviours because rewards are a strong predictor of positive change. For example; livestock farmers might not practice personal protective equipment [PPE] or post-exposure prophylaxis [PEP] until they see how it can make their life safe from several life-threatening zoonotic diseases like flu and rabies.

Benefits constructs comprises both medical and psychological benefits of engaging in health promoting behaviours (Conner & Norman, 2006, p. 49).

**Perceived Barrier:** It is related to the individual's assessment of difficulties in behavior change. Even if an individual perceives a health condition as threatening and believes that a particular action will effectively reduce the threat, barriers can break the engagement with health-promoting behaviour. Before giving up or taking up something, people will make numerous efforts and rethink about the issues and challenges. One of the reasons why people don't change their health behaviours is that they may think that doing so is going to be hard. Those thoughts are sometimes just a matter of psychological difficulties and sometimes physical, sociocultural, or the ones caused by the role of time and money. For example, most of the farmers don't wear the PPE complaining that it is time consuming, and they deny vaccination thinking that they are expensive. Here comes some perceived money barriers to healthy behaviour changes in the communities (Champion & Skinner, 2008, pp. 47- 49). The construct of barriers in the health belief model (HBM) relates to the perceived obstacles or downsides associated with adopting a recommended health behaviour. These barriers may be viewed as a costly, hazardous, inconvenient, time-consuming, unpleasant, or painful by individuals (Acharya, 2020).

**Cues to Action:** The HBM posits that a cue, or trigger, is necessary for prompting engagement in health-promoting behaviours. Cues to action is basically related to external events or information from close others, the media, or health care providers, promoting engagement in health-related behaviours. Posters related to healthy lifestyle, advice by friends or relatives to quit smoking, or routine doctor visit are some examples of cues to action (Champion & Skinner, 2008, p. 49). Several

strategies can trigger motivation or preparedness for embracing appropriate health behaviours. This readiness signifies a mental state primed for action, susceptible to influence from various exposures (Acharya, 2020).

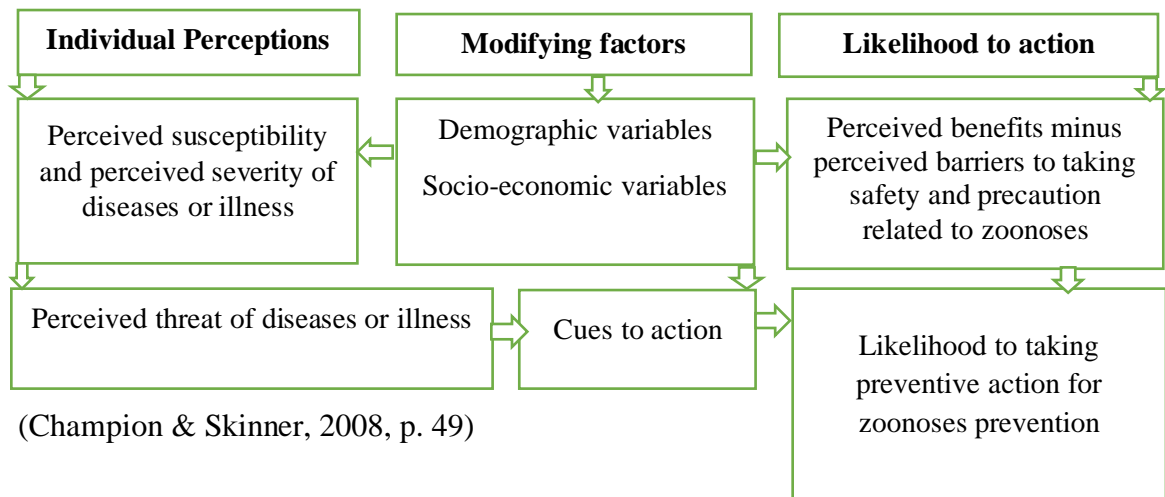
**Self-Efficacy:** This refers to the confidence in one's ability to adhere to treatment or recommendations (Acharya, 2020). It is an element which was added with four components of the HBM in 1988 (Champion & Skinner, 2008, p. 49). It refers to an individual's perception of his or her competence to successfully perform a behaviour. Self-efficacy was added into the HBM in an attempt to provide a better explanation for individual differences in health behaviours. HBM was applied to more significant, long-term behaviour change such as diet modification, exercise, and smoking. Inventers of the model recognized that confidence in one's ability to effect change in outcomes (i.e., self-efficacy) was a key component of health behaviour change.

So, the constructs of HBM are effective in the field of social sciences to determine the level of health-related behaviours of people. In this study, the researcher sought to assess the risk of zoonoses on livestock farmers with the help of the constructs of HBM, (perceived susceptibility, severity, benefits, barriers, self-efficacy and cues to actions). If they perceived the zoonotic related threats, they may adopt safety practices during the exposure to their livestock (use PPE, pre and post exposure prophylaxis etc, for example), and if there is any health-related problem they face, they will visit the health facilities. However, their health behaviour will depend on their existing level of knowledge on particular risk factors.

Several studies demonstrate the efficacy of interventions based on the health belief model (HBM) in fostering behaviour modification. For instance, Shojaeizadeh

et al. (2011) found that an intervention based on the HBM improved individuals' knowledge and adherence to pap smear tests for cancer screening.

**Figure 2.** *The Component of Health Belief Model*



Some studies have found enhanced effectiveness by incorporating additional variable like cues to action and self-efficacy into the health belief model (HBM) to bolster its predictive power. Orji et al. (2012) observed a 40 to 71 percent increase in the predictive capacity of the HBM when including these six constructs compared to the traditional version. Moreover, various HBM-based studies on behaviours such as teeth brushing for dental health, managing weight and preventing type two diabetes, flu prevention through vaccination, yoga practice for overall well-being, reducing drinking and driving incidents, improving dietary habits to combat obesity, and promoting cancer screening have demonstrated success in facilitating behaviour change (Hayden, 2019).

After a rigorous study, I adopted HBM in my research for the evaluation of existing perceptions of livestock farmers who are still following traditional practices while they have exposure to livestock and consumption of their production because HBM and its constructs are reliable and comprehensive to assess the threat

perceptions of livestock farmers, basically due to its top predictability capacity for health behaviour. Just as the theory is applicable to so many of the above-mentioned empirical studies, so is it in my research in the sense that the constructs found their expression in my study when we say that livestock farmers think taking safety practices like wearing boots, gloves, an apron, a mask [PPE], and vaccination [PEP], etc. are time-consuming, costly, uneasy to wear, or absolutely unnecessary. As a post-positivist researcher, I set my limitations in this study to only observing ground reality, noticing the phenomenon in close relationship with respondents, and disseminating the study results to academic communities.

### ***Review of Studied Zoonoses***

***Rabies:*** It is a fatal zoonotic disease of the central nervous system caused by the Lyssa virus type 1. It mainly affects warm-blooded animals, particularly carnivores such as dogs and wolves. The virus spreads when an infected animal bites or licks another, usually through broken skin or mucous membranes. Rabies is a vaccine-preventable zoonotic disease. Some nations have successfully eliminated rabies through strategic vaccination programs; however, it is still a public health problem and economic importance in South East Asia. It is endemic in eight countries of South East Asia, except Maldives, South Korea and Timor- Leste, and estimated to be roughly 45% of global human deaths due to the rabies in this region (World Health Organisation (WHO), 2012).

Human rabies is found in 150 countries and territories, excluding Antarctica. Asia, notably India, and Africa have the highest incidences, but estimating the disease's impact is challenging due to limited data. Dogs are the primary source of rabies deaths, causing up to 90% of fatalities. Countries like Australia, Japan, Hong

Kong, the Maldives, and the UK have eradicated rabies through strategies such as dog licensing, stray dog control, and mass vaccination. Around 1.5 billion people are at risk of rabies, with about 4 million receiving post-exposure treatment (ARV) annually (Bagale & Adhikari, 2019). Nepal faces rabies as an endemic problem, resulting in 100 livestock and 10 to 100 human deaths annually, and 35,000 humans are reported to receive rabies post-exposure prophylaxis (Devleesschauwer et al., 2016).

***Brucellosis:*** Brucellosis, a prevalent bacterial infection caused by a collection of bacteria belonging to the brucella genus, is transmitted from animals to humans, often through unpasteurized dairy products such as milk and cheese, or direct contact with infected animals and their secretions. Identifying brucellosis in its early stage can be challenging since its symptoms closely resemble common flu symptoms. The World Organization for Animal Health ranks brucellosis as the second most crucial zoonotic disease globally, trailing only behind rabies (Acharya et al., 2017). Human brucellosis claims about 200 lives per million individuals annually. In India, where approximately 80% of people live in close proximity to domestic and wild animals, the risk of zoonotic disease transmission, including brucellosis, is significant (Kang et al., 2014). Brucellosis is an endemic issue in Nepal. Many livestock farmers are unaware of this disease, which could lead to sporadic outbreaks. The first human case of brucellosis in Nepal was documented in 1979 in Pokhara (Acharya et al., 2016). Similarly, in 2015, a brucellosis outbreak affected seven individuals in Kavre (Bagale & Adhikari, 2019). Approximately 2-3 percent of cattle in Nepal are seropositive for brucellosis, and human and animal brucellosis is quite common in Nepal (Acharya et al., 2017). However, due to the absence of updated data, we have no actual ideas about the present status. Healthcare providers must remain vigilant about the

possibility of this zoonotic infection and consider brucellosis as a potential diagnosis for patients displaying vague symptoms and prolonged unexplained fevers. So, based on professional exposure, livestock farmers and their family are highly vulnerable to zoonotic brucellosis.

***Swine Flu (H1N1):*** It is caused by novel strain of influenza stemming from the H1N1 virus. Manifesting symptoms similar to the common flu, this emerging zoonotic ailment engenders a human health threat due to the absence of immune familiarity, making individuals susceptible unlike conventional flu strains. Those at elevated risk of swine flu include individuals aged over 65, children below five years, persons with chronic medical conditions, and those possessing compromised immune systems (WHO, 2011).

The swine flu pandemic, originating in Mexico, erupted in 2009 and was officially designated by the WHO as the first pandemic of the twenty-first century. This pandemic was attributed to a novel influenza A virus subtype H1N1, identified in April 2009, which disseminated globally until May 2010, with reports spanning more than 214 countries and encompassing 18,114 deaths (Adhikari et al., 2011). In particular, Asian nations, led by South Korea, followed by China, Hong Kong, and Thailand, experienced significant incidences. Nepal recorded 172 H1N1 cases with 2 fatalities in 2009 (Bagale & Adhikari, 2019).

Pigs act as the amplifying host for swine flu, thereby placing individuals engaged in pig farming or related occupation at heightened vulnerability to this zoonotic pathogen. A recent resurgence in September 2018 witnessed outbreaks of Swine flu and Hong Kong flu, impacting roughly 2,100 individuals and resulting in four deaths within Nepal's Saptari district (Bagale & Adhikari, 2019). This resurgence

underscores the ongoing threat posed by swine flu and its capacity to induce health crises.

***Avian Influenza (H5N1):*** It is an illness caused by the avian influenza type A virus, impacting birds. The H5N1 virus naturally appears in wild aquatic birds and can transmit to different bird and animal species, including domestic poultry. Although avian flu typically does not infect humans, there is a risk of human infection when the virus is airborne and is inhaled. The H5N1 virus reemerged in 2003 and 2004 after its initial appearance in humans during a poultry outbreak in Hong Kong in 1997 (Gutiérrez et al., 2009). In the Southeast Asia Region (SEAR), from 2004 to 2013, a total of 228 cases of human avian influenza A were reported, resulting in 181 deaths. In 2013, Bangladesh and Indonesia reported 4 cases with 4 fatalities of human influenza A H5N1 (Bagale & Adhikari, 2019). In Nepal, avian influenza was first observed in Hetauda in 2008. Since then, 106 outbreaks have been recorded in Nepal, with 36 occurrences in Kathmandu (Aryal, 2013).

***Tapeworm:*** Taeniasis, caused by adult tapeworms acquired through consuming infected pork, is linked to poverty, pork consumption, and suboptimal pig husbandry (Rajshekhar et al., 2003). While adult worms can induce mild gastrointestinal discomfort, more severe cysticercosis arises when tapeworm larvae reach the brain, leading to neurocysticercosis and associated neurological symptoms. Asia, particularly India, Indonesia, Vietnam, and Nepal, experiences a significant prevalence of these diseases. For instance, up to 50% of India's partial seizure patients attribute their epilepsy to cysticercosis (Rajshekhar et al., 2003).

Postmortem examinations of pigs in Kathmandu and Dharan found 14% positive for cysticercosis. In a Syangja district community, antemortem tests indicated

32% of pigs tested positive for *T. solium* via lingual examination, and 24% via serology. In Syangja district, a human survey demonstrated a high taeniasis prevalence of 43%, whereas in Tanahun district, 18% were positive. Taeniasis occurrence correlated with ethnic groups surveyed, reflecting food habits, literacy, and hygiene. Notably, Magar, Sarki, Darai, and Bote ethnic groups displayed prevalence rates of 50%, 28%, 10%, and 30%, respectively (Joshi et al., 2004). This underscores the susceptibility of farming communities in Nepal to zoonotic taeniasis.

***Bovine tuberculosis (BTB):*** Bovine tuberculosis is a contagious bacterial infection with significant implications for both the economy and public health. It primarily affects cattle but can also impact humans and other mammals due to its causative agent, *Mycobacterium bovis*, being closely related to the bacterium responsible for human tuberculosis (FSPH, 2006). In cattle, BTB leads to reduced milk production, weight loss, and mortality. The disease can be transmitted through respiratory secretions or contaminated feed and water. Human transmission is possible through consuming unpasteurized dairy products or close contact with infected animals. A study in Chitwan, Nepal, revealed a 15% prevalence of bovine tuberculosis among livestock in households of tuberculosis patients. Patient involvement in livestock care and raw milk consumption contributed to disease transmission (Pandey et al., 2012). Similarly, 10% of cattle in households of 50 were found to be infected with *Mycobacterium bovis* (Gaire & Subedi, 2012).

Although information on human tuberculosis cases arising from bovine origins is limited, it is assumed that a significant proportion of extrapulmonary tuberculosis cases in humans may stem from bovine sources (Olea-Popelka et al., 2017). Rigorous food safety practices, such as pasteurization and meat inspection, have reduced this

risk in developed countries. Control measures for BTB include testing and culling infected animals, restricting livestock movement, and enhancing farm biosecurity. Research on cattle vaccination against BTB is ongoing, though challenges in effectiveness and implementation persist. Nepal considers BTB to be a prevalent zoonotic disease (ANSAB, 2015).

### ***One Health as a Theoretical Perspective***

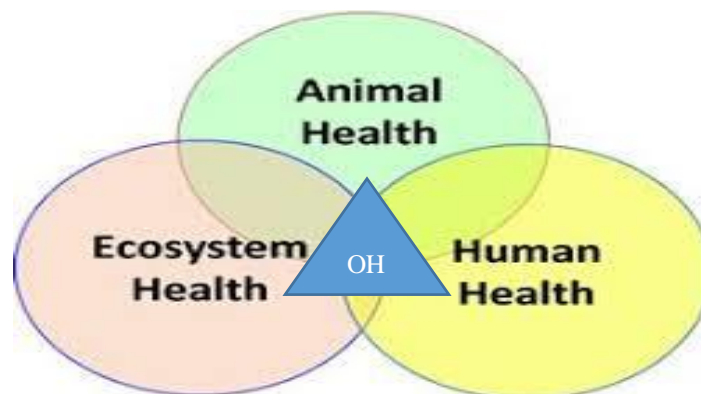
Center for Disease Control and Prevention (CDC, 2018a) mentions that One Health (OH) is a collaborative, multisectoral, and transdisciplinary approach working at the local, regional, national, and global level with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment. In 2007, the One Health (OH) approach received initial endorsement for pandemic preparedness from the American Medical Association (AMA) in collaboration with the American Veterinary Medical Association (AVMA). Subsequently, in 2008, the Food and Agriculture Organization (FAO), the World Organization of Animal Health (OIE), and the World Health Organization (WHO) joined forces with the United Nations Children's Fund (UNICEF) and the World Bank to establish a unified strategic framework rooted in the principles of the One Health approach. This framework aimed to mitigate the risk of infectious diseases emerging at the intersection of the animal-human ecosystem (Gayathri, 2020).

In the context of Nepal, the government of Nepal takes some initiation to strength One Health programs in the country. In 2019 (2076 BS), the government developed and approved the One Health strategy. However, the OH programme in Nepal is still in its infancy stage. Some donors funded programmes in collaboration with the government. They organized awareness campaigns as part of celebrations,

including World Rabies Day, World Antimicrobial Resistance Awareness Week, and World Animal Health Day (Acharya et al., 2019).

The OH approach emphasizes mutual collaboration between the human health, animal health, and ecological sectors, to fight against the zoonoses. Close contact between human, animals and the surrounding environment provides more probabilities for zoonoses transmission to animals and human and vice versa. However, many people who are outside the program related to zoonoses, have no idea about OH approach. In this study, researcher tried to identify the concept on OH approach among the public health and veterinary professionals which might support for further initiation to control the zoonoses under the one umbrella.

**Figure 3.** *Concept of One Health Approach*



### **Review of Empirical Literature**

The status of zoonosis and infectious diseases common to man and animals as possible public health emergencies of international concern has been an emerging research issue at the present. Similarly, building the data base for future efforts to reduce risk of infection at animal human health interface is another challenge in this field. Taylor et al. (2001) reported that 61% of all human pathogens are zoonotic, but it is neglected. In this section, some studies that were conducted on livestock farmers

and tried to assess the zoonotic threats based on their knowledge, practices and prevalence status of zoonoses are mentioned.

### ***Knowledge, Practices, and Perception Towards Zoonoses***

Akinade et al. (2015) conducted the zoonoses related study and showed that there was a huge gap between knowledge and practices among the livestock farmers. They suggested effective prevention and control of zoonotic disease through educational programs and awareness creation involving collaboration of all health experts such as public health and veterinary health experts, policy makers and government authorities in all the countries. Similarly, Cediél and others suggested that disinfection, cleaning, food preparation, pasteurisation, and personal hygiene at home and at work, deworming and vaccination in both animal and human are some suggestive safety techniques to prevent zoonotic diseases (Cediél et al., 2013).

The study related to knowledge, awareness, and risk of zoonotic diseases among the smallholder livestock farmers in sub-urban area in Bangladesh, shows that one thirds (35%) livestock farmers were not read and write and majority of the respondent farmers (70%) had small herd size (2-6). However, the study reveals several risk factors associated with traditional practices. Approximately, half of the farmers (43%) were found to have built animal sheds very close to their residents, but they also did not use any sort of disinfectant to clean the shed on a regular basis. But a hundred percent of the respondents wash their hands with soap water after interacting with animals where the majority (70%) of the farmers did not clean animals shed. Almost two thirds (65%) of the farmers were found to have shared the same source of drinking water for animals and humans and the open access of children and visitors into the farm (Chowdhury et al., 2018). Those practices could be a potential risk of zoonotic transmission in communities. Similarly, the same study

presents that more than half (52%) respondents had no clear idea about zoonotic disease transmission from animal to human. Foot and mouth disease (FMD), anthrax, rabies, mastitis, tetanus, brucellosis, bovine TB are endemic in that community but, except for FMD, the farmers had medium knowledge about other diseases, which reflect the zoonoses risk in the community. FAO (2018) also reports that, in Nigeria 3044 human died due to brucellosis and 300 thousand humans were affected by bovine TB in 2016. The possible reason for that evidence is poor knowledge and ignorance of zoonotic diseases among farmers in these suburban areas.

Similarly, a study done by Tesfaye et al. (2013) in South-western Ethiopia, shows that the most frequent known zoonoses in this territory was rabies (97.1%) and one fourth (25.7%) respondents said that at least one family member was bitten by suspected rabid dog previously. Likewise, taeniasis 83.4 percent, and anthrax 55.4 percent, were the other commonly known zoonotic disease in this area. Among the respondents, small holder dairy farmers had the highest awareness and traditional farmers had the lowest awareness towards the zoonoses. However, traditional farmers were found as the major consumers of raw milk. These practices increase the vulnerabilities for bovine tuberculosis and brucellosis which were common zoonoses in the above study area but none of them were familiar with brucellosis.

The impact of poor knowledge is that livestock farmers never perceive the zoonotic threats and continue to practice risky behaviours. This is challenging for health educators and public health advocates of the communities.

### ***Zoonoses Risk for Livestock Farmers***

The World Society for the Protection of Animals (WSPA, 2009) compiled a series of reports examining the public health threat posed by some of the main zoonotic diseases and the effects of farming systems on this threat. The study found

that zoonotic diseases carried by farmed animals pose a major threat to public health and animal welfare. Industrialisation of livestock farming has led to a dramatic increase in the number of livestock's especially poultry and pigs, reared for food. This has been accompanied by an equally dramatic rise in our consumption of meat, particularly chicken meat. This increased consumption leads to more chances for exposure to food borne pathogens and is consistent with the increased number of cases reported.

Similarly, Pandey and others indicate that people are highly vulnerable to tuberculosis by animals infected with bovine TB. In the households of 60 patients with tuberculosis, 15 percent of the cattle were found to be bovine TB positive; however, farmers have little knowledge about bovine tuberculosis (Pandey et al., 2012). Furthermore, the study reports that out of 70 respondents, 54 percent consumed raw milk, only 4 percent had the knowledge that unpasteurized milk can transmit tuberculosis; 23 percent had the knowledge of zoonotic diseases, and only 9 percent heard about bovine tuberculosis.

Jha's, (as cited in Bagale & Adhikari, 2019) study titled "Neglected zoonosis situation in Nepal" found that national zoonotic diseases control programme was lacking. Surveillance plan is not in place that prioritize zoonotic diseases. Likewise, laboratory diagnostic capacity for priority zoonotic diseases is not adequate. In the same vein, there are insufficient trained human resources for controlling zoonotic diseases. The study also found that there are high chances of disease transmission at weekly livestock markets.

On the basis of this evidence, it can be concluded that industrialisation of livestock farming may reduce hunger and poverty in the nation. However, most

countries and farmers had inadequate knowledge, poor practices in terms of zoonoses, and countries have inadequate law, acts, and strategies to regulate safe handling of livestock related profession. Therefore, to minimize the zoonotic risk, government need to revise their policy and strategies and adopt many interventional programmes. Immunization, education, training, farm registration, effective quarantine, monitoring and surveillance are, for example, some suggestive approaches to control the zoonoses.

### ***Prevalence of Zoonoses***

Pant and others assert that most human cases of rabies are transmitted from domestic dogs that act as the major reservoir host and vector (Pant et al., 2013). Rabies is a deadly zoonotic disease that is endemic in many parts of developing countries like Nepal where limited information about rabies is available. In the same way, the Department of Health Services (DoHS) published the annual reports where 22627 animal bite cases were reported, out of which 88 % were dog bites. Among the victims, six died (Department of Health Services, 2017b). This report also indicates that nearly half of Nepali's population is at risk and a quarter at moderate risk of rabies. This is the only zoonosis that is always fatal. In the South East Asian Region, Maldives is the only country which does not have any animal rabies (CDC, 2018b).

Similarly, avian influenza (H5N1) known as bird flu is another terrible flu in the zoonotic field that was first detected in 1996 in geese in China, and the virus was first detected in humans in 1997 during a poultry outbreak in Hong Kong (Gutiérrez et al., 2009). H5N1 viruses usually do not infect people. Globally rare cases of human infection with these viruses have been reported. In Nepal, in 2009, avian influenza [in poultry] was first observed in Jhapa district. Until now, it has been seen 106 times in

Nepal and 36 times in Kathmandu (Aryal, 2013). In march 2019, one human death was recently reported in Kavre district due to bird flu (Shrestha, 2019).

Similarly, bovine tuberculosis caused by mycobacterium bovis (M. Bovis) is a public health problem in agrarian countries like Nepal where the majority of the population is involved in the farming profession [livestock] without any professional preparation. Close contact with livestock without any safety, consumption of raw milk, lack of proper farm hygiene management, socioeconomic status of farmers are some risk factors for bovine tuberculosis transmission in Nepal (Pandey et al., 2012).

Due to the lack of adequate studies and laboratories facilities on bovine TB, we are not able to track the exact sources of human TB in Nepal, and animal screening practices are also not properly in place in the country. However, some studies show that several human TB comes from animal sources [Bovine TB]. Pandey and others also mention that among the 78 buffaloes and 22 cattle tested, 12 (15.4%) and 3 (13.6%) were found bovine TB positive. Likewise, out of 60 tuberculosis patient's households, bovine tuberculosis was found in 15 percent. All TB patients were involved in feeding, milking or other farm management procedure, and twenty-four percent of patients even had the habit of raw milk consumption (Pandey et al., 2012).

Acharya et al. (2017) states that brucellosis is the second most important zoonotic disease in the world after rabies. Annually, about 200 per million individuals die from human brucellosis around the world. It has been reported to be endemic in Nepal. Most of the livestock farmers have low knowledge about human brucellosis which may outbreak anytime and anywhere. In Nepal, the first human case was reported in 1979 in Pokhara (Acharya, 2016). In India, approximately 80% people

live in close contact with domestic and wild animals, which poses critical risk of zoonoses transmission such as brucellosis (Kang et al., 2014).

Swine flu is caused by the H1N1 virus. It originated in pigs, but spreads primarily from person to person. It is a newly emerging zoonotic disease that is dangerous for humans because our immune system cannot recognize the virus and cannot prepare the defensive mechanism that protects us from the virus.

The swine flu pandemic outbreak that in 2009 began in Mexico with 25,214 cases was reported and 217 cases died. Then it spread around the world. At least 74 countries were reported to have approximately 30,000 confirmed laboratory cases. Similarly, in 2010 February, more than 213 countries reported at least 16,455 deaths worldwide. In Asian countries, South Korea had the most confirmed cases, followed by China, Hong Kong, and Thailand. 172 H1N1 cases were reported with 2 deaths in Nepal (Adhikari et al., 2011).

Similarly, taeniasis is an intestinal infection with adult tapeworms, caused by ingestion of infected pork. Cysticercosis is usually asymptomatic unless the larva invades the central nervous system (CNS), resulting in neuro cysticercosis, which can cause seizures and various other neurological signs. Several patients reported from Asian countries indicate the wide prevalence of taenia solium cysticercosis. It is the cause of epilepsy in up to 50% of Indian patients presenting with partial seizures and also the major causes of epilepsy in Indonesia, Vietnam and Nepal (Rajshekhhar et al., 2003).

During 1995-1997 in Bir hospital 4 cases of neurocysticercosis were confirmed out of 25033 major surgery cases while 11 confirmed cases were reported in Kanti children hospital at the same time (Joshi et al., 2004). Similarly, Sah and others reported that porcine cysticercosis was highly prevalent in Banke district.

Among the randomly selected 110 pigs slaughtered, 32 were found infected by *T. solium* cysticercosis (Sah et al., 2017). Evidence indicates that people who consume pig are at high risk of porcine cysticercosis. Therefore, interventional programs in public health and veterinary health should be implemented in this area according to the OH approach.

Personal hygiene, environmental sanitation, and effective WASH practices may contribute to preventing several zoonotic diseases. Exposed to infected animals without any personal protective equipment (PPE) and practices like hand washing, wearing gloves, boots, aprons, masks etc., livestock farmers are facing zoonotic risk. Very simple preventive practices such as hand washing can prevent several fatal zoonosis, but such practices are not satisfactory. UNICEF reported that a safe water supply can reduce morbidity by 15 percent, latrine use can by 35 percent and hand washing practices can by 43 percent and child mortality can be reduced by 33 percent with such practices (UNICEF, 2004, as cited in water aid, 2006). So, to prevent zoonosis, we need to campaign these events in farming communities with multi-sectoral collaboration.

Based on evidence from the literature, zoonoses of different forms and magnitudes, sporadic, endemic, epidemic, and pandemic, cause a public health threat that may be attributed to traditional farming practices, sociocultural myths, poverty, illiteracy, environmental pollution, deforestation, habitat destruction, and global warming across the world.

### ***Educational Intervention for Zoonoses Control***

Several sociodemographic characteristics such as poverty, illiteracy, traditional malpractices, etc. may get people to follow several rutted rituals in farming communities of Nepal. They build animal's sheds close to their residents, expose them

to animals without any safety, consume raw milk, or several other animal productions, resulting in vulnerability to zoonoses.

Some studies suggest that there is a positive association between education or training and zoonoses related knowledge and practices among livestock farmers. Education and training are significant for positive change in a profession such as livestock farming. However, most of the farmers in Nepal have been deprived of such education and training.

Dhakal et al. mention that, out of 400 pig farmers, only 36 (9.0%) got training in which 21 (58%) of the training was organized and conducted by the government, 9 (25%) by farmers groups, and 6 (17%) were conducted by non-governmental organizations. Of the 120 farmers who were aware of Japanese Encephalitis (JE), 53 percent learned about the disease through media sources, 28 percent from friends and community members, 9 percent from health care providers, 7 percent from training events, and 4 percent through academic study (Dhakal et al., 2014).

Similarly, Kanda et al. (2015) mention that interventional programmes enhanced rabies prevention and pet care practices in setting with limited resources. The result also indicates that intervention programmes positively increased the pupil's awareness of rabies in a short period of time, and school teachers played a key role in disseminating the message of rabies prevention to their pupils as part of the school curricula.

Furthermore, the study shows that appropriate information through the school curriculum would reduce rabies threats in the communities. Close collaboration with local education offices is key to successful implementation of school-based rabies control programmes, which is in turn, crucial to the eradication of rabies from Sri-Lanka (Kanda et al., 2015). In the Philippines, an effective pilot program, the 'Rabies

Information and Education Campaign,' has been integrated into the school curricula across all elementary schools in a specific region (Lapiz et al., 2012). Similarly, studies conducted in Nigeria, as suggested by Dzikwi et al. (2012), emphasize the significant recommendation of providing adequate education on rabies to children.

Ngowi et al. (2008) conducted a randomised community-controlled trial to assess the effectiveness of an intervention involving health and pig-management education in reducing the incidence rate of porcine cysticercosis caused by *taenia solium* (pork tapeworm). They took a sample of 827 pig-keeping households. The study team gave each participant household a sentinel piglet to raise along with knowledge about the transmission and prevention of porcine cysticercosis. Such knowledge was improved by more than 42 percent in the intervention group when measured in 10 -12 months post-test.

Similarly, Hundal et al. (2016) studies the impact of training on the knowledge level of goat farmers in Punjab. One hundred twenty-five farmers were randomly selected and interviewed with a pre-tested interview schedule. Farmers were offered five-day specific training on goat farming and re-assessed their knowledge after its completion. The study revealed that 17.6%, 31.2%, and 42.4% of respondents had completed education up to middle, matric, and senior secondary levels, respectively. Conversely, only 8.8% of trainees were graduates. Prior to training, merely 2.4% of farmers were classified as having high-level knowledge. However, following the training, a substantial 76.8% of the farmers attained a high level of knowledge ( $p < 0.01$ ).

The findings of the studies on the interventional programmes concluded that health education and related training programs were associated with knowledge, attitude, and preventive practices of livestock farmers. Therefore, such programs must

be incorporated into health education in school curriculum that reflects zoonoses content, and training packages must be in place for livestock farmers.

### **Review of National Health Policies of Nepal**

Nepal has developed and implemented different plans and policies to control infectious diseases. Based on the developed policies, the country has developed some laws, acts, and strategies to control the infectious diseases (zoonoses), and protect the health of the people.

The 1991 National Health Policy (2048 BS), which was the first health policy in Nepal, basically emphasizes upgrading the health of the remote population by extending basic primary health services up to the community level. Preventive, promotive, and curative health services are the basic components of this policy. There was a provision for at least one healthcare facility in every village development community (VDC) of Nepal with an emphasis on primary health care and referral health services (Department of Health Services, 1991).

Zoonotic disease preventive programs were not specified in this policy. However, the preventive component of the health policy included the malaria and kala azar control programme, as well as the communicable disease control programme, as an integrative health service in endemic districts.

National Health Policy 2014 (2071 BS) states that all Nepali citizens should have physical, mental, social, and spiritual health to lead productive and quality lives. The policy tries to treat zoonosis as something similar to other communicable diseases. The policy postulates that in order to manage the diseases transmissible from animals and insects to humans, a mechanism will be developed for effective coordination and collaboration among the stakeholders by taking epidemiology and

disease control division (EDCD) as its focal unit (Department of Health Services, 2014).

National health policy 2019 (2076 BS) has been recently introduced by ministry of health and population in Nepal, in which the government included the several provisions to make a preparedness plan to manage the communicable disease, insect borne diseases, zoonotic diseases, climate change and other infectious diseases, as well as a disaster management plan for timely response to the victim (Department of Health Services, 2019).

To control and manage zoonotic and communicable diseases, the government of Nepal conducts several programmes through the EDCD. Malaria elimination programme, Kala-azar elimination programme, dengue control programme, lymphatic filariasis control programmes are conducted by disease control section. In addition, the zoonotic disease sub-section is responsible for the prevention and control of snake bite, rabies, and other zoonotic diseases in EDCD.

The disease surveillance and research section of the EDCD regularly conducts the surveillance of various communicable diseases throughout the year. Collecting information and analysing data is done to determine actions that are needed to prevent outbreaks and reduce the burden of communicable diseases. Some surveillance activities conducted through EDCD are malaria, kala-azar, dengue, acute gastroenteritis (AGE), cholera and severe acute respiratory infections (SARI) and other epidemic potential diseases / syndromes (like enteric fever, leptospirosis, hydrophobia, chikungunya), and water quality monitoring and surveillance. Similarly, epidemiology and outbreak management section, non-communicable disease, and mental health section, and leprosy control, and disability management section also conduct programs related to zoonotic and communicable diseases management.

Since 1991, Nepal has been conducting several such health programs based on national health policy. However, a lack of clear policy, plan and programme about interventional activities to control the zoonoses are still evident. Second health policy 2014 addressed zoonosis as a crucial health issue and included plans to intervene in zoonosis using EDCC as a focal unit. The National health policy 2019 emphasize the overall preparedness plan to control the zoonoses and communicable diseases. Specific zoonotic control plan is nevertheless found missing. From the perspectives of research scholars, there are gaps between the policies and programs, to control the zoonoses. Most of the programs on the policy focus on epidemic or outbreak response. Highly vulnerable population to zoonosis (i.e., livestock farmers) are still deprived of preventive programs and vaccination opportunities, which might create a great risk of zoonosis to the communities.

### **Review of National Livestock Health Policy of Nepal**

National livestock health policy 2021, which includes a disease control strategy focused on vaccinating livestock against highly prevalent diseases such as Peste des Petits Ruminants (PPR), Diphtheria, Black quarter (Charchare), Classical Swine Fever, Ranikhet (Newcastle disease), Gambarro, Rabies and Anthrax. The policy also emphasizes the importance of appointing registered veterinarians at the local level (Ministry of Agriculture and Livestock Development, 2021). To fulfill its goals and objectives, the government adopts some veterinary policies (Policy section number; 7.1 to 7.4), including;

7.1. Strengthening public and private animal health services at all levels and enhancing service quality according to the federal structure.

7.2. Detecting, controlling, preventing and eliminating animal and fish-related diseases, as well as diseases that have a negative impact on the economy and public health.

7.3. Implementing laws, standards, structures, and basic principles of animal welfare to ensure the well-being of healthy animals and the production of clean animal products, thereby promoting public health through their production and distribution.

7.4. Ensuring the reliability and quality of the entire livestock sector in compliance with national and international standards, thus enhancing the effectiveness of regulatory roles (Ministry of Agriculture and Livestock Development, 2021).

However, despite the intentions of the policy, there are limitations that have led to many local-level veterinary programs focusing on simple curative services, vaccination programs, and basic laboratory services conducted by veterinary paramedics.

### **One Health Strategy in Nepal**

The "One Health" strategy in Nepal is a comprehensive approach that recognizes the interconnection of human, animal, and environmental health. This strategy aims to promote collaboration and coordination among various sectors, including human health, animal health, and the environment, to address the complex health challenges at the interface of humans, animals, and ecosystems (Ministry of Agriculture and Livestock Development, 2019). To control and manage the emerging and re-emerging epidemic and zoonoses, the One Health strategy in Nepal focuses mainly; multisectoral collaboration, disease surveillance and outbreak response, strengthening and capacity building of various sectors, preparedness and response during the disaster, and communication and advocacy (Ministry of Agriculture and

Livestock Development, 2019). However, it should be noted that in Nepal the predominant implementation of OH-related initiatives is undertaken by non-profit organizations and donor agencies (Subedi et al., 2022). It is essential to emphasize that Nepal lacks a distinct institutional framework dedicated to the oversight and management of One Health initiatives, encompassing activities, programs, and research.

### **Zoonoses Control Program in SAARC**

The South Asian Association for Regional Cooperation (SAARC) is an economic and geopolitical organization which was established in 1985, to promote socio-economic development, stability, and welfare within its member nations. Nepal, Bangladesh, Bhutan, India, Maldives, Pakistan, Sri Lanka, and Afghanistan are the member states of SAARC which respects the mutual cooperation to manage the regional concerns between the member states. SAARC has been taking some collective initiation for prevention, control, and elimination of zoonosis. There is still a need for both proactive and reactive interventional programmes to combat zoonosis in SAARC, as the South Asia region is a hotspot for endemic and emerging zoonotic diseases (Mckenzie et al., 2016).

To control human rabies in the region, SAARC conducted a regional workshop in 2003 that recommended the development of a SAARC strategy for rabies elimination. Similarly, Rabies in Asia Foundation (RIA), in collaboration with the WHO and SAARC secretariat, hosted the SAARC rabies meeting in 2011 in Mysore, India. The SAARC technical meeting held in Colombo in 2012 also discussed on rabies elimination programs. Likewise, in 2013, SAARC rabies meeting was held in Dhaka supported by FAO, OIE and WHO (Pant, n.d.). With the statement

of 'Prevention and control of rabies in SAARC countries', SAARC secretariat conducted the workshop in Colombo, Sri-Lanka in 2015. Similarly, in 2019 SAARC secretariat conducted the workshop with the strong commitment to eliminate rabies elimination 'zero by 2030' in SAARC region, in Kathmandu Nepal. OIE, WHO, FAO, and GARC are united with SAARC to fight against rabies. This platform has pledged its commitment and technical support to assist and accompany rabies endemic countries in their efforts to end human deaths from dog-mediated rabies by 2030 through mass dog vaccination, post-exposure prophylaxis, public awareness, and strong surveillance (SAARC, OIE, 2019).

### **Curriculum Review**

In reviewing the school-level health education curriculum in Nepal, the curriculum has been found to be "an integrated curriculum under the concept of broad field curriculum". Starting from grade one to three, health education includes science and physical education. In grades four and five, it merges with physical and creative art. However, there are no specific zoonoses content in the curriculum. In grades six to eight, health education is integrated into the school curriculum with similar curriculums such as physical education as a core curriculum. However, from grade nine to twelve health and physical education is only seen as an optional curriculum (Curriculum Development Center [CDC], 2019).

Based on the district-level passive surveillance system, fourteen different zoonotic diseases are found to be most common in Nepal. These are namely bird flu, swine flu, rabies, brucellosis, bovine TB, tape worm, leptospirosis, toxoplasmosis, echinococcosis / hydatids, salmonellosis, Japanese encephalitis, botulism and anthrax (ANSAB, 2015). However, diarrhoea, round worm, rabies, scabies, HIV/ AIDS

related contents are instead given space in the curriculum of grade six. Tapeworm, kala-azar, malaria, and HIV/AIDS related contents find their expression in grade seven curriculum. Hepatitis and HIV/AIDS are the contents of the grade eight curriculum. But, surprisingly, in the nine to twelve grade level health and physical education curriculum the zoonotic contents are found only in elective curriculum (Curriculum Development Center [CDC], 2019). Although diarrhoea, rabies, tuberculosis and malaria related contents are, for instance, stated in grade eleven in an elective paper, there are few zoonoses-related contents in health and physical education curriculum at grade twelve. At grades nine and ten, health and physical education is mentioned as an elective curriculum, but the curriculum will be implemented only from 2080 B.S. academic years (in grade nine from 2079 and grade ten from 2080 B.S.). In these grades, the health, population and environment curriculum has been applied at school as a core curriculum with few zoonoses contents. Similarly, even at the bachelor level and above health education curriculum, zoonoses contents have the slimmest presence. It may concern the people working in health-related field that health education along with considerable zoonoses contents has been degraded into elective status whereas such issues ought to be given high priority when such diseases are common prevalence in the society. There is a stark lack of the core curriculum with zoonoses-related content in health education from the school to the university level. This reflects curriculum gaps from the perspective of zoonoses and health education.

Similarly, based on the curriculum reviewed in veterinary science in Nepal, the Council for Technical and Vocational Training (CTEVT) conducted the eighteen-month, non-academic course to preparation for the mid-level veterinary manpower. In

this curriculum, zoonoses-related content is incorporated. Under the course title; veterinary epidemiology and public health, the contents is designed like; the basic concept of zoonoses, waterborne zoonoses, milkborne zoonoses, meatborne zoonoses, important zoonotic diseases and their control, i.e, rabies, brucellosis, tuberculosis, highly pathogenic avian influenza and swine flu (Curriculum Development Division, 2016). However, in the secondary level technical and vocational education curriculum in agriculture (Curriculum Development Center [CDC], 2019), and bachelor level of agriculture science (BSc), there is not any zoonoses related contents in the curriculum (Tribhuvan University, Institute of Agriculture and Animal Science, 2020).

Bachelor of veterinary science and animal husbandry (BVSc & AH) under the Agriculture and Forestry University, Chitwan Nepal, found zoonoses related contents in 9th semester. BVSc & AH is the bachelor level academic course which is closely related to multiple dimensions of animal health including zoonoses and public health issues in the curriculum (Agriculture and Forestry University, 2015).

**Table 1.** *School-Level Health Education Curriculum in Nepal*

Level	Grade	Health Education in Curriculum	Zoonoses Contents
Basic Level	[1-3]	Integration with Science, Health and Physical Education	Not specified
	[4-5]	Integrated with Health, Physical and Creative Art	Not specified
	[ 6]	Health and Physical Education [Integrated Curriculum]	Diarrhoea Round worm Scabies Rabies Jaundice HIV/ AIDS
	[ 7]	Health and Physical Education	Tape worm Kala-azar Malaria HIV/ AIDS

Level	Grade	Health Education in Curriculum	Zoonoses Contents
	[ 8]	Health and Physical Education	Meningitis Encephalitis Hepatitis-B HIV /AIDS
Secondary Level	[ 9]	Health and Physical Education [new curriculum – elective II]	It will be applied up to 2079
	[9]	Health, Population and Environment Education [old - core curriculum]	Zoonotic related contain not specified
	[ 10]	Health and Physical Education [new curriculum – elective II]	It will be applied up to 2080
	[10]	Health Population and Environment Education [old - core curriculum]	Roundworm, Common Cold [Not specified zoonotic diseases]
	[ 11]	Health and Physical Education [Elective I]	Diarrhoea Malaria Rabies Tuberculosis Encephalitis
	[ 12]	Health and Physical Education [Elective I]	Not specified

*National Curriculum Framework, 2076(CDC, 2019)*

However, few of the selective students only enrolled in this course. So, we need to emphasis zoonoses-related content in secondary level curriculum as a core curriculum with appropriate practical session, which might be accessible for the students of farming communities. The existing school-level health education curriculum with zoonoses contents is mentioned in the above table (Table 1).

### **Research Gap**

The majority of human diseases come from animal sources. People in close proximity to animals are even more susceptible to zoonoses. Globally, every year, a great number of people are victimized due to zoonotic-related illnesses with huge economic losses. However, based on the literature most of the poor and developing countries are not serious about the issues of zoonoses (Pandey et al., 2012; Chowdhury et al., 2018; FAO, 2018; Tesfaye et al., 2013). However, by the nature of

their occupation, livestock farmers, wildlife workers, and veterinarians are more exposed to animals, facing zoonosis threats.

To my knowledge, there have been limited studies in the field of livestock farming in terms of zoonoses in Nepal. Some researches found in literature have mainly discussed single zoonotic diseases related to livestock farmers (Pandey et al., 2012; Sah et al., 2017) and mainly focused only on economic perspective (Aryal, 2013). This empirical evidence also indicates that there was low knowledge and poor preventive practices related to zoonoses on the part of livestock farmers. In this scenario, with the well-structured research tools applied by the researcher, the present study might close down the research gap and also try to identify the knowledge - practice gaps in the fields of livestock farming.

In Nepal, health education in the school curriculum is limited to an integrated curriculum with limited content of zoonoses. However, since empirical evidence from globally points to low knowledge and poor practices by livestock farmers related to zoonoses (Akinade et al., 2015), we also need to strengthen school curriculum with health education and zoonoses content in Nepal. The study might serve as a milestone in bridging the curriculum gap if the issues raised in the study are taken into account by the concerned stakeholders.

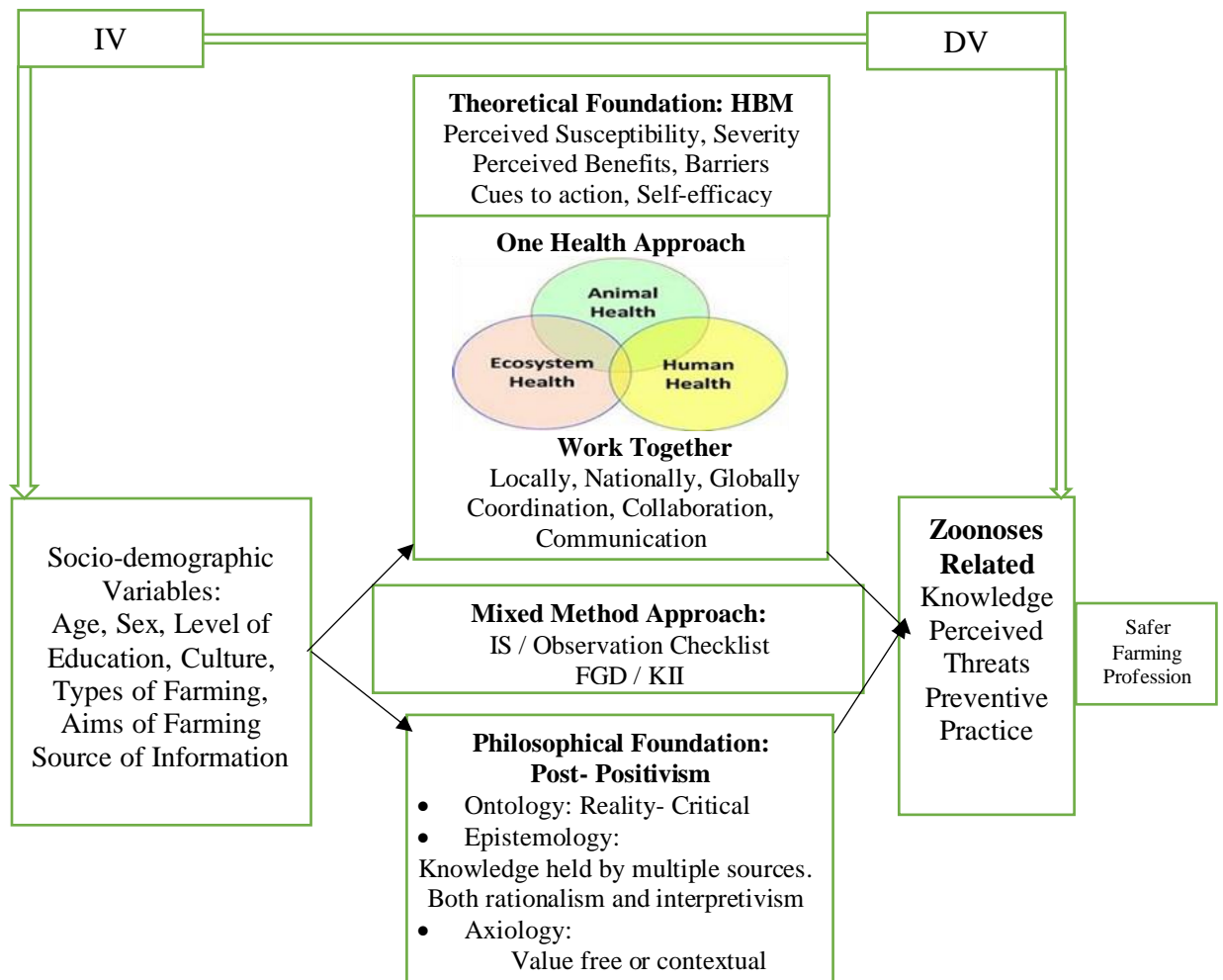
Review of the health policy of Nepal found that the policies mainly focused on epidemic and outbreak response to zoonoses. The health policy abounds in more reactive programmes than proactive and preventive ones regarding zoonoses. The One Health concept, emerging in the realm of zoonoses, represents a collaborative and proactive strategy for addressing diseases associated with zoonotic transmission (CDC, 2018a). However, gaps persist in the National health policy of Nepal. Therefore, to effectively control zoonotic diseases, it is imperative to incorporate and

adapt the components and principles of the one health approach (OH) into the national health policy. Findings of the current study indicate that most of the livestock farmers in Nepal adopt traditional farming practices. Vaccination for livestock and other pre and post-exposure prophylaxis for zoonoses were found to have low coverage in the study. This phenomenon has been uncovered in the present study to support filling those research gaps, curriculum gaps and policy gaps, and significantly contributing to the farming communities of Nepal.

### **Conceptual Framework**

This conceptual framework provides an overall framework for the research. Based on reviewed empirical and theoretical literature, I have constructed this conceptual framework. It is mainly based on HBM and supported by the OH approach under the mixed method research (approach) design. According to the HBM, people will adopt a healthy behaviour if they realize that the circumstances are severe or susceptible to the illness.

In this study, most of the sociodemographic variables such as age, sex, education, types of farming, and aims of farming of the respondents are independent variables. The dependent variables of the study are knowledge, perception, and preventive practices of the respondents regarding zoonoses.

**Figure 4. Conceptual Framework**

(IV= Independent Variables; DV= Dependent Variables)

In this study following the convergent parallel mixed method, the researcher wanted to know the situation of threats from the zoonosis among the livestock farmers in Nepal based on the perspectives of their existing knowledge, threat perceptions, and preventive practices related to zoonoses. The framework also reflects a comparison and analysis of the effects of socio-demographic dimensions on dependent variables (knowledge, threat perceptions, and preventive practices of zoonotic diseases) with reference to HBM and OH approaches, along with post-positivism as the philosophical foundation of the research (figure 5).

### **Implication of the Review for the Research**

The review of the literature is a summary or reflection of previous research work on a related topic that is significant for future research work. The previous literature provides clarity and a specific focus on the research problem. Similarly, to identify the research gap, develop the research objective, research questions, choose a research methodology and paradigm, the review contributed a great deal on the part of the researcher. Keep the researcher informed about the research topic and contextualize the research problem are other major outcomes of the literature review. The articles, journals, books, dissertations, reports, etc. which were reviewed in this journey came out useful in various ways for the researcher.

People perceive differently how they are suffering from diseases. Theoretical literature which was reviewed in this paper helped to develop an understanding of the history and theory of diseases. To develop a clear understanding of how people change their behaviour in healthy ways once they attain proper knowledge of the way diseases are harmful to people, I reviewed some behaviour change theories such as HBM, TTM, TPB and OH approaches. After having reviewed the theories, I applied the constructs of HBM to compare the threats perception of livestock farmers regarding zoonoses in the study.

Most of the articles reviewed in empirical parts helped the researcher build understanding about livestock farmers' knowledge, practices and impacts of different variables such as their education on zoonoses prevention in farming communities. Similarly, reviewing the national health policies of Nepal and school level health education curriculum helped the researcher to determine the priority and provision of government in the issues. Thus, the literature review provided the researcher with a

clear guideline to find the ground reality of the research site, close the research gap, and develop a new concept in the field of zoonoses.

## CHAPTER III

### Methods and Procedures

#### Philosophical Understanding

Post positivism is the philosophical foundation of this study. The post-positivist tradition comes from 19th century. An early manifestation of post-positivism in the social sciences can be found in the work of Weber, the late nineteenth and early twentieth century sociologist. Weber developed the concept of verstehen or 'understanding' as a hermeneutic (q.v.) technique by which knowledge of the social world is to be gleaned (Fox, 2008). Post positivist approach to knowledge perhaps stands mid-way between the positivist approach that assumes that there is a single truth which can be detected by rigorous scientific methodologies by ruling out the importance of subjectivity altogether, and relativism which affirms that there is no absolute reality that is discoverable, but it is always in a flux. In between the extreme two stances about reality lies post-positivism which is bifurcated: realist post positivism and constructivist post positivism (Fox, 2008). Since the latter leans considerably toward relativism, the researcher has discarded the philosophical approach for realist post positivism because the researcher studied the 'social facts' with the help of statistical tools on the one hand. Interpretivism, on the other hand, also found its expression in the study when I took to qualitative data while appreciating the social actors' perceptions and opinions on the research topic.

Post-positivist paradigms represent critical realism (Guba, 1990). In this research livestock farmers normally follow the traditional practices (e.g., constructivism) but due to impact of science and technology, industrialization, globalization, commercialization (realism), they are shifting their farming paradigm embracing modern and healthy way (post-positivism). Researcher in this study try to

determine the zoonoses related risks based on existing zoonoses associated knowledge, threat perception and zoonotic preventive practices of livestock farmers. So, to determine these realities with-out any biased, researcher visited a farming community to wear a lens of post-positivism in the study.

An ontologically realist post-positivistic researcher assumes that social reality is out there and has enough stability and patterning to be known while at the same time, reality can be shaped and reshaped through the subjective involvement of social actors, livestock farmers, in the case of this research. The fact that zoonoses exist objectively is a necessary condition but it is not sufficient because whether they exist for the livestock farmers and if they do, how they perceive them also matters a great deal in this research to come closer to the reality about zoonoses in the particular context, the research site. Post positivists believe that a reality exists, and the researcher's role is to bring that reality out (Tanlaka et al., 2019). Here, in this study, there may be many ways of animal husbandry that could lead to zoonosis. So, my role was to bring that real situation to light with the help of objective tools and subjective interpretation, since post-positivism enjoys the triangulation of the study from different perspectives. As I worked with human beings, they are independent and have unique social backgrounds and status. Therefore, I believe that reality can be known only imperfectly. I also believe that I can not get reality fully like the positivists get, because they work in labs or defined settings whereas, I work in real community scenarios. So, ontology of my study is not like the 'naive' reality that positivists believe, but the ontology of reality that I side with is critical reality where my role is to acknowledge the real practices of the livestock farmers related to zoonosis.

Epistemologically, post-positivists believe that reality can be uncovered, or knowledge can be developed through multiple methods. The positivist thinks that the

researcher and the participants in the study are assumed to be independent, i.e., they do not have influence on each other. Post-positivists modify this belief by recognizing that the theories, hypotheses and background knowledge held by the investigator can strongly influence what is observed (Lacey, 2010). While researchers were collecting the quantitative data, it was assumed that there was a detached relationship with participants, and I tried to ensure close relationship between the investigators and the participants while collecting the data qualitatively.

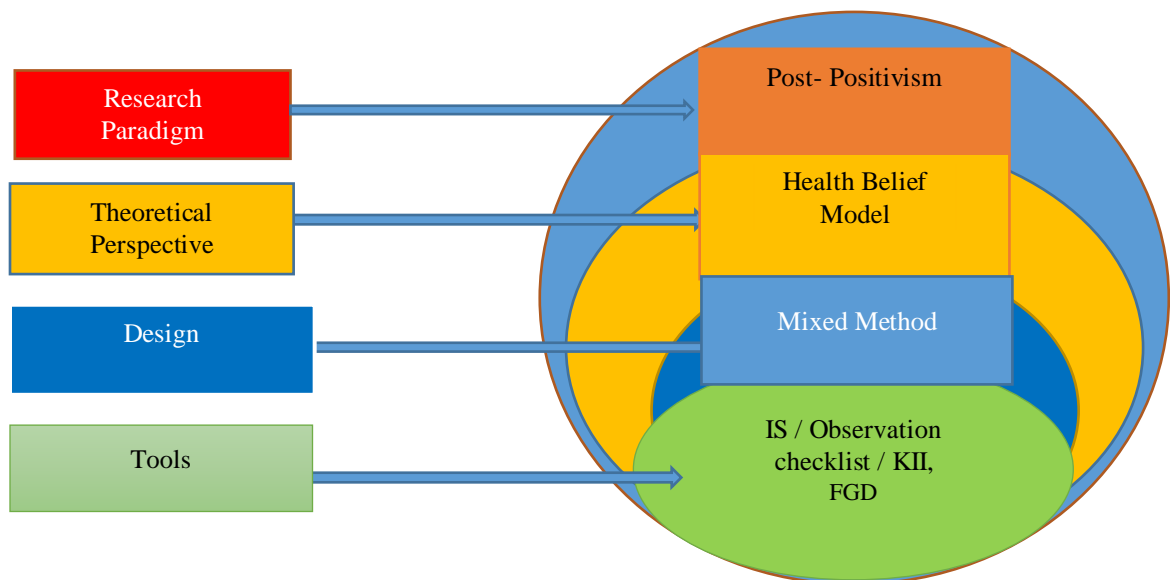
Post-positivist researchers assume that social reality is measurable and knowable, although difficult to access (Guba, 1990). So, I did try to bring knowledge of reality in such a way that it could be measured in terms of numbers or percentages. I believe that since I was working with a complex social structure, in this case everything could not be explained in terms of numbers and percentages only. So, I had adopted some qualitative information to closely understand phenomena and the knowledge that I dealt with in this research. My epistemological stance in this study is both rationalism and interpretivism.

Methodologically, the post-positivists modify the positivists' position by encouraging the use of multiple strategies for gathering and analysing the data (including qualitative data) (Phakiti, 2014). Multiple strategies would allow the researchers to obtain a more complete set of empirical evidence. In this study, based on convergent parallel mixed method research design, the data related to perception and knowledge of livestock farmers which were reflected in their daily practices that would determine health and disease were collected through the quantitative design, and data which were related to their culture, experiences, feeling, pain, sorrow, or pleasure were captured under the qualitative (QUAN + qual) method (Creswell & Clark, 2017).

Axiologically, while positivists believe that research is or can be value-free or value-neutral, post-positivists take the position that bias is undesired but inevitable, and therefore the investigator must remain conscious about minimizing the bias and appreciate its pervasiveness. I was in the process of researching how my own values and beliefs might influence my research and tried to be as neutral as possible in terms of values. While working with my choice of measures, populations, questions, I was aware that values might be contextual.

Within the framework of this study, the researcher equally believed and captured both objective and subjective realities. However, was not apply the interventional activities like a pragmatist, or advocated to the single reality, therefore he strongly claimed his paradigm in the study with a post-positivist lens.

**Figure 5.** *Philosophical Understanding of the Research*



### Methods of the Study

The study used QUAN + qual research approach (design). This method or approach as the third paradigm can help bridge the schism between quantitative and qualitative research (Bryman, 2018). Multiple methods evidently have a leverage over a single method in terms of entertaining multiple perspectives before a conclusion is

drawn in the research. A key feature of mixed methods (quantitative and qualitative) research is its methodological pluralism.

The mixed method or mixing methods in research design is endowed with the strengths for research in the field of social science, as description, words, and pictures can be used to add meaning to numbers in mixed methods while answering a wider and more complete range of research questions, and at the same time not restricting the researcher only to a single method or approach. The method can provide stronger evidence for a conclusion through convergence of findings and can add insights and understanding, which might otherwise be missed. Quantitative and qualitative research used together produce more complete knowledge necessary to inform theory and practice (Creswell & Creswell, 2017). So, due to the nature of research variables, the researcher in this study followed the Quan + qual research design as an approach.

### **Research Design**

This study was based on the cross-sectional Quan + qual (convergent parallel) research design as an approach. Mixed method uses multiple world views or paradigm (post-positivism, constructivism, critical realism) and pragmatism. Creswell suggests that mixed method research is an approach in which researchers collect, analyze, and interpret both quantitative and qualitative data, integrate the two approaches in various way and frames the study within a specific design (Doyle et al., 2016). The central premise of mixing or using two methods in this research is better for understanding research problems than either approach alone.

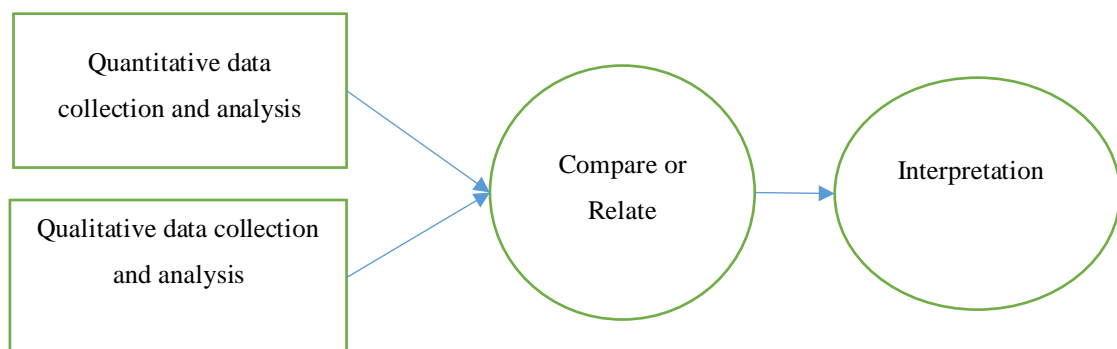
Under the Quan + qual method approach, the researcher followed the convergent parallel research design. Applying the sequential design may be time-consuming and burdening to participants, because of the lengthy nature of their

involvement (Crewswell & Clark, 2017), this was considered by the COVID-19 pandemic situation, we closely perceived such evidence. Some of the data related to farmers' knowledge, threats perception, zoonoses preventive practices, and health care seeking behaviour were collected through quantitative techniques; and socio-cultural values, belief, tradition, practices, experiences, and malpractices which had a connection with zoonotic threats in terms of livestock farmers were captured by qualitative techniques. Similarly, to address research objectives or answer the research questions, the researcher used more quantitative data than qualitative data (QUAN + qual) in the study.

With the convergent parallel research design, the researcher gathered both quantitative and qualitative data, analyzed both datasets separately, compared the results from the analysis of both datasets, and made interpretation as to whether the results would support or contradict each other. Direct comparison of the two data sets by the researcher provides a convergence of data sources (Crewswell & Clark, 2017).

### ***Convergent Parallel Mixed Method***

**Figure 6.** *Schematic Representation of the Convergent Parallel Mixed Method*



## **Population, Sample Size, and Sampling Procedure**

### ***Population***

The population of the study was the farmers who were keeping one or the other types of livestock (including poultry and buffalo) and actively involved in livestock caring role, and the stakeholder who were responsible for livestock and zoonotic management sector such as in charge of government health facilities and veterinary office (they are serving as health service providers during human and animals illness, respectively), and members of livestock related cooperatives, who conducted the programs related to livestock farming and zoonoses control in the community (i.e., training, health camp, insurance, etc.). Those institutions were operating in the municipalities that were selected for the study. A single respondent, who had to actively participate in livestock farming or related work, was chosen from each household and institution.

### ***Sample Size***

According to the National population and housing census 2011, total number of households (livestock farmers) in Nasong 4, Manang was 232; in Bhanu 5, Tanahun, 1365; and Kawasoti 17, Nawalpur (Nawalparasi- East), 1238. So, the total number of livestock farmers was 2835 which was the study population. The probability proportional to size (PPS) sampling technique was used to calculate the sample size of each municipality and rural municipality. A total of 380 samples were taken randomly for quantitative data, while 14 samples [8 KIIs; 3 veterinary in charge, 3 health post in charge, 2 cooperative members and 6 FGD] were taken by purposively for qualitative data (Creswell, 2009).

The heads of all local veterinary offices, the in charge of local health institutions, and the head of local farmer cooperatives who were directly or indirectly related to zoonotic management were purposely selected from the study area as key informants. The following formula suggested by Solvin (Susanti et al., 2019) was used to calculate the sample size:

$$n = \frac{N}{1+N(e^2)} \dots\dots\dots (1)$$

Total livestock farmers = 2835 (Central Bureau of Statistics, 2012).

Where, n = sample size

N = total population

e = accepted margin of error

Here, N = 2835

e = 0.05 (5 %)

e<sup>2</sup> = 0.0025

Therefore, sample size = 350.54 = 351

For adjustment of nonresponse rate: 10 %

Adjusted sample size = 351\*10% = 35.1 (351 + 35.1) = 386

### ***Sampling Procedure***

Before sampling was carried out, I reviewed the livestock status of Nepal presented by the Ministry of livestock development, 2017 (see Appendix1). On the review, some patterns of livestock keeping were discovered, making the determination of the sample size and methods easier for the researcher. Out of seven

provinces, due to its accessibility and alignment with research criteria, Gandaki province was selected purposively as it is located nearly in the center part of the country, which covers all three geographical and ecological regions, namely Mountain, Hill and Terai with adjoining Tibet (China) in the north and (Utter Pradesh) India in the south, and which is inhabited by different ethnic people with different sociocultural practices related to livestock.

In the province, there are eleven districts, among which two (Manang and Mustang) are Mountainous districts, eight (Gorkha, Lamjung, Tanahun, Kaski, Parbat, Baglung, Syangja & Myagdi) are Hilly districts, and only one district Nawalpur (Nawalparasi- East) lies in the Terai region. Cattle, buffalo, goat, sheep, pig, yak/chaury and poultry are the main livestock rearing in this province (Ministry of Agriculture and Livestock Development, 2017). From Mountainous and Hilly districts, Manang and Tanahun were selected respectively employing simple random sampling techniques. Since Nawalpur is the only Terai district, it was automatically selected by the researcher.

Similarly, Nasong rural municipality of Manang, Bhanu municipality of Tanahun and Kawasoti municipality of Nawalpur (Nawalparasi- East) district were randomly selected. Ward no 4 (Dharapani) from Nasong rural municipality, Manang; ward no 5 (Bar Bhanjhyang) from Bhanu municipality Tanahun; and ward no 17 (Kumarwanti) from Kawasoti municipality Nawalpur (Nawalparasi- East) were selected by simple random sampling techniques. Finally, the sample size was selected from the population of the randomly selected research site in each district applying the probability proportional to size (PPS) sampling technique in the study.

Similarly, the researcher purposively selected a veterinary health unit and a government-run public health unit, and a local cooperative related to livestock from

each research site: the wards mentioned above, ward 4 (Nasong Rural Municipality), ward 5 (Bhanu Municipality), and ward 17 (Kawasoti Municipality). From each ward, the heads of both health institutions and a member of the cooperative were also selected purposively to get qualitative information related to the perspective of livestock and zoonoses and also tried to determine the health care seeking behaviours of the respondents, as well as the implementation situation of programs based on the One Health approach in both veterinary and public health facilities. Furthermore, to explore the sociocultural values of livestock in farming communities, the researcher conducted two FGD sessions in each research site with purposely selected livestock farmers who were not selected for the survey interview in the study. The following table could provide more clarity about the population, sample size, and sampling process in the study (Table 2).

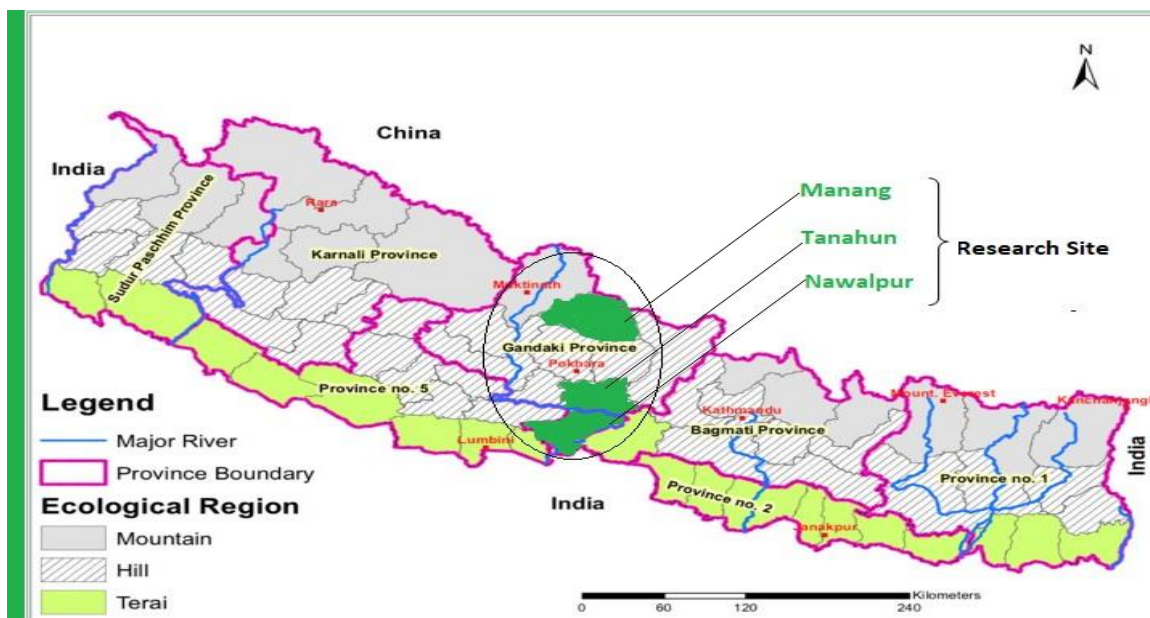
**Table 2. Sampling and Sample Size**

Nepal			
Total Provenance = 7			
Gandaki Province (Purposively selected)			
Total district = 11			
Mountain	Hill	Terai	
Manang, Mustang	Gorkha, Lamjung, Tanahun, Kaski, Parbat, Baglung, Syangja, and Myagdi	Nawalpur	
Manang	Tanahun	Nawalpur	Manang and Tanahun randomly selected
Total Rural Municipality(4)	Total Rural and Municipality(10)	Total Rural and Municipality (8)	
Nasong Rural Municipality	Bhanu Municipality	Kawasoti Municipality	Randomly selected
Ward No 4 Dharapani N = 232 (HHs)	Ward No 5 Bar- Bhanjang N = 1365 (HHs)	Ward No 17, Kumarwanti N =1238 (HHs)	Randomly selected N= 2835 (HHs)
n=32	n=186	n=168	n=386
$n = \frac{N}{1+N(e2)}$ (For quantitative data)			
<b>For qualitative data:</b>			
2 FGD	2 FGD	2 FGD	(Purposively selected)
2 KII	3 KII	3 KII	(Purposively selected)

## Study Area

In Gandaki province, the researcher selected three districts [Manang, Tanahun, and Nawalpur, (Nawalparasi- East) districts] using a simple random sampling technique which ensured the coverage of three ecological zones namely, Mountain, Hill and Terai with diverse sociocultural practices. Among the three selected districts, Manang is a mountainous district, located in the northern part of the country between the boarder of Nepal and China (Tibet), while Tanahun is a hilly district, located nearly in the center part of the country, and Nawalpur (Nawalparasi- East) is located in the southern part that represents the Terai zone and the boarder district of Nepal and India.

**Figure 7.** Study Area



Adopted from Agergaard et al. (Agergaard et al., 2022, p. 8)

## Research Tools

As the study followed the quantitative dominant Quan + qual research approach, it required both quantitative and qualitative information. For this, the researcher formulated quantitative and qualitative nature of the research tools. During

the formulation of research tools, the researcher seriously considered sequences, length, layout, and language while constructing the questionnaire. During the process of tool development (quantitative; interview schedule including observation checklist, and qualitative; FGD and KII guidelines), researchers consult multiple rounds with research supervisors, subject experts, veterinarian, medical officer, and public health experts like a Delphi technique. I followed a multi method approach to collect the data. There were four types of research tools (Table 3) in the study. With the consent form on the first page of six pages, the interview schedule (IS) had a total of four sections consisting of questions on sociodemographic status (21 questions), knowledge related to zoonoses (26 questions), preventive practices of zoonoses (15 questions), along with the observation checklist (14 statements), and questions related to perception statements based on HBM constructs. The following tools were used for the data collection process in the study.

**Table 3.** *Data Collection Tools*

<b>Quantitative Tools</b>	<b>Qualitative Tools</b>
Interview schedule [IS]	Focus Group Discussion (FGD) guideline
Observation checklist	Key informant interview (KII) guideline

### ***Validity and Reliability of the Tools***

To obtain the actual data related to the objectives and research questions, I designed research tools (interview schedule) with reference to related studies. Employing a technique similar to Delphi technique, I then had consultation with my research supervisor; and with the health education and public health experts, medical and veterinary officers. This helped to ensure the face and content validity of the research tools. Also, to verify the validity and reliability of the research tools, it was tested in the Tanahun and Nawalpur districts in similar circumstances of the research

site. Out of the total sample size, ten percent (38 /19 +19) quantitative sample and a single set of guidelines for KII and FGD of each category (total = 4); veterinary in charge, health post in charge, livestock-related cooperative member and FGD participants, were tested in the Bhanu municipality ward no 8 Tanahun on February 7- 9, 2020 and Kawasoti municipality ward no 15 Nawalpur on February 21 -23, 2020. After the pretest, the research tools were corrected, edited, and further modified for some variables based on the pre-test interview sessions according to the guidance of research supervisors.

Similarly, before the finalization of the research tools, it was tested, re-ested, edited and Cronbach's alpha for the Likert-type scale was calculated. For the opinion and perception of respondents towards zoonoses, it was merged at three-point scale in the nearness for Likert's type scale statement. The Cronbach's alpha was 0.724. This value is accepted in studies of social science (George & Mallery, 2003). This process helped to make IS more valid and reliable in the study (Table 3). According to Denscombe (Denscombe, 1998), the use of multi-methods for examining one issue supports the research findings and increases the validity of the data. The fact is concerned with two main issues: whether the instruments used for measurement are accurate and measuring what they want to measure. Major amendments of the IS were made as follows (Table 4).

**Table 4. Pre-test of Interview Schedule**

<b>Pre-test</b>	<b>Date</b>	<b>Place</b>	<b>Amendment/revisions/corrections</b>
First	2020/02/7-8	Bhanu - 8, Tanahun	<ol style="list-style-type: none"> <li>1. In socio-demographic related questions; exclude some questionnaire and limited to total- 21, revised the multiple options; [i.e., revised- main occupations of the family, income by livestock, options of causes of illness]</li> <li>2. Exclude some knowledge measuring questions (basically related to highly technical sentences) and maintain four to six questions for each disease.</li> <li>3. Include Q.N. 5 in part three (to ensure the proper use of PPE i.e, soap, mask, gloves, and boots). Exclude some practice measuring questionnaire and limited to total-15.</li> </ol>
Second	2020/02/21-22	Kawasoti- 15, Nawalpur	<ol style="list-style-type: none"> <li>1. In part three [observation checklist], include the measurement scale (clean, acceptable, poor) for categorization of the sanitation status of the households, shed/farm and toilet.</li> <li>2. In part four, revised some perception measuring statements to make them meaningful based on constructs of HBM and limited to total 14.</li> <li>3. Added one open-ended question to compare the qualitative data obtained from FGD.</li> <li>4. Consent form added in separate page.</li> <li>5. Added one question related to One Health approach. E.g., question no. 5 in KII for health service provider and question no. 4 in KII for veterinary professionals.</li> </ol>

Finally, the researcher finalized the research tools in consultation with the research supervisors. The final version of survey questionnaire and other tools is attached in Appendix II.

## **Data Collection Procedure**

For the purpose of field work, I took the approval letter from Graduate School of Education (GSE), TU, and visited the respective municipalities with the approval letter. After reaching the research site, first of all, I introduced myself to municipal officials and informed them of the purpose of the study. After that, I took the official approval for data collection in their municipalities. The researcher followed the same process in all municipalities and wards. Approval letters are in Appendix Section (see appendices; IV-VI).

For data collection, it took 33 days from October 28, 2020 to November 30, 2020 in Bhanu municipality, Tanahun, 30 days from December 4, 2020 to January 2, 2021 in Kawasoti municipality, Nawalpur (Nawalparasi- East), and 7 days from March 23 to 29, 2021 in Nasong rural municipality Manang. In all three study districts, a total of 380 respondents were interviewed for the study. Similarly, I selected FGD participants and also visited the local veterinary and public health unit run by the government for KII. In this connection, I met two chairpersons of livestock-related local cooperatives. They were all responsible stakeholders for the livestock and zoonoses management sectors in the communities, whom I selected as a source of qualitative information. I collected both quantitative and qualitative data simultaneously based on the convergent parallel mixed-method approach. At the introductory phase of data collection, I established a good relationship with the participants. Moreover, I considered basic ethical norms and values of mixed-method research such as informed consent of participants, privacy, data protections, burden of participants etc (Preissle et al., 2015) during the data collection phase in the study.

For quantitative data collection, the researcher visited the selected wards in the respective municipalities. Since livestock farmers were not found to have registered with any institution such as municipal offices. on the research site, the researcher listed the name of every household in support of local veterinary health workers and selected every seventh household from the population (sampling interval) based on systematic random sampling technique. Initially, the first household was selected using a simple random sampling technique, then every seventh household was interviewed. If there was a seventh household absent from the list, the researcher visited the nearest household in its place. The required sample size in Manang was 32; in Tanahun, 176; and in Nawalpur (Nawalparasi- East), 172 based on the PPS sampling technique.

A total of 380 livestock farmers were interviewed using a structured questionnaire (including the Likert scale questionnaire) with mainly closed ended questions. All quantitative questionnaires sought to identify the knowledge, perception of threats and preventive practices of livestock farmers related to zoonoses. Data were collected using the face-to-face interview technique in the house of the livestock farmers. To determine the zoonoses preventive practices, I have observed with observation checklists all 380 households and surrounding environment i.e., shed of livestock, toilet, and distance between home and shed. Similarly, due to the time constrain, since it was not possible for the researcher to observe all preventive practices whole day, to confirm the respondents' practices of wearing masks, gloves, and boots and washing hands with soapy water, I inquired about the application of personal protective equipment (PPE), and observed the presence and used condition of these PPE in the households of the members who said that they had

used PPE during livestock handling. This included checking for the availability of soap, masks, gloves, and boots during the observation period, which helped verify their regular practices. During the observation period if protective materials were present with used condition, the researcher could verify that respondents had actually used PPE during exposure. The observation process was completed based on an observation checklist which was included in the same questionnaire sheet (see; appendix II, part - III). For the purpose of quantitative data collection, the researcher enrolled some assistance, who had a paramedic in the veterinary and public health profession, and was oriented by the researcher mainly on the nature of the research, the objectives, the patterns of the questionnaire, the simplify of technical words, that is, 'zoonoses' and the data collection procedure, with ethical issues. They were deployed along with the researcher. However, all qualitative data were collected by the researcher himself. Consent was obtained before the interview and the focus group discussion. The average interview and observation time in single households was 55 minutes and the response rate was one hundred percent. All research tools were translated into Nepali language.

To obtain an in-depth understanding related to zoonoses threats, preventive practices, cultural and traditional values and perceptions related to livestock, and consumption of raw products (meat, milk, etc.) of livestock, the researcher conducted a total of six FGD (two in each municipality), and FGD guidelines were designed after discussion with an expert panel like a Delphi technique and pretested in similar areas of the research site, which was determined by a common guideline for qualitative methods in the literature (Hennink et al., 2019). The participants in FGD were selected purposely with the help of the local veterinarian of the livestock farmers

who were not included as quantitative respondents. The FGD guideline was followed in the FGD sessions. The researcher obtained consent prior to the session. In this session, the researcher was acted as moderator and the local veterinary paramedic was supported as the notetaker.

Similarly, the researcher visited all government veterinary offices, health institutions and farmers' cooperative in the study area for conducting the key informant interview [KII]. Before taking the interview, the researcher established a good relationship with the participants while explaining to them objectives and methodology of the research. Through KII, the researcher tried to obtain some information related to the health care seeking behaviour of community people and the OH approach on service providers in the study areas. The researcher conducted a total of eight KII with stakeholders [health post in charge, veterinary in charge and livestock-related cooperative members] for the study, with a single KII in each institution at the research site, but Nasong rural municipality (Manang) did not have any livestock related cooperative during the data collection period.

### **Data Quality Management and Analysis Procedures**

As I followed the Quan +qual research (approach) design, I analysed the data by applying both descriptive and thematic approaches where data were separately analysed based on their nature. I have been conscious of the ethical issues of mixed method research during data analysis (i.e., data integration and data triangulation during the contradictory results (Preissle et al., 2015). In quantitative parts; to determine the knowledge on studied zoonoses I have given 1 score in every correct answer and no score (0) granted for an incorrect response. The respondents were then categorised based on their correct answers: those who had no knowledge of any

question indicated by '0' (No knowledge); those who answered up to 4 questions correctly indicated by '1' (Some knowledge); and those who knew all the answers indicate '2' (Good knowledge). Likewise, based on self-reported preventive practices (use of PPE) responded were categorized in three groups (i.e., daily user, occasionally user, and never user), which were determined based on checklist, and using Likert scale, zoonoses related threat perceptions were analysed which were designed based on HBM constructs. I applied univariate, bivariate, and multivariate data analysis procedures using SPSS statistical software (Singh, 2007). I conducted these analysis methods to identify the association between the variables where multivariate analysis was supported to determine the net effect of education on knowledge and preventive practices towards zoonoses. Similarly, qualitative data were analyzed thematically, as illustrated in the following.

### ***Quantitative Data Management and Analysis***

To maintain the quality of data, I reviewed the questionnaire form whether there was any inconsistency, error, mistake, etc. Then I entered the data into a Microsoft excel sheet. After completion of the data entry work ten percent of the total sample (n=380) was re-checked to determine whether there was an error or mistake. To analyze the quantitative data, the data was imported into the Statistical Package for Social Science (SPSS) software. The data was processed according to the nature of the variable by using descriptive statistics. Univariate, bivariate, and multivariate analysis were performed as required (Denis, 2018).

Univariate analysis such as mean, median, and percentage was used to describe the characteristics of respondents and present the situation. Bivariant analyzes such as the chi-square test/fisher's exact test were used to examine the

association between independent and dependent variables. Similarly, educational variables that were found to be significantly associated with dependent variables were further assessed by multivariate analysis. Before adjusting the variables in multivariable analysis, multicollinearity issues among the variables were evaluated and no collinearity issues among the variables were found. Multivariate analysis (logistic regression) was performed to examine the net effect of education on knowledge and practices towards the zoonoses among livestock farmers in the study. Frequency distribution table, figures, and cross table were used to present the findings of the study. The confidence level was marked at 95 percent so the significance value was considered at 95%, ( $p < 0.05$ ). Tables were prepared for statistical analysis according to the consultation with the supervisors and statisticians. For the purpose of further analysis, some variables were recategorized and mentioned with operational definitions in relation to measurement scale (i.e., religion, level of education) in the study (Table 5). Finally the data was handled to maintain confidentiality with anonymity. These are universal ways to maintain the quality of quantitative data (Acharya, 2020).

**Table 5.** *Variables Description and their Measurement Scale*

<b>Variables</b>	<b>Description</b>	<b>Measurement scale</b>
Age of the respondents	Respondent's current age at time of survey. [Generally, interviews were conducted with heads or senior members of households. In this study none of the respondents were age less than 20 years, and to maintain the interval consistency it was categorized in 3 categories]	Ordinal for bivariate analysis 1 = 20 -39 years 2 = 40 - 59 3 = 60 and above years
Religion of the respondents	Religion which was followed by respondents and their households. It was also recoded for multivariate analysis.	Ratio scale for multivariate Nominal 1 = Hindus 2 = Buddies 3 = Christian 4 = Muslim 5 = Bon
	Re-categorized into two items	0 = Hindu 1 = Non-Hindu

<b>Variables</b>	<b>Description</b>	<b>Measurement scale</b>
Respondent's education	Literacy status of the respondents. Which refers to; Illiterate = who had no read and write. Up to basic level = formal education up to grade eight and who had read and write with-out formal education. Secondary and higher level = respondents who had education grade nine to above all.	Ordinal 1 = Could not read and write 2 = Up to basic level 3 = Secondary and higher
	Recategorized into two items Below secondary = respondents who could not read and write and with up to basic level education. Secondary and above = respondents who had education with grade nine to above.	1 = Below secondary 2 = Secondary and above
Zoonoses related knowledge	It was measured based on the correct answer regarding the studied diseases, which included their causes, symptoms, mode of transmission, and preventive measures of zoonoses.	Nominal 0 = No 1 = Yes
Zoonoses preventive practices	Used or applied PPE during close exposure to livestock [hand washing with soap water, mask, gloves, boots wearing practices]	Ordinal 1 = Regular 2 = Occasionally 3 = Never
Type of livestock farming	Pattern of farming during time of survey [Single (i.e., cow) Mixed (i.e., cow, goats, poultry in same household)]	Nominal 1 = Single 2 = Mixed
Aim of farming	Purpose of livestock farming in respondent's households	Nominal 1 = Household consumption 2 = Sale / commercial
Perception	Personal observation towards zoonotic diseases. Initially, it was measured by Likert five scale and further categorized in to three categories.	Nominal 1 = Agree 2 = Neutral 3 = Disagree

### ***Qualitative Data Management and Analysis***

There are different methods of qualitative data analysis, and I have adopted thematic analysis with a manual approach. To assured the quality of the data, recording files of FGD were repeatedly listened to, and transcribe into clean version of the Nepali language, and the data were translated into English language. After that, the texts (data) were transferred into computer files. Due to the more readable than verbatim transcription, the researcher followed intelligent verbatim transcription in the study (Kawahara, 2007). The transcribed data were also repeatedly read for coding into different themes. The themes were generated based on an inductive approach. At first, basic themes were generated using the response of FGD and KII

based on research questions of the study. By using the basic themes and by focusing more specifically on research questions and research variables, organizing themes were created in the second steps. Then, global themes were derived from the organizing themes. These three types of themes were developed sequentially. Finally, the researcher analysed qualitative data in his dissertation report addressing each theme to describe how often the themes come-up and what they mean.

To identify contradictory or supporting opinions among FGD and survey respondents, the researcher used a framework matrix to put both quantitative and qualitative data side by side to perform comparison and contrast tasks. These were the common techniques used to analyze qualitative data and maintain its quality. Similarly, in the qualitative data analysis and discussion section, the researcher used the verbatim code in abbreviation forms (i.e. F- female, M- male, Ma- Manang, Na- Nawalpur, Ta- Tanahun, Vet- Veterinarian, yr- years) in the study.

### **Methodological Analysis**

In the realm of academia, the researcher in this study adopted a mixed-method research design with a focus on the convergent parallel mixed-method research approach. The primary objective was to investigate zoonoses-related knowledge, threat perceptions, and preventive practices among livestock farmers. Adopting quantitative and qualitative methods was aimed at strengthening the credibility and validity of the study results.

Creswell and Creswell (2017) posited that the integration of diverse research methods not only necessitates discrete decisions regarding data collection and analysis, but also requires a coherent rationale, a structured framework, and clearly defined integration strategies. The benefits of this mixed-method approach,

particularly in terms of heightened reliability, needed to be demonstrated, especially when faced with resource constraints (Salehi & Golafshani, 2010). It was imperative to ensure that the research questions were aligned with the mixed-methods design and that a suitable framework was chosen to harmonize the various data sources. Ethical considerations were paramount throughout the research process, encompassing participant selection, data analysis, and dissemination of results (Preissle et al., 2015).

To gain a deeper understanding of the mixed-method research approach within multisectoral research, the researcher also conducted a comprehensive global review of the literature on zoonoses and One Health-related topics. They employed various methodologies, such as systematic reviews (Akinade et al., 2015) to assess public knowledge of zoonotic diseases and simple random sampling by Chowdhury et al. (2018) involving smallholder livestock farmers. Tesfaye et al. (2013) conducted a cross-sectional study to evaluate the public perception of zoonotic diseases in different groups. Pandey et al. (2012) examined tuberculosis in bovine animals raised by infected patients through a cross-sectional study. Subedi et al. (2022) surveyed 333 veterinary students to gain insight into their perspectives on the One Health approach. These studies offer valuable methodological guidance to the researcher.

### ***Key Aspects of the Methodological Analysis***

**Sampling.** The research was conducted across three municipalities in distinct districts. The researcher employed systematic random sampling to conduct interviews with a total of 380 livestock farmers. The sample size varied across municipalities and was determined using the Probability Proportional to Size (PPS) sampling technique.

**Sampling Strategy.** The researcher employed a multi-stage sampling approach. The Gandaki Province was purposively selected due to its accessibility and

alignment with research criteria. Districts, municipalities, and wards were chosen via simple random sampling, and households were then systematically sampled from these wards.

**Quantitative Variables.** Variables such as age, sex, religion, education, zoonoses related knowledge, perception, preventive practices, type of livestock farming, and farming goals were measured and categorized appropriately.

**Data Types.** The study incorporated both quantitative and qualitative data. Quantitative data were garnered through structured questionnaires, while qualitative data were collected through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs).

**Questionnaire.** Structured questionnaires featuring closed-ended questions and observation checklist were utilized to collect quantitative data from the livestock farmers. These questions centered on zoonoses knowledge, perceptions, and practices.

**FGDs.** Six Focus Group Discussions (FGDs) were organized, two in each municipality. FGD participants were purposively selected with the help of local para-veterinarians. The discussions delved into topics related to zoonoses threats, preventive practices, cultural values, and the consumption of livestock products.

**KIIs.** Key Informant Interviews (KIIs) were conducted with stakeholders from government veterinary offices, health institutions, and farmers' cooperatives. These interviews were conducted with the aim of gaining insights into health care seeking behaviors of the communities and reflection on One Health (OH) approaches for the health service providers in the study areas.

In summary, the study's methodological analysis showcased a systematic and comprehensive approach to data collection, analysis, and validation. The utilization of a mixed-method approach effectively addressed the research objectives.

### **Data Triangulation**

The researcher applied data triangulation so that it would increase the credibility and validity of the study. Moreover, David (2010) states that data triangulation is the use of a variety of data sources, including time, space and persons in a study. Findings can be corroborated and any weakness in the data can be compensated for by the strengths of other data, thereby increasing the validity and reliability of the research findings.

As a post-positivist researcher, I analysed both subjective and objective realities (data) separately. Triangulation helped the researcher to make the data accurate and enrich findings of the study. To make data more transparent, the quantitative (objective) data displayed in various tables and qualitative themes represented in narrative were compared to make sure whether the constructs being talked about in the research would converge or diverge. Basically, there are four types of triangulations; data triangulation, investigator triangulation, methodological triangulation and theory triangulation (David, 2010, pp.6-18). However, the researcher in this study applied only data and method triangulations to make the research findings more reliable and authentic.

Under the methodological triangulation, the researcher in the study used both quantitative and qualitative methods based on the convergent parallel mixed method approach, and in data triangulation, the researcher collected data from different sources; livestock farmers, health service providers in both public health and

veterinary fields, livestock related cooperative members, observation of household sanitation. Quantitative and qualitative results were therefore separately analysed by the researcher, but results were triangulated in discussion section by using the themes which were generated in the analysis phase (i.e., cultural and religious attachment with livestock, diverse ethnic-religious values of livestock, culture and religion driven demanded of livestock, and perception towards zoonoses etc.). Qualitative data were used not only to make sense of livestock farming practices but also uncover the several hidden realities related to livestock in farming communities, resulting in cogent validity of the quantitative findings.

### **Ethical Considerations**

The research proposal of this study was approved by the research committee of GSE -TU (Ref; 68-076/077; March 18, 2020). Before starting the field works, the researcher took the approval letter from the Graduate School of Education, Tribhuvan University and visited related municipalities for data collection. The researcher received authority from respective municipal offices. People were not forced to be research participants or respondents in any way. Before data collection, objectives of the study and use of collected data were informed to respondents. Cultural value, norms and traditions of each respondent was dealt with respect during the process of data collection. The researcher in this research assured that collected data and information would not be available to anyone who was not directly involved in this research. The consent was taken before the interview or FGD and respondents or participants were requested to participate voluntarily. Moreover, I followed the ethical standards outlined by the American Psychological Association throughout the entirety of my research (American Psychological Association, 2020).

## **CHAPTER IV**

### **Analysis and Interpretation of Data**

This chapter presents the quantitative findings, followed by the qualitative ones. The results are presented on the basis of the research objectives and research questions of the study. In this study, through quantitative data, the researcher evaluated the knowledge, perceptions, and practices of livestock farmers towards zoonoses. Qualitative data was then used to support and create the trustworthiness of the quantitative data and also to explore the many unveiled livestock-related practices in the farming communities of the research site with a qualitative flavour. For the purpose of data analysis, I have used statistical (univariate, bivariate, and multivariate) and thematic analysis as per the study objectives and nature of data. Most of the results have already been published in several journals (Bagale et al., 2020, 2021, 2022; Bagale, Adhikari, & Acharya, 2023; Bagale, Adhikari, Acharya, & Kreps, 2023; Bagale, Adhikari, Acharya, Devkota, et al., 2023; Bagale & Adhikari, 2019).

### **Socio Demographic Characteristics of the Respondents**

This research was conducted in the districts of Manang, Tanahun, and Nawalpur (Nawalparasi- East) in the Gandaki province, covering all three ecological zones (Mountain, Hill, and Terai) of Nepal. Among the 380 respondents surveyed, 32 (8.4%) were from Manang, 176 (46.3%) were from Tanahun, and 172 (45.2%) from the Nawalpur district. The Probability proportional to size (PPS) sampling technique was employed to determine the sample size in the study (Table 6).

**Table 6.** *Socio-demographic Characteristics of the Respondents*

<b>Variables</b>	<b>Attributes</b>	<b>Frequency</b>	<b>Percent</b>
District	Manang	32	8.4
	Tanahun	176	46.3
	Nawalpur	172	45.2
Sex	Female	174	45.8
	Male	206	54.2
Age group	20 -39	227	59.7
	40 -59	128	33.7
	60 and above	25	6.6
Religion	Hindu	348	91.6
	Buddies	15	3.9
	Christian	14	3.7
	Bon	3	0.8
Ethnicity	Dalit	28	7.4
	Janajatis	263	69.2
	Brahmin/Chhetri	89	23.4

The study found that majority of respondents (54.2%) were male. Almost three in five (59.7%) fell within the 20 to 39 age range, while one thirds (33.7%) were aged between 40 to 59, and fewer than one in ten (6.6%) were 60 and older. The median age of the respondents was 35 years. The vast majority of respondents (91.6%) identified as Hindu, with Janajatis comprising the largest ethnic group in the study, making up 69.2 percent of the sample.

### **Background Characteristics of the Respondents**

This research was conducted among a randomly selected sample of 380 livestock farmers in Gandaki province. Table 7 shows the background features of the respondents, many of which have a connection to zoonotic diseases.

**Table 7.** *Background Characteristics of the Respondents*

<b>Variables</b>	<b>Attributes</b>	<b>Frequency</b>	<b>Percent</b>
Main source of family income	Livestock/ Poultry	30	7.9
	Agro farming	257	67.6
	Public service	33	8.7
	Foreign employee	29	7.6
	Trade	27	7.1
	Other	4	1.1
Average monthly income from livestock	Less than 15,000	297	78.2
	15,000 to 30,000	72	18.9
	Above 30,000	11	2.9
Educational status of respondents	Could not read and write	16	4.2
	Up to basic level	199	52.4
	Secondary and above	165	43.4
Aim of livestock farming	Household consuming	328	86.3
	Commercial farming	52	13.7
Training related to farming	Yes (short course)	11	2.9
	No	369	97.1
Type of livestock farming	Single	31	8.2
	Mixed farming	349	91.8
Keeping livestock in household +	Cow	107	28.2
	Buffalo	200	52.6
	Goat/sheep	260	68.4
	Pig	26	7.1
	Poultry	340	89.5
	Yak/Chauri	7	1.8
	Other	8	2.1
Death of livestock last year	Yes	42	11.1
	No	338	88.9
Government support for livestock	Yes	13	3.4
	No	367	96.6
Insurance of livestock	Yes	46	12.1
	No	334	87.9

+ Percentage may exceed 100 due to multiple responses

Data reveals that agro-farming was the primary source of income of the 257 (68%) respondents' households, whereas a few households were involved in public services, livestock farming, foreign employment and trade as their main sources of income with 8.7, 7.9, 7.6 and 7.1 percent respectively. Financially, the majority of the livestock farmers (78.0%) earned a very low amount of money (<15,000 per month) through their livestock. In terms of education, slightly more than half (52.0%) of the respondents had basic-level education, 44 percent of them had secondary-level

education and a few (4.0%) were illiterate. Very nominal (3.0%) of the livestock farmers were found to have received training related to livestock farming.

Similarly, in the study, 9 out of 10 (91.8%) households were found to have kept mixed types of livestock where poultry, goat/ sheep, buffalo and cow are the common rearing livestock (90%, 68%, 53%, and 28% respectively) in their households, although the main aim of that farming was found to be household consumption (86%). Data also show that only 13 (3.4%) farmers received government support for livestock farming, and a little more than one in ten (12.1%) farmers were enrolled in the insurance programme of their livestock with the collaboration of the veterinary office and the local farmer's cooperative, while a similar percentage of respondents (11.1%) shared their experience with the death of livestock in which they reported that some of such deaths were caused even by a zoonotic agent within one year of the study (Table 7).

### **Category of Keeping Livestock Bases in Ecological Zone**

The data show that cows, goats/sheep and poultry/ ducks were the livestock kept in all study districts. However, cows and poultry were found at higher percentages (80.23% and 96.5% respectively) in the Nawalpur district than in other study districts. Similarly, pigs and buffalo were reared only in Tanahun and Naralpur districts, while Yak / Chauri were reared exclusively only in Manang district (Table 8).

**Table 8.** *Category of keeping livestock in household based by the eco-belt*

Livestock Households →	Manang		Tanahun		Nawalpur	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Cow	25	78.12	128	72.72	138	80.23
Buffalo	0	0	90	51.1	110	64.0
Goat/Sheep	27	84.4	139	79.0	94	54.7
Poultry/ Duck	28	87.5	146	83.0	166	96.5
Pig	0	0	7	4.0	19	11.0
Yak/Chauri	7	21.6	0	0	0	0

### Information on Zoonoses and Sources of the Information

Data show that nearly all livestock farmers (96%) have heard about zoonotic bird flu, while 91 percent are informed about rabies, and slightly more than half of respondents (54%) did so about zoonotic swine flu (Table 9).

**Table 9.** *Information on Zoonoses and Sources of Information*

Variables	Attributes	Frequency[N=380]	Percent
Information on zoonoses +	Rabies	345	90.7
	Brucellosis	6	1.6
	Swine flu	206	54.2
	Bird flu	364	95.8
	Neurocysticercosis	10	2.6
	Bovine TB	12	3.2
	I don't know	2	0.5
Variables	Attributes	N=378	%
Source of information	Radio/TV/Newspaper	353	93.4
	HF's and health workers	197	52.1
	FCHVs	101	26.7
	Neighbours /friends	328	86.8
	Text book /curriculum	162	42.9
	Others	21	5.5

+ Percentage may exceed 100 due to multiple responses

The data additionally show that brucellosis, neurocysticercosis, and bovine tuberculosis were mentioned by very few respondents at 1.6, 2.6 and 3.2 percent respectively in the study.

Similarly, broadcasting media such as radio, television, and newspaper are the main sources of information in the farming communities. Out of 378 respondents, nearly all (93%) received information from these sources. Neighbours and friends are the second major sources of information (86.8%) among livestock farmers, and more than half (52%) received zoonoses-related information from health workers or health facilities, while more than 2 in 5 (42%) farmers received such information from curriculum and text book during their school period. Female Community Health Volunteers (FCHV) contributed more than one fourth (27%) to the information, and 5.5 percent were found to be exploring other media as a source of information related to zoonoses. However, they were informed about the zoonoses by more than one source (Table 9).

### **Knowledge on Zoonoses Based on Ecological Zone**

Rabies, brucellosis, bovine tuberculosis, avian influenza, swine flu, and tapeworm (neurocysticercosis) are the zoonotic diseases studied in this study.

#### ***Knowledge of Zoonotic Rabies***

Data show that of the 380 respondents, 91 percent heard of zoonotic rabies. Ecological distribution of such information about rabies on the part of the respondents is observed as follows. Manang, Tanahun and Nawalpur, that is 94.0, 86.0 and 95.0 percent, respectively (Table 10).

**Table 10.** Rabies; Knowledge According to the Ecological Zone

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Heard	345	90.7	30	93.8	151	85.8	164	95.3
Not heard	35	9.2	2	6.2	25	14.2	8	4.7
Causative agent of rabies								
Virus*	115	33.33	3	10.0	24	15.9	88	53.7
Others	91	26.37	2	6.7	76	50.3	13	7.9
I don't know	139	40.2	25	83.3	51	33.8	63	38.4
Symptoms of rabies +								
Hydrophobia	302	87.5	11	36.7	148	98.0	143	87.2
Salivation	145	40.02	19	63.3	17	11.3	109	66.5
Irritation	59	17.1	8	26.7	13	8.6	38	23.2
Mode of transmission								
Bitten by rabid animals... *	319	92.4	27	90.0	136	90.1	156	95.1
Other	15	4.3	0	0	15	9.9	0	0
I don't know	11	12.1	3	10.0	0	0.0	8	4.9
Preventive measure of rabies								
Wash the wound and contact HFs *	336	97.4	25	83.3	148	98.0	163	99.4
Others	4	1.1	1	3.3	3	2.0	0	0
I don't know	5	1.4	4	13.3	0	0.0	1	0.6
Knowledge of ARV (Freely availability in Gov. hospital)								
I know	153	44.3	0	0	40	26.5	113	68.9
I don't know	192	55.7	30	100.0	111	73.5	51	31.1
Possible outcome								
It is 100% fatal *	106	30.7	5	16.7	36	23.8	65	39.6
It is curable	192	55.7	14	46.7	105	59.0	73	42.4
I don't know	47	13.6	11	36.7	10	6.6	26	15.9
Overall knowledge on zoonotic rabies								
No knowledge	35	9.2	2	6.2	25	14.2	8	4.7
Some knowledge	271	71.3	28	87.5	147	83.5	96	55.8
Good knowledge	74	19.5	2	6.2	4	2.3	68	39.5

+ Percentage may exceed 100 due to multiple response // \* correct answer

The data reveal that of the 380, approximately a third (33.3%) respondents were aware of the causative agent of rabies. Symptoms of rabies such as hydrophobia, salivation, and irritation, were familiar to 87.5%; 40.0%; and 17% respectively. Similarly, more than 9 out of 10 (92.4%) respondents knew about the mode of transmission, while almost all respondents (97.4%) were aware of rabies preventive practices in the study. However, only 44 percent of the respondents had knowledge on the freely availability of anti-rabies vaccine at district level government hospitals, and nearly one third (31%) had an understanding of the prognosis of rabies, indicating a vulnerable situation in the study.

Ecologically, a higher percentage of respondents (53.7%) in Nawalpur had knowledge about the causative agent compared to other study districts. Symptoms of rabies including hydrophobia, salivation, and irritation, were well known by the respondents in Tanahun, Nawalpur, and Manang, with a percentage of 98.0%; 66.5% and 26.7% respectively. The majority of the respondents had knowledge on preventive measures (99.4%; 98.0% and 83.3%) in Nawalpur, Tanahun, and Manang, respectively. However, knowledge about the free availability of ARV (68.9%, 26.5%, and 0.0%) and the prognosis of rabies (39.6%, 23.8%, and 16.7%) was poor among respondents in Nawalpur, Tanahun, and Manang districts, respectively.

However, the overall knowledge of zoonotic rabies (good knowledge 19.5%) was found to be unsatisfactory in the study. When comparing the levels of Knowledge between the study districts, it is evident that a higher proportion of respondents in Nawalpur showed good knowledge (39.5%) compared to other study districts (Table 10).

### ***Knowledge of Zoonotic Brucellosis***

Brucellosis, a prevalent zoonotic disease in Nepal, typically spreads through aborted cattle and contaminated milk and its production processes. However, only a few livestock farmers had knowledge about zoonotic brucellosis, as found in the study.

**Table 11.** *Brucellosis; Knowledge According to Ecological Zone*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Heard about brucellosis								
Yes	6	1.6	0	0.0	3	1.8	3	1.8
No	374	98.4	32	100.	173	98.2	169	98.2
Brucellosis causative agent								
Bacteria*	2	33.3	0	0.0	1	33.3	1	33.3
I don't know	4	66.6	0	0.0	2	66.7	2	66.7
Brucellosis symptoms in human								
Fever and joint pain*	0	0.0	0	0	0	0	0	0
Others	2	33.3	0	0	1	33.3	1	33.3
I don't know	4	66.7	0	0	2	66.7	2	66.6
Brucellosis mode of transmission								
To consume raw milk.*	1	16.7	0	0	0	0	1	33.3
others	1	16.7	0	0	1	33.3	0	0
I don't know	4	66.6	0	0.	2	66.7	2	66.7
Preventive measures of brucellosis +								
Consumption of								
pasteurize milk	2	33.3	0	0	1	33.3	1	33.3
Use of PPE	3	50.0	0	0	2	66.7	1	33.3
Avoidance of animal touch	2	33.3	0	0	1	33.3	1	33.3
Overall knowledge on brucellosis								
No knowledge	374	98.4	32	100	173	98.29	169	98.25
Some knowledge	5	1.3	0	0	3	1.71	2	1.16
Good knowledge	1	0.3	0	0	0	0.0	1	0.58

+ Percentage may exceed 100 due to multiple response // \* correct answer

Table 11 shows the knowledge related to brucellosis among livestock farmers across various ecological regions in Nepal. Out of the 380 respondents, only 6 (1.6%) had heard about it. When comparing the three ecological zones, no respondents in Manang knew about it, and equal numbers of respondents, that is, only 3 (1.8%) in both Tanahun and Nawalpur districts, heard about brucellosis. Out of the three who knew about brucellosis, only one respondent (33.3%) from each district Tanahun and Nawalpur had knowledge regarding the causative agent. However, none of the respondents in any of the districts were familiar with the symptoms of brucellosis in human beings. Similarly, the mode of transmission was known by only one respondent (33.3) in Nawalpur, and preventive measures were known by higher respondents in Tanahun (66.6%) than in Nawalpur (33.3%).

Therefore, based on the correct response regarding brucellosis, livestock farmers had 98.4%, 1.3% and 0.3% that had no knowledge, some knowledge and good knowledge, respectively.

#### ***Knowledge on the Zoonotic Swine Flu***

Swine flu, a contagious zoonotic disease, is transmitted from infected pigs (swine) to humans. Farmers who have not adopted safety measures during exposure to infected pigs are susceptible to swine flu infection. Therefore, individuals engaged in swine farming should possess fundamental knowledge about pig-related zoonotic diseases such as swine flu. Table 12 illustrates the knowledge on swine flu among the livestock farmers in three ecological zones of Nepal.

**Table 12.** *Swine Flu; Knowledge According to Ecological Zone*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Heard	206	54.2	7	21.9	93	52.8	106	61.6
Not heard	174	45.8	25	78.1	83	47.2	66	38.4
Causative agent of swine flu								
Virus*	121	58.7	3	42.9	67	72.0	51	48.1
Others	19	9.2	0	0	16	17.2	3	2.8
I don't know	66	32.1	4	57.1	10	10.8	52	49.1
Symptoms of swine flu								
Like a normal flu	160	77.7	4	57.1	89	95.7	67	63.2
Others	3	1.4	0	0	1	1.1	2	2.1
I don't know	43	20.9	3	42.9	3	3.2	37	34.9
Mode of transmission								
Droplet infection	160	77.7	4	57.1	89	95.7	67	63.2
Other	2	0.9	0	0.0	1	1.1	1	0.9
I don't know	44	21.3	3	42.9	3	3.2	38	35.8
Preventive measures of swine flu +								
Avoid touch facial part	160	77.7	5	71.4	88	94.6	67	63.2
Avoid un-necessary travel	36	17.5	3	42.9	10	10.8	23	21.7
wear mask	123	59.7	5	71.4	55	59.1	63	59.4
Overall knowledge on zoonotic swine flu								
No knowledge	174	45.78	25	78.12	83	47.16	66	38.37
Some knowledge	117	30.78	3	9.37	49	27.84	65	37.79
Good knowledge	89	23.42	4	12.5	44	25.0	41	23.84

+ Percentage may exceed 100 due to multiple response // \* correct response

The data show that out of 380 respondents, only more than half (54%) heard about swine flu. Ecologically, 22, 53 and 62 percent respondents in Manang (n =32), Tanahun (n =176) and Nawalpur district (n =172) respectively, heard about it. Likewise, in total, 206 respondents who were informed about swine flu, only more than half (58.7%) had knowledge about the causative agent. In Tanahun district, a

higher percentage of respondents (72%) demonstrated knowledge about the causative agents compared to Nawalpur (48%), and Manang (43%) districts.

In calculating the number of respondents on both the knowledge of symptoms and the mode of transmission about swine flu in all study districts, they were equal. Nevertheless, the highest percentage of respondents (95.7%) who possessed knowledge about the mentioned areas were from Tanahu, surpassing those from Nawalpur (63.2%) and Manang (57.1%). The wearing of masks, one of the preventive methods for swine flu, was adopted by respondents with the trend 71.4, 59.4 and 59.4 percent in Manang, Tanahun, and Nawalpur, respectively. Furthermore, avoiding touching facial part unnecessarily was responded by the higher respondents in Tanahun (95%) as compared to the Manang (71%) and Nawalpur (63%). However, the least number of respondents across all study districts responded for avoiding unnecessary travel compared to other methods.

Therefore, based on correct responses, overall knowledge regarding swine flu among livestock farmers was as follows: 45.27% had no knowledge, 30.78% had some knowledge, and 23.42% had good knowledge. When comparing Knowledge levels between study districts, it is evident that a higher proportion of respondents in Tanahun showed the good knowledge (25.0%) compared to other study districts (Table 12).

### ***Knowledge on Zoonotic Bird Flu***

Avian influenza, commonly known as bird flu, and highly heard zoonotic disease in the study. It is highly contagious among avian species. However, due to close contact without safety precautions, people can contract bird flu, which poses a

significant risk to them. Table 13 unveils the knowledge of bird flu among livestock farmers in three ecological zones of Nepal.

**Table 13.** *Bird Flu; Knowledge According to Ecological Zone*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Heard about bird flu	364	95.8	28	87.5	173	98.3	163	94.8
Not Heard	16	4.2	4	12.5	3	1.7	9	5.2
Causative agent of bird flu								
Virus*	226	62.1	9	32.1	123	71.1	94	57.7
Others	11	3.0	0	0	5	2.9	6	3.7
I don't know	127	34.9	19	67.9	45	26.0	63	38.7
Bird flu mode of transmission +								
Contact without safety....	283	77.7	12	42.9	124	71.7	147	90.2
Consumption of raw poultry product	349	95.9	25	89.3	171	98.8	153	93.9
Contact infected poultry faeces	81	22.2	12	42.9	21	12.1	48	29.4
Symptoms of bird flu in poultry +								
Diarrhoea	124	34.1	3	10.7	105	60.7	16	9.8
Nasal discharge	51	14.0	3	10.7	34	19.7	14	8.6
Cough sneezing	21	5.8	2	7.1	13	7.5	6	3.7
Swelling eye lid and joint...	224	61.5	3	10.7	159	91.9	62	38.0
Preventive measures of bird flu +								
Consumed well-cooked poultry ...	345	94.8	22	78.6	172	99.4	151	92.6
Hand washing with soap water	286	78.6	22	78.6	143	82.7	122	74.8
Use PPE	153	42.1	7	25.0	40	23.1	106	65.0
Overall knowledge on zoonotic bird flu								
No knowledge	16	4.2	4	12.5	3	1.7	9	5.2
Some knowledge	344	90.5	27	84.4	158	89.8	159	92.4
Good knowledge	20	5.3	1	3.1	15	8.5	4	2.3

+ Percentages may exceed 100 due to multiple responses // \* correct response

Data shows that out of 380 respondents, almost all (96%) heard about bird flu. When comparing the study districts, it was found that respondents from all study districts heard about the disease at a similar percentage. For example, 98, 95 and 88 percent respondents had information about bird flu in Tanahun, Nawalpur, and Manang, respectively. However, knowledge of the causative agent was found to be low compared to the previous variable (heard about bird flu). Out of 364 respondents, only 62.1 percent knew about the causative agent. Ecologically, 71, 58 and 32 percent respondents had knowledge on the agent in Tanahun (n = 173), Nawalpur (n = 163), and Manang (n = 28), respectively.

If farmers have a knowledge of the mode of transmission of zoonotic diseases, they can break the chain of transmission that supports to protect them from various infections. The findings regarding bird flu were encouraging. Across all study districts, respondents demonstrated greater knowledge of bird flu transmission through the consumption of raw poultry products (meat or egg) with 99, 94 and 89 percent of respondents in Tanahun, Nawalpur and Manang, respectively. This awareness surpassed their understanding of other transmission routes, such as direct contact without safety precautions and contact with infected poultry faces. However, in terms of bird flu in poultry, the respondents in Manang and Nawalpur had poorer knowledge compared to Tanahun: 7.1 to 10.7 percent of respondents in Manang were aware of the symptoms along with 7.5 to 91.9 percent in Tanahun and 3.7 to 38 percent in Nawalpur. Similarly, the respondents had better knowledge about the preventive methods of bird flu in Tanahun compared to the other two districts. Out of the 173 respondents (99%) in Tanahun were familiar with at least one preventive

method of bird flu whereas 93 percent in Nawalpur (n=163), and 78 percent in Manang (n=28) knew about preventive methods.

So, based on the correct response on bird flu related knowledge among livestock farmers, overall knowledge was found; 4.2%, 90.5%, and 5.3% had no knowledge, some knowledge, and good knowledge, respectively. When comparing Knowledge levels between study districts, it is evident that a higher proportion of respondents in Tanahun had good knowledge (8.5%) compared to other study districts (Table 13).

### ***Knowledge of Zoonotic Tapeworm***

Neurocysticercosis (NCC) is a zoonotic condition wherein cysts of the tapeworm travel to the human brain. It is prevalent in Nepal; however, livestock farmers had little knowledge about it. Table 14 reveals the knowledge of neurocysticercosis caused by the cyst of tapeworm among the livestock farmers in studied three districts.

**Table 14.** *Neurocysticercosis; Knowledge According to the Ecological Zone*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Heard	10	2.7	4	12.5	3	1.7	3	1.8
Not heard	370	97.3	28	87.5	173	98.3	169	98.2
Causative agent								
Helminthic *	4	40.0	1	25.0	1	33.3	2	66.7
Others	2	20.0	1	25.0	0	0	1	33.3
I don't know	4	40.0	2	50.0	2	66.7	0	0.0
Symptoms of NCC in human								
Headache with fits *	8	80.0	3	75.0	3	100.0	2	66.7
Others	1	10.0	1	25.0	0	0	0	0
I don't know	1	10.0	0	0.0	0	0.0	1	33.3
Mode of transmission								
Faecal oral route *	1	10.0	1	25.0	0	0	0	0
Other	8	80.0	3	75.0	3	100.0	2	75.0
I don't know	1	10.0	0	0.0	0	0.0	1	25.0
Preventive measure of NCC								
Maintain food hygiene *	8	80.0	3	75.0	2	66.7	3	100.0
Others	1	10.0	0	0	1	33.3	0	0.0
I don't know	1	10.0	1	25.0	0	0.0	0	0.0
Overall knowledge on Tape worm								
No knowledge	370	97.4	28	87.5	173	98.3	169	98.3
Some knowledge	10	2.6	4	12.5	3	1.7	3	1.7
Good knowledge	0	0.0	0	0.0	0	0.0	0	0.0

\* *Correct response*

Of the total of 380 respondents, only 10 (2.7%) heard about the NCC. Geographically, higher respondents in Manang 4 (12.5%) were recorded than in Tananhu 3 (1.7%), and Nawalpur 3 (1.8%). Of the total of the respondents, only 4 (1%) had knowledge about the causative agent of NCC. With comparative analysis, 25.0 (n = 4), 33.3 (n = 3) and 66.7 (n = 3) percent of respondents were found to have known about causative agents in the Manang, Tanahun, and Nawalpur districts,

respectively. On the contrary, a large proportion of respondents were familiar with the symptoms of NCC than about the causative agent in Manang and Tanahun. However, only one respondent (3.1%) in Manang knew about the modes of transmission of NCC with none in the other two districts. Likewise, similar results were observed between the symptoms of NCC in humans and its preventive measures. Of the 380 respondents, only 8 (2.1%) knew about preventive measures. The comparative analysis reveals that 75.0 percent of the respondents in Manang (n=3), 66.7 percent in Tanahun (n=2), and 100.0 percent in Nawalpur (n=3) had knowledge of preventive measures against NCC.

So, based on the correct response regarding tapeworm (neurocystercosis) related knowledge among livestock farmers found; 97.4%, 2.6%, and 0.0% had no knowledge, some knowledge, and good knowledge, respectively. When comparing Knowledge levels across study districts, it is evident that a higher proportion of respondents in Manang had some knowledge (12.5%) compared to other study districts (Table 14).

### ***Knowledge on Zoonotic Tuberculosis***

Bovine tuberculosis is a prevalent zoonotic disease in Nepal. It is common in cattle. However, individual in close proximity to cattle without adequate safety measures are susceptible to contracting bovine tuberculosis. In this study, out of the total 380 respondents, only 12 (3.1%) heard about bovine TB. To compare in the study districts, none of the respondents in Manang (n = 32) had information about it; however, 1.7 (n = 176) percent in Tanahun and 5.2 (n = 172) percent of the respondents in Nawalpur heard about it. This was not a satisfactory result (Table 15).

**Table 15.** *Bovine Tuberculosis; Knowledge According to Ecological Zone*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Heard of bovine TB	12	3.1	0	0	3	1.7	9	5.2
Not heard	368	96.9	32	100.	173	98.3	163	94.8
Causes of bovine TB								
Bacteria*	4	33.33	0	0	2	66.7	2	22.2
Others	0	0	0	0	0	0	0	0
I don't know	8	66.7	0	0.0	1	33.3	7	77.8
Symptoms of bovine TB in animals +								
Continuous weight loss	5	41.7	0	0	1	33.3	4	44.4
Fever	3	25.0	0	0	0	0	3	33.3
Prolonged cough	5	41.7	0	0	2	66.7	3	33.3
Mode of transmission +								
Consume raw milk	6	50.0	0	0	1	33.3	5	55.6
Droplet from animals	4	33.3	0	0	1	33.3	3	33.3
Contact animals wound	4	33.3	0	0	1	33.3	3	33.3
Prevention of bovine TB +								
Consume boil milk	8	66.7	0	0	2	66.7	6	66.7
Use of PPE	5	41.7	0	0	2	66.7	3	33.3
Immunization	1	8.3	0	0	0	0	1	11.1
Overall knowledge on bovine TB								
No knowledge	368	96.8	32	100	173	98.3	163	94.8
Some knowledge	6	1.6	0	0.0	1	0.6	5	2.9
Good knowledge	6	1.6	0	0.0	2	1.1	4	2.3

+ Percentages may exceed 100 due to multiple responses // \* correct response

Regarding Knowledge on other variables such as the causative agent and symptoms of bovine TB, the respondents in Manang, had no idea about it. However, equally 2 respondents in Tanahun (66.7%, n = 3), and Nawalpur (22.2%, n = 9) were found to have known about the causative agent as bacteria. Similarly, 33.3 to 66.7 percent of respondents in Tanahun and 33.3 to 44.4 percent in Nawalpur correctly responded to at least one answer on the symptoms of bovine TB in animals.

Knowledge among respondents on the modes of transmission of bovine tuberculosis was found as follows: consuming raw milk (33.3 %) in Tanahun, (55.6 %) in Nawalpur; droplets and contact with infected wounds (33.3) in both districts. Similarly, equally 66.7 percent respondents from Tanahun and Nawalpur responded that consuming pasteurized milk was one of the preventive methods of BTB. Sixty-six percent of the respondents in Tanahun and 33 percent in Nawalpur agreed on PPE as preventive methods against bovine TB. However, immunization as the preventive method to their children as soon as possible after birth which protects from tuberculosis was responded by one respondent (11.1%) only in Nawalpur (Table 15).

So, based on the correct response regarding bovine tuberculosis related knowledge among livestock farmers found; 96.8%, 1.6%, and 1.6% had no knowledge, some knowledge, and good knowledge, respectively.

In conclusion, based on data, 5.3%, 19.5% and 23.42% respondents had good knowledge; 90.5%, 71.3% and 30.78% had some knowledge of zoonotic bird flu, rabies and swine flu respectively. However, in relation to bovine tuberculosis, neurocysticercosis, and brucellosis, only a small percentage of the respondents had some and good knowledge in the study. Ecologically, in Tanahun, a higher proportion of respondents (8.5% and 25.0%) demonstrated good knowledge regarding zoonotic bird flu and swine flu, respectively. In Nawalpur, 39.5%; 2.3%; and 0.58% of respondents had good knowledge of zoonotic rabies, bovine tuberculosis, and brucellosis, respectively. However, it is not worth anything that none of the respondents demonstrated a good knowledge of neurocysticercosis in the study.

## Perception Towards the Zoonoses

People interpret their surroundings and events through their past experiences, and their actions are influenced by these perceptions. Table 16 illustrates the perceptions of livestock farmers regarding zoonotic diseases, which can shape the implementation of various preventive measures to mitigate zoonotic risks.

**Table 16.** *Farmer's Perception towards Zoonoses*

Statement	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
It is believed that humans and animals can pass diseases to one another								
Agree	372	97.9	30	93.8	170	96.6	172	100.0
Neutral	7	1.8	2	6.3	5	2.8	0	0.0
Disagree	1	.3	0	0.0	1	0.6	0	0.0
Traditional healers cure zoonotic diseases like rabies								
Agree	25	6.6	1	3.1	1	0.6	23	13.4
Neutral	20	5.3	9	28.1	5	2.8	6	3.5
Disagree	335	88.2	22	68.8	170	96.6	143	83.1
It is likely I will get sick from livestock (i.e., Rabies) sometime during my life								
Agree	348	91.6	31	96.9	149	84.7	168	97.7
Neutral	26	6.8	1	3.1	22	12.5	3	1.7
Disagree	6	1.6	0	0	5	2.8	1	0.6
If I got sick from livestock (e.g., rabies, brucella), the illness would be very bad								
Agree	356	93.7	31	96.9	154	87.5	171	99.4
Neutral	22	5.8	0	0	22	12.5	0	0
Disagree	2	0.5	1	3.1	0	0	1	0.6
When I wash my hands after cleaning up animal waste, I am decreasing my chances of getting zoonoses								
Agree	346	91.1	30	93.8	152	86.4	164	95.3
Neutral	31	8.2	0	0	24	13.6	7	4.1
Disagree	3	0.8	2	6.3	0	0	1	0.6
By talking with veterinarian about the risk of zoonoses, I am doing something to care for myself and animals								
Agree	317	83.4	22	68.8	134	76.1	161	93.6
Neutral	58	15.3	9	28.1	39	22.2	10	5.8
Disagree	5	1.3	1	3.1	3	1.7	1	0.6
Washing my hands each time after interacting with my animals will take too much time								
Agree	183	48.2	2	6.3	110	62.5	71	41.3
Neutral	68	17.9	5	15.6	38	21.6	25	14.5

Statement	Total	Manang		Tanahun		Nawalpur		
Disagree	129	33.9	25	78.1	28	15.9	76	44.2
I have talked with my veterinarian about the risks of diseases shared between humans and animals								
Agree	131	34.5	8	25.0	65	36.9	58	33.7
Neutral	111	29.2	8	25.0	58	33.0	45	26.2
Disagree	138	36.3	16	50.0	53	30.1	69	40.1
I encourage other family members to thoroughly wash their hands after interaction with animals								
Sometime do	204	53.7	20	62.5	92	52.3	92	53.5
Usually do	150	39.5	10	31.3	65	36.9	75	43.6
Always do that	26	6.8	2	6.3	19	10.8	5	2.9

Table 16 presents that out of 380 respondents, almost all (97.9%) agreed with the statement, 'it is believed that humans and animals can pass diseases to one another'. However, the very nominal (0.3%) respondents disagreed and the remaining (1.8%) were found neutral. According to the data, of the study districts, all respondents (100) in Nawalpur, 97 and 94 percent in Tanahun and Manang, respectively agreed on the statement.

Out of the total respondents, nearly 9 in 10 (88%) respondents disagreed on the statement that 'traditional healers cure zoonotic diseases like rabies', but 6.6 percent agreed, and 5.3 percent found neutral. Districts based perception towards the statement stood at 97, 83 and 69 percent respondents disagreeing in Tanahun, Nawalpur and Manang, respectively. This means that most of the livestock farmers in the study areas did not trust traditional healers to cure zoonotic diseases. Similarly, with the statement, 'it is likely I will get sick from livestock (i.e. rabies) sometime during my life', almost all (91.6%) respondents expressed positive expression (agree), but very few (1.6%) disagreed, and 6.8 percent were neutral. The perceptions of the respondents in two districts were almost similar with the exception of Tanahun, where 13% were neutral.

In the statement 'If I got sick from livestock (e.g., rabies, brucella), the illness would be very bad', 93.7 percent respondents agreed, 6 percent were neutral, and very few (0.5%) disagreed. A similar perception was found in the Manang and Nawalpur districts (96.9 and 99.4 respectively), but in Tanahun, the percentage of those who agreed was found to be low (88%) compared to other districts.

In the statement, 'When I wash my hands after cleaning up animal waste, I am decreasing my chances of getting zoonoses', more than ninety (91.1%) respondents were found to have agreed. However, less than ten percent (8.2%) were neutral and 0.8 percent disagreed. Looking at the perception at the district level, Manang (93.8%), Tanahun (86.4%) and Nawalpur (95.3%) perceived that they would benefit (agree) from such practice.

By talking to the veterinarian about the risk of zoonotic disease, I am doing something to care for myself and my animals. This statement sought to measure the cues to action of livestock farmers to control zoonoses. In this context, more than 4 in 5 (83%) agreed, (1.3%) disagreed, and (15%) respondents found neutral on the statement. Talking about study districts, more respondents in Nawalpur (94%) agreed in comparison to 76 and 69 percent in Tanahun and Manang, respectively.

Likewise, the statement 'washing my hands each time after interacting with my animals will take too much time', where out of 380 respondents, nearly half (48%) of respondents perceived hand washing as a time barrier. However, one third (34%) of the respondent disagreed and 18 percent found neutral on the statement. When comparing the study districts, a higher percentage of respondents (78%) in Manang disagreed compared to 16 and 44 percent in Tanahun and Nawalpur, respectively. However, almost two thirds (63%) in Tanahun, 41 percent in Nawalpur, and 6 percent

of the respondents in Manang perceived daily hand washing after interaction with livestock as a time barrier. However, nearly 15.6, 21.6, and 14.5% percent of the respondents from Manang, Tanahun, and Nawalpur, respectively were found to be neutral in the statement.

In the statement, 'I have talked with my veterinarian about the risk of diseases shared between humans and animals,' 36.3 percent of respondents disagreed, 34.5 percent agreed, and 29.2 percent were neutral. The analysis shows that 25, 37 and 34 percent of respondents agreed in Manang, Tanahun, and Nawalpur districts, respectively. However, 50, 30 and 40 percent livestock farmers disagreed on this statement, and around one-quarter of the respondents in all districts were neutral.

In the statement, 'I encourage other family members to thoroughly wash their hands after interaction with animals,' majority of the respondents (53%) sometimes encouraged their family members in that, 40 percent usually encouraged, and 7 percent respondents always encouraged their families in this direction. At the district level, only 6, 11 and 3 percent respondents always encouraged; 31, 37 and 44 percent usually encouraged; and 63, 52 and 54 percent respondents sometimes encouraged their family members about hand washing after interaction with animals in Manang, Tanahun, and Nawalpur districts, respectively (Table 16).

### **Zoonoses Preventive Practices**

Healthy practices contribute to positive health and well-being. Since animals frequently serve as host for many zoonotic diseases, individuals closely exposed to livestock are vulnerable to zoonoses. Therefore, to prevent zoonoses, it is necessary for livestock farmers to follow safety practices. Table 17 unveils some practices carried out by livestock farmers in the study districts.

**Table 17.** *Practices of Personal Protective Equipment's to Prevent from Zoonoses*

<b>Variables</b>	<b>Total</b>		<b>Manang</b>		<b>Tanahun</b>		<b>Nawalpur</b>	
Hand washing with soap water after close contact to livestock								
	N=380	%	N=32	%	N=176	%	N=172	%
Regular	231	60.8	23	71.9	50	28.4	158	91.9
Occasionally	149	39.2	9	28.1	126	71.6	14	8.1
Mask wearing during exposure with livestock / poultry								
Regular	25	6.6	2	6.3	2	1.1	21	12.2
Occasionally	161	42.4	4	12.5	107	60.8	50	29.1
Never	194	51.1	26	81.3	67	38.1	101	58.7
Gloves using during caring the livestock / poultry								
Regular	7	1.8	1	3.1	1	0.6	5	2.9
Occasionally	106	27.9	15	46.9	71	40.3	20	11.6
Never	267	70.3	16	50.0	104	59.1	147	85.5
Boot wearing during exposure with livestock / poultry								
Regular	5	1.3	2	6.3	0	0	3	1.7
Occasionally	77	20.3	19	59.4	46	26.1	12	7.0
Never	298	78.4	11	34.4	130	73.9	157	91.3
Availability of above PPE in households during interview time								
Soap	347	91.3	32	100	167	94.9	148	86.0
Mask	150	39.4	5	15.6	64	36.4	81	47.1
Gloves	56	14.8	10	31.3	19	10.8	27	15.7
Boots	31	8.1	20	62.5	5	2.8	6	3.0

Table 17 shows the everyday practices of livestock farmers during exposure to livestock. Among the 380 respondents surveyed, over half (60.8%) reported consistently washing their hands with soap and water after direct contact with livestock. However, 39.2 percent of the people were found to have been washed with soap only occasionally. Ecologically, the hand washing pattern in all three districts was found to fluctuate with (71.9%) in Manang, (28.4%) in Tanahun, and (91.9%) in Nawalpur districts and a significant number of respondents still avoided using soap water during the hand washing period after close exposure to livestock.

Mask wearing practices during exposure at the farm / shed were poor in study districts. Out of a total of 380 respondents, only 6.6 percent of livestock farmers wore a mask regularly. However, due to the impact of the COVID -19 pandemic, 42 percent of farmers used masks occasionally, while more than half (51%) never wore masks on their farm. In comparing the results among the studied three districts, only 12, 1 and 6 percent respondents wore masks regularly in Nawalpur, Tanahun, and Manang respectively. Additionally, more than 3 in 5 (61%) respondents in Tanahun used it occasionally. However, 4 in 5 (81%) of the respondents in Manang and 3 in 5 (59%) in Nawalpur never used mask during the exposure period.

Glove wearing practices were also found to be insubstantial among respondents. Out of 380 respondents, only 7 (1.8%) used gloves regularly during the livestock care period. More than two thirds (70%) never used gloves on their farm/ shed and nearly one-thirds (28%) respondents used it only occasionally. Ecologically, very few respondents in Manang (3.1%), Tanahun (0.6%) and Nawalpur (2.9%) regularly used gloves during close exposure with livestock, whereas 46.9 percent, 40.3 percent and 11.6 percent used it occasionally. However, a large number of respondents (50.0, 59.0, and 85.5%) in Manang, Tanahun, and Nawalpur respectively, never used gloves. Likewise, in Manang, 6.3% of the respondents regularly wore boots, which was higher than in the other two districts. In contrast, none of the respondents in Tanahun used boots regularly and only a few (1.7%) in Nawalpur did so.

The analysis indicates that livestock farmers were more vulnerable than ever to zoonosis due to the lack of proper use of PPE. Hand washing with soap water, which is easy and affordable PPE in farming communities, was also found only by

60% in the study. However, preventive practices and the availability of personal protective equipment (PPE) in the household, such as soap, masks, gloves and boots, during the interview period were found to be similar to each other. Out of 380 respondents, 91, 39, 15 and 8 percent households had soap, mask, gloves and boots available, respectively. The relationship between preventive practices and the availability of PPE is consistent (Table 17).

### ***Farm and Household Sanitation Practices***

In Nepal, most of the livestock farmers involved in mixed farming rely on traditional practices. The level of farm and household sanitation within these farming communities is influenced by factors such as socioeconomic status, education, and various sociocultural aspects of the community.

**Table 18.** *Farm and Households Sanitation Base on Ecological Zone*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Cleanness of farm / shed								
Clean/ good	62	16.3	7	21.9	42	23.9	13	7.6
Acceptable	306	80.5	25	78.1	125	71.0	156	90.6
Poor	12	3.2	0	0	9	5.1	3	1.7
Home environment of livestock farmers								
Clean	95	25.0	8	25.0	39	22.1	48	27.9
Acceptable	277	72.9	24	75.0	131	74.5	122	70.9
Poor	8	2.1	0	0	6	3.4	2	1.2
Toilet sanitation								
Clean	60	15.8	10	31.2	11	6.2	39	22.7
Acceptable	283	74.5	22	68.8	134	76.2	127	73.8
Poor	37	9.7	0	0	31	17.6	6	3.5

Table no 18 reveals that the sanitation of the sheds in the study districts was consistently rated as good or acceptable. Out of 380 sheds/ farm, 81 percent were deemed acceptable and 16 percent were considered to have good sanitation. However,

in Tanahun and Nawalpur districts, 5 and 2 percent of the sheds, respectively, were found to have poor sanitation.

Data also show that out of 380 households, more than two-third (73%) of the households and their surrounding were found to be satisfactory, whereas one-fourth (25%) were found to have good sanitation during the study period. Similarly, two percent of households were found to have a poor environment according to public health aspects. Data compared across the studied districts found that 75 percent both Manang and Tanahun, and 71 percent in the households of Nawalpur district were satisfactory. However, 3 and 1 percent of households were found to have poor environment in Tanahun and Nawalpur, respectively.

Similarly, during the assessment of toilet sanitation, among the 380 households, 75 percent toilets were found to be in acceptable condition and 16 percent were found to be well in terms of public health. However, 10 percent of the toilets were still found to have poor sanitation in these communities. While doing comparative study, in the studied districts, 18 percent (n=176) toilets were in poor condition in Tanahun and 4 percent (n=172) in Nawalpur.

### ***Livestock Caring, Consumption and Waste Management Practices***

Most diseases that can transfer from animals to humans are usually contracted through direct contact. Handling or being in close proximity to livestock without adequate personal protective equipment (PPE) can result in people contracting a variety of zoonotic infections. Table 19 shows some of the existing practices of the livestock farmers in the study districts.

**Table 19.** *Livestock Related Common Practices in Farming Communities*

Variables	Total		Manang		Tanahun		Nawalpur	
	N=380	%	N=32	%	N=176	%	N=172	%
Disposal practices of dead animals								
Digging hole	336	88.4	6	18.8	176	100.	154	89.5
Throw into the river	44	11.6	26	81.2	0	0	18	10.5
Children exposure to livestock								
Yes	254	66.8	28	87.5	149	84.7	77	44.8
No	126	33.2	4	12.5	27	15.3	95	55.2
Pregnant women exposure to livestock								
Yes	248	65.3	31	96.9	153	86.9	64	37.2
No	132	34.7	1	3.1	23	13.1	108	62.8
Sick animal consuming practices								
Yes	64	16.8	23	71.9	17	9.7	24	14.0
No	316	83.2	9	28.1	159	90.3	148	86.0
Caring practice during parturition or abortion of livestock								
Gloves	55	14.5	1	3.1	15	8.5	39	22.7
Bare hands	325	85.5	31	96.9	161	91.5	133	77.3
Vaccination practice to livestock								
Yes	135	35.5	3	9.4	8	4.6	124	72.1
No	245	64.5	29	90.6	168	95.4	48	27.9

Table 19 shows that out of 380 respondents, 88 percent of the respondents have disposed of dead animals in the holes, while 12 percent threw them into the nearest rivers. When compared with different studied districts, 100, 89 and 19 percent of the respondents dispose of dead animals in digging holes in Tanahun, Nawalpur and Manang, respectively. However, the majority (81%) of farmers in Manang disposed of dead animals on the nearest river. Likewise, among 380 surveyed farmers, over two-thirds (67%) reported that their children had frequent contact with livestock. These exposures were more prevalent in Manang and Tanahun, reaching 88 and 85 percent respectively, compared to 45 percent in Nawalpur. Similarly, out of 380 households, more than two-thirds (65%) of the pregnant women in the role of

animal care takers were closely exposed to their livestock. The prevalence of this practice was higher in Manang (97%) and Tanahun (87%) compared to Nawalpur (37%). Likewise, among the 380 respondents, 17 percent households still consume meat from sick animals. This behaviour was more prevalent in Manang (72%, n=32) compared to Nawalpur (14%, n=172) and Tanahun (10%, n=176).

Close exposure such as taking care during parturition or abortion is a possible situation to transmit zoonoses to humans. In this study, out of total respondents, most (86%) were exposed to livestock with bare hands, and only 14 percent used gloves as protective equipment. Compared between the districts studied, almost a fourth (23%) of the livestock farmers in Nawalpur used gloves during these situations and the ratio was found to be low in Tanahun and Manang (8.5 and 3.1%), respectively. Similarly, vaccination practices were also observed to have poor coverage in study districts. Out of 380 respondents, only one third (36%) have vaccinated their livestock as a pre-exposure prophylaxis. The results indicate that Nawalpur had a higher coverage rate (72%) compared to Manang (9%) and Tanahun (5%). According to the data, a significant portion of farmers seemed to have ignored vaccination as a preexposure prophylaxis in all ecological zones. This can lead to zoonotic outbreaks at any time and anywhere (Table 19).

### **Health Care Seeking Behavior of Livestock Farmers**

The researcher tried to identify the health care seeking behaviour of livestock farmers during the illness of their family members and domesticate livestock. The health care seeking behaviour has to do with the decision-making process of an individual or family members during the illness. It may be influenced by several factors such as education, wealth, or the norms and values of the entire community.

In this study, more than 9 in 10 (91.6%) respondents' households visited the health institutions and health workers during their illness, and a similar number of households (93%) also contacted veterinarians during their animal health problems. Where nearly one in ten (8.4%) and (7.1%) households still believe in traditional healers such as Dhami / Jhankri (shamans) or Lama / Purohit during human and livestock illnesses (Table 20).

**Table 20.** *Health Care Seeking Behaviour of Livestock Farmers*

Variables	Total		Manang		Tanahun		Nawalpur	
	380	%	32	%	176	%	172	%
First contact for treatment of family member								
Health institution	348	91.6	5	15.6	173	98.3	170	98.8
Traditional healer	32	8.4	27	84.4	3	1.7	2	1.2
First contact for treatment of livestock sickness								
Veterinarian	353	92.9	13	40.6	173	98.3	167	97.1
Traditional healer	27	7.1	19	59.4	3	1.7	5	2.9

When comparing the health care seeking behaviour among the studied three districts, it was found that the Tanahun and Nawalpur districts resembled similar behaviour, where almost (98 and 99%) livestock farmers in the districts initially consulted a health institution or health workers during their illness. However, in Manang, the majority of the respondents' households (84.0%) still followed traditional healing practices such as Dhami, Jhankri or other herbal therapy initially during their sickness.

Not only in case of human illness, people in Tanahun and Nawalpur districts were also found to giving equal priority to the health of their livestock. Almost equal (98 and 97%) farmers visited veterinarians for their livestock treatment in Tanahun and Nawalpur districts, respectively. But in Manang, only less than half (41%) farmers contacted veterinarians. This number was nearly three times higher compared

to the farmers who visited health institutions (15.6%) to consult on human health. However, in the study, the health care seeking behaviours of the community were perceived differently by the participants in the qualitative phase.

### ***Subjective Reflection on Health Care Seeking Behaviour***

The views on healthcare-seeking behaviors differed between focus group participants and healthcare providers compared to survey respondents. This disparity unveils a significant gap between the experiences of those surveyed and the perspectives of service providers, emphasizing the intricacies of the dynamics of community health.

*At first, people tend to contact traditional healers or treat themselves using herbal remedies; however, it depends on the nature of the illness.*

It depends on the nature of illness. Most people would visit traditional healers or self-medicate with herbal therapy, and if those practices did not subside the illness, people would visit health institutions.

- [KII- Paramedic/F/25yr/Ma]

FGD participants mentioned that: *because of easy access to health facilities, people visit there at first.*

It depends on the nature of sickness. If there is a health institution near our households, we generally visit there. Otherwise, we use traditional or herbal therapy like *Jadibuti and Dhami, Jhankri*. But nowadays health workers are available in our community, so we first contact them. - [Farmer/M/49 yr/Ma]

*Health-seeking behaviors depend on the nature of illness and socioeconomic factors.*

I have been working here since 2015. The community people in this area takes advantages of both practices side by side during their sickness. However, in mostly surgical cases, people initially visit the health institutions. Other less serious sicknesses are cured by superstitious mediums like *witchcraft and worshipping gods and goddesses*. The sociocultural, educational, or financial status of families also influences those practices in these communities. – [KII- Paramedic/M/31yr/Ta]

FGD participants also state that: *At first, people rely on herbal or home-based care for minor illness and seek further treatment if illness persists.*

Simply, having fever, pain, etc. is treated with general medicine and herbs at home. Even if after 1-2 days the disease remains same, we take them to

nearby chemists or hospital, and if the sick person does not see any improvement with this all, we also take the sick person to witch doctors.

- [Farmer/M/54yr/Ta].

*Traditional healers are easily accessible and are often the first contact for childhood illness.*

There are 20 -22 *witch doctors* (Dhami / Jhankri) in this area where most sick children go to the *witch doctors*. If health conditions do not improve, they prefer to go to health institutions.

- [KII- Paramedic /M/39yr/Na].

FGD participants explain that: *For some chronic or mental illnesses, they prefer to visit traditional healers; however, they visit hospitals for treatment of other maladies.*

We do visit doctors, but first we go to *witch doctors*. It depends on the nature of disease. We might either go to *witch doctors* or hospitals. When the patient is severing, (convulsion/ fits) shaking, then we go to *lamas, or witch doctors*, but we remain unaware about the reason why. - [Farmer/M/65yr/Na]

### **Activities Based on One Health Approach**

The researcher conducted a key informant interview (KII) related to the One Health (OH) approach, which is an emerging concept for controlling zoonoses. The findings revealed that most of the participants, who were health service providers in both fields of public health and veterinary medicine, had limited knowledge of this approach. Most of the programs in their institutions were found to have been conducted vertically in a traditional approach. However, they acknowledged the importance of multi-sectoral collaboration to control zoonoses with the related themes mentioned below.

### **Collaboration and cooperation against zoonoses**

*Veterinary health workers accepted mutual collaboration (OH) against zoonoses. They mention that:*

If we conduct mutual programs with multisectoral collaboration, it might be effective to control the zoonoses. - [Vet. /M/54yrs /Ma].

*The Veterinarian accepted the One Health (OH) concept, and has started to implement their programs in a collaborative approach:*

Of course, we should do it anyway. Currently, we have been coordinating with government health facilities and performing some targeted programs. But we have not practiced in the clinical protocol. If we were able to do so, zoonotic diseases might be under control. - [Vet. /M/28yr/Na].

But public health facilities in all studied districts conducting their programs vertically as a traditional approach. These facilities lack prior information on the concept of One Health (OH) approach, and no organization has implemented any programs based on the One Health approach in study communities.

### **Association; Sociodemographic Variables and Zoonoses Preventive Practices**

In general, human behaviour tends to be influenced by the cultural norms prevalent in their home and society. People often adopt these cultural practices without questioning their validity until they encounter intervention programs aimed at promoting positive change. In this chapter, the researcher tried to find out the association between some sociodemographic variables and the zoonoses preventive practices carried out by the livestock farmers. Table 21 illustrates the association between sociodemographic variables and daily handwashing practices with soap and water among livestock farmers following close contact with their animals.

**Table 21.** *Hand Washing Practices by Sociodemographic Variables*

Variables	Total		Hand washing with soap water				X <sup>2</sup>	P- value
	N	%	Regular	%	Occasionally	%		
Age								
20-39	227	59.7	172	75.8	55	24.2	53.62	***
40-59	128	33.7	51	39.8	77	60.2		
60 and above	25	6.6	8	32.0	17	68.0		
Sex								
Female	174	45.8	85	48.9	89	51.1	19.19	***
Male	206	54.2	146	70.9	60	29.1		
Education								
Below secondary	215	56.6	86	40.0	129	60.0	89.78	***
Secondary and above	165	43.4	145	87.9	20	12.1		
Aim of Farming								
Household consuming	328	86.3	194	59.1	134	40.9	2.71	NS
Commercial	52	13.7	37	71.2	15	28.8		
Type of Farming								
Single	31	8.2	23	74.2	8	25.8	2.54	**
Mixed	349	91.8	208	59.6	141	40.4		

Note: *p* value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Non-significant

Based on the age of the respondents, younger farmers (20 -39 years) were found to be the highest users (75.8%) of soap and water after close contact with their livestock compared to the 40-59 age group (39.8%) and the age group over 60 years (32%), and the data reveal the significant association between age groups of the respondents and regular hands washing practices ( $\rho < 0.001$ ) in the study. Similarly, based on sex, a higher percentage (70.9%) of male were regular users of soap water than females (48.9%) with a significant association between sex and hand washing practices in the study ( $\rho < 0.001$ ).

Regarding the association of the level of education with hand washing practices, the higher respondents (87.9 %) having a secondary and above level education were found to wash hands with soap water regularly after close exposure to livestock than the respondents below secondary level education (40.0 %). This was statistically significant with their level of education ( $p < 0.001$ ).

Multivariate analysis also revealed that people with secondary and higher education were approximately 11 times (OR=10.9; 95% CI: 6.3-18.7) more likely to follow regular handwashing practices with soap water compared to those with education below the secondary level (Table 34).

Data also show that the farmers who adopted commercial livestock farming were found to be higher regular users of soap water (71.2%) compared to the household consuming farmers (59.1%), and farmers who were practicing a single type of livestock farming were higher users (74.2%) of hand washing with soap water than (59.6%) those who adopted mixed types of livestock. However, both variables (household farming and commercial farming/single and mixed types of farming) were not statistically significant in terms of hand washing practices with soap water.

#### ***Mask Wearing Practices by Sociodemographic Variables***

When observing mask-wearing practices among livestock farmers (Table 22), 20 -39 years of age group respondents were found to be more regular users of masks (9.7%), than (2.3%) of 40-59 years. But none of the farmers in the 60 and old age group were found to have worn masks regularly during close exposure to livestock and poultry. Thus, younger farmers were significantly associated with regular mask use practices. However, a larger number of livestock farmers in all age groups were rarely found to use masks during exposure to livestock.

**Table 22.** *Mask Wearing Practices by Sociodemographic Variables*

Variables	Mask Wearing Practice								X <sup>2</sup>	P- value
	N	%	Regular	%	Occa	%	Never	%		
Age										
20-39	227	59.7	22	9.7	108	47.6	97	42.7	22.1	*** (#)
40-59	128	33.6	3	2.3	48	37.5	77	60.1		
60 above	25	6.6	0	0.0	5	20.0	20	80.0		
Sex										
Female	174	45.8	8	4.6	80	46.0	86	49.4	3.06	NS
Male	206	54.2	17	8.3	81	39.3	108	52.4		
Education										
Below secondary	215	56.6	7	3.3	91	42.3	117	54.4	9.27	** (#)
Secondary and above	165	43.4	18	10.9	70	42.4	77	46.7		
Aim of farming										
Household consume	328	86.3	22	6.7	140	42.7	166	50.6	0.16	NS (#)
Commercial	52	13.7	3	5.8	21	40.4	28	53.8		
Type of farming										
Single	31	8.2	1	3.2	11	35.5	19	61.3	1.26	NS (#)
Mixed	349	91.8	24	6.9	150	43.0	175	50.1		

Note: Occa = Occasionally, # refers to Fisher's Exact test values // p value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Not-significant

Based on sex, a higher number of male respondents (8.3%) used masks regularly than (4.6%) females. However, a larger number (46.0 and 39.3%) of both male and female respondents used masks only occasionally and nearly half (49.4 and 52.4%, female and male respondents, respectively) never used them during the exposure period. Therefore, based on the data, mask-wearing practices were nonsignificant with sex ( $\rho > 0.05$ ).

On comparing mask users with the level of education of livestock farmers, it was found that farmers with higher education (secondary and above) were found to be more regular users of the mask (10.9%) than those with below secondary level

education (3.3%). Therefore, education and regular mask using practices were found to be statistically significant (10.9%,  $\rho < 0.01$ ). However, the purpose of farming and the types of farming were not associated with regular mask use practices in the study (Table 22).

### ***Gloves Using Practices by Sociodemographic Variables***

Data shows that only very few livestock farmers in the age group 20-39 (2.2%), 40 -59 (1.6%) and above 60 (0%) used gloves regularly during close contact with livestock. However, the data showed statistical significance ( $\rho < 0.01$ ) with age factors and gloves-wearing practices in the study. Similarly, in terms of sex, the least respondents used gloves regularly (female = 1.7% and male = 1.9%) in the study. Data also reveal that respondents with higher education followed regular gloves using practices more (2.4%,  $\rho < 0.001$ ) than those with below secondary education (Table 23).

**Table 23.** *Gloves Wearing Practices by Sociodemographic Variables*

Variable	Gloves Wearing Practice									
	N	%	Regular	%	Occa.	%	Never	%	X2	P-value
Age										
20-39	227	59.7	5	2.2	74	32.6	148	65.2	12.36	** (#)
40-59	128	33.7	2	1.6	31	24.2	95	74.2		
60 and above	25	6.6	0	0.0	1	4.0	24	96.0		
Sex										
Female	174	45.8	3	1.7	56	32.2	115	66.1	2.98	NS (#)
Male	206	54.2	4	1.9	50	24.3	152	73.8		
Education										
Below secondary	215	56.6	3	1.4	46	21.4	166	77.2	11.41	** (#)
Secondary and above	165	43.4	4	2.4	60	36.4	101	61.2		

Variable	Gloves Wearing Practice									
Aim of farming										
Household consuming	328	86.3	6	1.8	85	25.9	237	72.3	4.79	** (#)
Commercial	52	13.7	1	1.9	21	40.4	30	57.7		
Type of farming										
Single	31	8.2	1	3.2	7	22.6	23	74.2	1.26	NS (#)
Mixed	349	91.8	6	1.7	99	28.4	244	69.9		

*Note: # refers to Fisher's Exact test values // p value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS=Not-significant*

However, the purpose of farming (household consumption and commercial) and the types of farming (single and mixed) were not found to be associated with gloves using practices during the exposure period, while only 1 to 3 percent of the respondents used gloves regularly.

#### ***Boots Wearing Practices by Sociodemographic Variables***

The practice of wearing boots was found to be very low across all categories of respondents in the study. Respondents with variables such as age, sex, level of education and type of farming were found to have used boots least regularly during exposure with the livestock (only up to 2.4%). However, commercial farmers were found to be higher boots users (5.8%,  $p < 0.001$ ) than household consumer farmers (Table 24). So, a larger number of respondents who were found to be non-users of the boots or only occasional users, and data were nonsignificant with socio demographic variables and regular boots using practices in the study.

**Table 24. Boots Wearing Practices by Sociodemographic Variables**

Variable	Boots Wearing Practice									X2	P- value
	N	%	Regular	%	Occasionally	%	Never	%			
Age											
20-39	227	59.7	3	1.3	46	20.3	178	78.4	1.46	NS (#)	
40-59	128	33.7	2	1.6	28	21.9	98	76.6			
60 and above	25	6.6	0	0.0	3	12.0	22	88.0			
Sex											
Female	174	45.8	0	0	34	19.5	140	80.5	4.32	NS (#)	
Male	206	54.2	5	2.4	43	20.9	158	76.7			
Education											
Below secondary	215	56.6	3	1.4	35	16.3	177	82.3	4.90	NS (#)	
Secondary and above	165	43.4	2	1.2	42	25.5	121	73.3			
Aim of farming											
Household consuming	328	86.3	2	0.6	54	16.5	272	82.9	27.26	*** (#)	
Commercial	52	13.7	3	5.8	23	44.2	26	50.0			
Type of farming											
Single	31	8.2	0	0.0	7	22.6	24	77.4	0.198	NS (#)	
Mixed	349	91.8	5	1.4	70	20.1	274	78.5			

Note: # refers to Fisher's Exact test values // p value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Not-significant

### ***Sick Animal Consuming Practices by Sociodemographic Variables***

Based on age groups, a higher percentage of younger farmers (20-39 years) avoided sick animals consuming practices (88.4%,  $\rho < .001$ ), in comparison to the other age groups such as 40 -59 (75.8%) and above 60 (72.0%). Similarly, more household consumer farmers were found to have avoided the consumption of sick animals (85.3%,  $\rho < .001$ ) in comparison to commercial livestock farmers (69.2%).

**Table 25.** Sick Animal Consuming Practices by Sociodemographic Variables

Variable	Sick Animal Consuming Practices						Chi square	P- value
	N	%	Yes	%	No	%		
Age								
20-39	227	59.7	26	11.4	201	88.6	11.901	***
40-59	128	33.7	31	24.2	97	75.8		
60 and above	25	6.6	7	28.0	18	72.0		
Sex								
Female	174	45.8	28	16.1	146	83.9	0.129	NS
Male	206	54.2	36	17.5	170	82.5		
Education								
Below secondary	215	56.6	42	19.6	173	80.4	2.56	NS
Secondary and above	165	43.4	22	13.3	143	86.7		
Aim of farming								
Household consuming	328	86.3	48	14.6	280	85.3	8.343	***
Commercial	52	13.7	16	30.8	36	69.2		
Type of farming								
Single	31	8.2	5	16.1	26	83.9	0.12	NS
Mixed	349	91.8	59	16.9	290	83.1		

Note: *p* value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Not-significant

However, other variables such as sex, education and types of livestock farming were found nonsignificant in terms of sick animal consuming practices in the study (Table 25).

### **Children Exposure to Livestock by Sociodemographic Variables**

Table 26 shows the association between sociodemographic variables and the exposure of children to their livestock, in which it was found that children of younger farmers (20-39 years) were found to have a lower exposure to their livestock (61.7%;  $p < 0.05$ ) in comparison to the 40-59 and older 60 years of respondents (74.2 and 76.0%, respectively). Similarly, the children of the male respondents were found to

have a lower exposure to their livestock (59.7%;  $\rho < 0.001$ ) as compared with the children of female respondents (75.2%). Children of respondents with higher education were given lower exposure (54.5%;  $\rho < 0.001$ ) than children of respondents with below secondary education (76.3%) in the study. Multivariate analysis also indicates that individuals with secondary and higher education were 0.37 times (OR=0.37: 95% CI: .241-.579) less likely to have their children closely exposed to livestock than those who have a higher education than secondary level (Table 35).

**Table 26.** *Children Exposure to Livestock by Sociodemographic Variables*

Variable	Children Exposure to Livestock						X <sup>2</sup>	P- value
	N	%	Yes	%	No	%		
Age								
20-39	227	59.7	140	61.7	87	38.3	6.824	*
40-59	128	33.7	95	74.2	33	25.8		
60 and above	25	6.6	19	76.0	6	24.0		
Sex								
Female	174	45.8	131	75.2	43	24.8	10.329	***
Male	206	54.2	123	59.7	83	40.3		
Education								
Below secondary	215	56.6	164	76.3	51	23.7	19.89	***
Secondary and above	165	43.4	90	54.5	75	45.5		
Aim of farming								
Household consuming	328	86.3	218	66.4	110	33.6	0.155	NS
Commercial	52	13.7	36	69.2	16	30.8		
Type of farming								
Single	31	8.2	21	67.8	10	32.2	0.12	NS
Mixed	349	91.8	233	66.8	116	33.2		

Note: p value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Not-significant

However, children of household consuming farmers and commercial livestock farmers were given fairly similar exposure (66.4 and 69.2%) with livestock.

Likewise, 67.8 and 66.8 percentage from single and mixed types of livestock farmers' children were exposed to their livestock, and data were nonsignificant.

### ***Pregnant Women Exposure to Livestock by Sociodemographic Variables***

Data show that respondents from younger farmers' households (20 -39 years) had pregnant women less exposed to livestock (59.0%,  $\rho < 0.001$ ) than those respondents in the categories of 40- 59 years (72.7%) and older than 60 years (84%) (Table 27).

**Table 27.** *Pregnant Women Exposure to Livestock by Sociodemographic Variables*

Variable	Pregnant Women Exposure to Livestock						X <sup>2</sup>	P- value
	N	%	Yes	%	No	%		
Age								
20-39	227	59.7	134	59.0	93	41.0	10.847	***
40-59	128	33.7	93	72.7	35	27.3		
60 and above	25	6.6	21	84.0	4	16.0		
Sex								
Female	174	45.8	130	74.7	44	25.3	12.642	***
Male	206	54.2	118	57.3	88	42.7		
Education								
Below secondary	215	56.6	164	76.3	51	23.7	26.50	***
Secondary and above	165	43.4	84	50.9	81	49.1		
Aim of farming								
Household consuming	328	86.3	211	64.3	117	35.7	0.922	NS
Commercial	52	13.7	37	71.1	15	28.9		
Type of farming								
Single	31	8.2	17	54.8	14	45.2	1.618	NS
Mixed	349	91.8	231	66.2	118	33.8		

Note: *p* value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS=Not-significant

Similarly, pregnant women in the households of male respondents were given less exposure (57.3%,  $\rho < 0.001$ ) than female respondents (74.7%). Pregnant women in the home of respondents with higher education were given less exposure (50.9%,  $\rho < 0.001$ ) than the respondents with education below the secondary level (76.3%).

Multivariate analysis also revealed that respondents with secondary or higher education were 0.322 times (OR=0.322; 95% CI: 0.21-0.51) less likely to have pregnant women as animal caretakers exposed to livestock compared to those with education below the secondary level (Table 36). Therefore, variables related to education with secondary and above (50.9%,  $\rho < 0.001$ ), male respondents (57.3%,  $\rho < 0.001$ ), and younger respondents (59.5%,  $\rho < 0.004$ ) were found to be statistically significant in terms of exposure of pregnant women to livestock (Table 27).

#### ***Pre-exposure Vaccination to Livestock by Sociodemographic Variables***

To prevent several zoonoses, preexposure prophylaxis vaccination contributes a significant role to farming communities. Data show that farmers who were younger (20-39 years) were found to have adopted vaccination for livestock to a greater extent (47.1%), than the 40-59 year age group (19.5%) and over 60 years (12%), which was statistically significant ( $\rho < 0.001$ ) in the study. Similarly, based on sex, male farmers were found to have adopted vaccination to a greater rate (44.7%;  $\rho < 0.001$ ) than female farmers (24.7%).

**Table 28.** *Preexposure Vaccination Practices by Sociodemographic Variables*

Variable	Practices of Vaccination to Livestock						X <sup>2</sup>	P- value
	N	%	Yes	%	No	%		
Age								
20-39	227	59.7	107	47.1	120	52.9	33.697	***
40-59	128	33.7	25	19.5	103	80.5		
60 and above	25	6.6	3	12.0	22	88.0		
Sex								
Female	174	45.8	43	24.7	131	75.2	16.386	***
Male	206	54.2	92	44.7	114	55.3		
Education								
Below secondary	215	56.6	43	20.0	172	80.0	52.11	***
Secondary and above	165	43.4	92	55.8	73	44.2		
Aim of farming								
Household consuming	328	86.3	115	35.1	213	64.9	0.227	NS
Commercial	52	13.7	20	38.4	32	61.6		
Type of farming								
Single	31	8.2	11	35.4	20	64.6	0.000	NS
Mixed	349	91.8	124	35.5	225	64.5		

Note: *p* value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Not-significant

Data also indicate that farmers with higher education had higher user rate (55.8%;  $p < 0.001$ ) of livestock vaccination compared to those with education levels below secondary (20.0%). The vaccination practice of younger farmers (20-39 years), male farmers and farmers with higher education is statistically significant in the study (Table 28). Multivariate analysis additionally indicates that those with secondary and above education were more than 5 times more likely (OR=5.04; 95% CI: 3.20-7.94) to be the chances of livestock vaccination as a preexposure prophylaxis (PEP) compared to those with education below the secondary level (Table 37).

Whereas nearly equal number of livestock farmers in connection with aims of farming; household-consuming farming (35.1%) and commercial farming (38.4%)

adopted preexposure prophylaxis vaccination to their livestock, types of livestock farming, single (35.4%) and mixed types of farming (35.5%), did so. Based on aims and types of farming, the data were nonsignificant ( $\rho > 0.05$ ) with pre-exposure prophylaxis vaccination in the study (Table 28).

### ***Caring Practices During Parturition by Sociodemographic Variables***

Data shows that out of 380 livestock farmers, 65.0, 28.4 and 6.6 percentage were covered by the 20-39, 40-59 and over 60 years of age groups, respectively. While comparing care practices during parturition and abortion of their livestock, it was found that younger farmers (20-39 years) were found to have higher gloves users (18.0%) than the 40-59 years age group (10.9%) with ( $p < 0.05$ ). However, none of the farmers over 60 years of age used gloves during these practices (Table 29).

**Table 29.** *Caring Practices during Parturition by Sociodemographic Variables*

Variable	Caring Practices during Livestock Parturition or Abortion							P-value
	N	%	Gloves use	%	Bare hands	%	Chi square	
Age								
20- 39	227	59.7	41	18.0	186	92.0	7.885	***
40-59	128	33.7	14	10.9	114	89.1		
60 and above	25	6.6	0	0.0	25	100.0		
Sex								
Female	174	45.8	22	12.7	152	87.3	0.868	NS
Male	206	54.2	33	16.1	173	83.9		
Education								
Below secondary	215	56.6	21	9.8	194	90.2	8.81	***
Secondary and above	165	43.4	34	20.6	131	79.4		
Aim of farming								
Household consuming	328	86.3	45	13.7	283	86.3	1.101	NS
Commercial	52	13.7	10	19.2	42	80.8		
Type of farming								

Variable	Caring Practices during Livestock Parturition or Abortion							
	N	%	Gloves use	%	Bare hands	%	Chi square	P-value
Single	31	8.2	5	16.1	26	83.9	0.075	NS
Mixed	349	91.8	50	14.3	299	85.7		

Note: *p* value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS= Not-significant

Data also demonstrates that in terms of sex, male farmers applied gloves more during the care of livestock (16.1%) than female farmers (12.7%). Likewise, farmers with higher education were found to have used gloves (20.6%;  $\rho < 0.01$ ) more than those with less than secondary education (9.8%). Multivariate analysis also indicates that livestock farmers with secondary and above education were 2.39 times (OR= 2.39; CI: 1.33 - 4.31) more likely to use gloves during care in the period of parturition or abortion of livestock than those who have education below secondary level (Table 38). Commercial livestock farmers were better in number to use gloves (19.2%) than household consuming farmers (13.7%), and farmers who kept single types of livestock (16.1%) exceeded mixed types of livestock farming (14.3%) in this glove-wearing practice, although these variables did not have association with gloves using practices during parturition or abortion of animals ( $\rho > 0.05$ ).

### **Association: Knowledge and Perception with Existing Education**

Education is a predicting variable. Under this objective, the researcher sought to identify the impact of education on knowledge, practices, and threats perception towards the zoonoses.

#### ***Education and Zoonotic Related Knowledge***

Data reveal how and to what extent existing education and zoonotic-related knowledge on some studied zoonotic diseases are associated in the study. Based on education, farmers were classified into three groups, with 16, 199 and 165 belonging

to the categories of; could not read and write, basic level, and secondary and higher education, respectively. Under this topic, the researcher excluded those diseases on which livestock farmers had the least knowledge (brucellosis, neurocysticercosis, and bovine tuberculosis). Therefore, the analysis in this instance focused only on data concerning knowledge of zoonotic rabies, bird flu, and swine flu to assess their association with the current educational attainment (Table 30).

**Table 30.** Association: Education and Knowledge on Studied Zoonotic Diseases

Variables	Category	Total	Knowledge %		X <sup>2</sup>	P-value
Information about zoonotic rabies						
	Education	N	Yes	No		
	Could not read and write	16	68.8	31.2	30.746	***
	Up to basic level	199	85.4	14.6		
	Secondary and above	165	99.4	0.6		
Knowledge on symptoms of rabies in dogs/ animals [hydrophobia]						
	Could not read and write	11	81.8	18.2	1.417	NS
	Up to basic level	170	85.9	14.1		
	Secondary and above	164	89.6	10.4		
Knowledge on mode of transmission of rabies						
	Could not read and write	11	90.9	9.1	11.220	NS
	Up to basic level	170	89.4	10.6		
	Secondary and above	164	95.7	4.3		
Knowledge on preventive measures of rabies						
	Could not read and write	11	90.9	9.1	10.047	NS
	Up to basic level	170	95.9	4.1		
	Secondary and above	164	99.4	0.6		
Knowledge on free ARV facilities in district level hospital						
	Could not read and write	11	0.0	100.0	39.087	*** (#)
	Up to basic level	170	31.2	68.8		

<b>Variables</b>	<b>Category</b>	<b>Total</b>	<b>Knowledge %</b>		<b>X<sup>2</sup></b>	<b>P-value</b>
	Secondary and above	164	61.0	39.0		
<b>Knowledge on prognosis of rabies</b>						
	Could not read and write	11	18.2	81.8	31.753	***
	Up to basic level	170	24.7	75.3		
	Secondary and above	164	37.8	62.2		
<b>Information about zoonotic swine flu</b>						
	Could not read and write	16	6.2	93.8	110.283	***
	Up to basic level	199	33.2	66.8		
	Secondary and above	165	84.2	15.8		
<b>Knowledge on symptoms of swine flu</b>						
	Could not read and write	1	0.0	100.0	8.774	NS (#)
	Up to basic level	66	78.8	21.2		
	Secondary and above	139	77.7	22.3		
<b>Knowledge on mode of transmission of swine flu</b>						
	Could not read and write	1	0.0	100.0	102.816	*** (#)
	Up to basic level	66	77.3	22.7		
	Secondary and above	139	78.4	21.6		
<b>Knowledge on preventive practices of swine flu [don't touch facial part unnecessarily]</b>						
	Could not read and write	1	100.0	0.0	0.711	NS (#)
	Up to basic level	66	80.3	19.7		
	Secondary and above	139	76.3	23.7		
<b>Information about zoonotic bird flu</b>						
	Could not read and write	16	87.5	12.5	4.359	NS
	Up to basic level	199	95.0	5.0		
	Secondary and above	165	97.6	2.4		
<b>Knowledge on symptoms of bird flu in poultry [swelling on head, eyelid and joint]</b>						
	Could not read and write	14	64.3	35.7	6.928	*
	Up to basic level	189	67.7	32.3		
	Secondary and above	161	54.0	46.0		

Variables	Category	Total	Knowledge %	X <sup>2</sup>	P-value
Knowledge on mode of transmission of bird flu [contact infected poultry without safety]					
	Could not read and write	14	21.4	78.6	46.361 ***
	Up to basic level	189	70.9	29.1	
	Secondary and above	161	90.7	9.3	
Knowledge on preventive practices of bird flu [use PPE] ***					
	Could not read and write	14	14.3	85.7	20.827 ***
	Up to basic level	189	33.3	66.7	
	Secondary and above	161	54.7	45.3	

Note: # Fisher exact test value // p value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS=Not significant

When assessing knowledge regarding zoonoses across different educational groups, it was noted that individuals with higher education exhibited greater awareness of zoonotic rabies compared to those with basic education (85.4%), or no literacy skills (68.8%). The data revealed a significant association between education level and knowledge about zoonotic rabies ( $p < 0.001$ ). Additionally, multivariate analysis also indicated that individuals with secondary education or above were nearly four times more likely (OR=3.8; 95% CI: 1.4 -7.7) to possess awareness of zoonotic rabies compared to those with education below the secondary level (Table 32).

Regarding knowledge of the symptoms of rabies in animals, specifically dogs, similar results were observed in all educational groups. Knowledge levels on hydrophobia as a symptom of rabies were 89.6%, 85.9%, and 81.8% for respondents with secondary and higher education, up to basic level education, and were not read and write, respectively.

Similarly, the number of respondents from all educational categories who knew the mode of transmission of rabies was very high (95.7%, secondary and above category; 89.4%, up to basic level category; 90.9%, were not read and write

category). However, respondents who had secondary and higher education were the highest in number. But the data were not significant in the study.

As regards knowledge of preventive measures, all respondents in all three educational categories almost competed with each other in percentage with secondary and higher education at 99.4, up to the basic level at 95.9%, and illiterate respondents at 90.9%. However, the highest respondents (99.4%) had secondary and higher education. But data were not found to have an association with preventive knowledge of rabies and educational level of the respondents.

Rabies, a disease preventable by vaccination, the government of Nepal offers free anti-rabies vaccine (ARV) services in primary health centers and district-level hospitals. Respondents without literacy were unaware of this service, while 31.2% with up to basic education and 61.0% with secondary and above education were informed ( $p < 0.001$ ). Knowledge about the prognosis of rabies was generally low, with percentages of 18.2%, 24.7%, and 37.8% for illiterate, up to basic level, and secondary and above categories, respectively. Data indicated a highly significant correlation with the level of education of the respondents ( $p < 0.001$ ).

In terms of knowledge regarding swine flu, it was observed that a higher percentage of respondents with higher education (84.2%) were informed compared to those with up to basic education (33.2%) and illiterate respondents (6.2%). Data demonstrated a statistically significant relationship ( $p < 0.001$ ) between education levels and awareness of zoonotic swine flu in the study. The multivariate analysis further demonstrated that individuals with advanced education were over 11 times more likely (OR=11.8; 95% CI: 7.1-19.64) to possess awareness of swine flu compared to those with education below the secondary level (Table 33). Data also

show that higher respondents having an education up to the basic level and secondary and above, respectively (78.8% and 77.7%) had knowledge about the symptoms of swine flu, while illiterate respondents had no knowledge of it.

Swine flu, a highly contagious zoonotic disease, showed that approximately equal percentages (77.3% and 78.4%) of respondents with education up to the basic level and secondary and above level were knowledgeable about the mode of transmission. But respondents without literacy did not have any knowledge of the transmission mode, signifying vulnerability in farming communities ( $p < 0.001$ ).

However, the total of respondents (100.0%) without formal education had knowledge about the preventive measure of swine flu, whereas 80.3 percent respondents having up to the basic level and nearly the same percentage (76.3%) having a secondary and higher education were found to have known about preventive methods. Furthermore, the data was not significant in the study.

Similarly, when comparing bird flu related knowledge with the level of education of the respondents, it was found that almost all respondents in all educational categories had information about bird flu. However, the higher respondents (97.6%) with a higher educational category heard about bird flu than those who had a basic level education and the illiterate respondents (95.0% and 87.5%), respectively. However, the data were not found to be statistically significant in the study. Interestingly, respondents who had an education up to the basic level (67.7%) were found to have a higher knowledge of the symptoms of bird flu in poultry compared to respondents who had an education of secondary and above (54.0%). Furthermore, the data was found to be statistically significant in the study ( $p < 0.05$ ). 'Exposure to infected poultry without safety' is one way of bird flu

transmission to human. Regarding knowledge on this indicator, it was found that the higher respondents (90.7%) having a secondary and higher education had knowledge about the mode of transmission of bird flu to humans in compared to the respondents (70.9%) who had an education up to the basic level and those who had no education (21.4%). Likewise, the data were found to be statistically significant in the study ( $\rho < 0.001$ ). Similarly, more than half (54.7%) of the respondents who had secondary and higher education had knowledge of preventive methods of bird flu compared to those who had basic education and illiterate respondents (33.3%) and (14.3), respectively. The data was found to be statistically significant in the study ( $\rho < 0.001$ ).

### ***Education and Threat Perceptions towards the Zoonoses***

Out of the 380 respondents, 215 (56.6%) had an education below the secondary level and 165 (43.4%) had a secondary and above. Table 31 shows the level of perception related to zoonoses based on their existing educational level. This helps to understand the impact of education on the perception of zoonotic threats in farming communities.

In the statement, ‘it is believed that humans and animals can transmit diseases to each other’ 96 percent respondents with below secondary education agreed, and only a few respondents (3.3%) responded to the statement neutrally and 0.5 percent disagreed. However, the respondents (100%) having secondary education and, above all agreed on the statement. Data were found statistically significant in the study with respect to zoonotic -related susceptibility and level of education ( $\rho < 0.05$ ) in the study. Similarly, in the statement, ‘traditional healers cure zoonotic diseases such as rabies’, where 87 percent respondents who had an education below the secondary level disagreed, 7 percent were neutral, and 6 percent agreed. In comparing

perception with education, respondents who had secondary education and higher were also found to have a similar perception to those who had an education below the secondary level in relation to their traditional healers seeking health behaviour. Out of the 165 respondents, nearly all (90%) disagreed, 2.4 percent were neutral, and 7.3 percent agreed on the statement. This means that most of the livestock farmers were motivated to modern therapy during zoonotic-related illnesses. However, statistically, the data were non-significant ( $p > 0.05$ ) in the study (Table 31).

**Table 31.** Association: Perception towards Zoonoses based on Level of Education

Level of Education	Category	%	Chi-square	P-value	Total
It is believed that humans and animals can pass diseases to one another					
Up to secondary	Agree	96.3	6.272	*	215
	Neutral	3.3			
	Disagree	0.5			
Secondary and above	Agree	100.			165
Traditional healers cure zoonotic diseases like rabies					
Up to secondary	Agree	6.0	4.831	NS	215
	Neutral	7.4			
	Disagree	86.5			
Secondary and above	Agree	7.3			165
	Neutral	2.4			
	Disagree	90.3			
It is likely I will get sick from livestock (i.e., rabies) sometime during my life					
Up to secondary	Agree	88.4	6.684	*	215
	Neutral	9.3			
	Disagree	2.3			
Secondary and above	Agree	95.8			165
	Neutral	3.6			
	Disagree	0.6			

Level of Education	Category	%	Chi-square	P-value	Total
If I got sick from livestock (e.g., rabies, brucella) the illness would be very bad					
Up to secondary	Agree	91.2	6.076	*	215
	Neutral	8.4			
	Disagree	0.5			
Secondary and above	Agree	97.0			165
	Neutral	2.4			
	Disagree	0.6			
When I wash my hands after cleaning up animal waste, I am decreasing my chances of getting zoonoses					
Up to secondary	Agree	87.0	13.315	***	215
	Neutral	12.6			
	Disagree	0.5			
Secondary and above	Agree	96.4			165
	Neutral	2.4			
	Disagree	1.2			
I have talked with my veterinarian about the risk of diseases shared between humans and animals					
Up to secondary	Agree	29.8	6.086	*	215
	Neutral	29.3			
	Disagree	40.9			
Secondary and above	Agree	40.6			165
	Neutral	29.1			
	Disagree	30.3			
I encourage other family members to thoroughly wash their hands after interaction with animals					
Up to secondary	Sometime	62.3	15.067	***	215
	Usually,	31.6			
	Always	6.0			
Secondary and above	Sometime	42.4			165
	Usually,	49.7			
	Always	7.9			

*p* value; <0.05=\*, <0.01=\*\*, <0.001=\*\*\*, NS=Not-significant

On the statement ‘It is likely I will get sick from livestock (i.e., rabies) sometime during my life’, 9 out of 10 respondents (88.0%) having an education below secondary agreed while 1 in 10 (9.3%) of them were neutral and 2.3 percent disagreed. However, 96.0 percent respondents with higher education perceived the statement to be true while, 3.6 and 0.6 percent of them were neutral and disagreed respectively. So, based on the data, the higher number of respondents in both educational groups perceived susceptibility to zoonotic threats ( $\rho < 0.05$ ) in the study.

The statement, ‘if I got sick from livestock (i.e., rabies, brucella) the illness would be very bad’ tries to measure the perceived severity of the zoonoses. In the statement, it was found that more than 9 in 10 (91.1%) respondents having education below secondary agreed, whereas 8.4 and 0.5 percent were neutral and disagreed respectively. However, nearly all (97.0%) respondents having an education secondary and above agreed, 2.4 percent were neutral and 0.6 percent disagreed on the statement. Based on the data, a higher number of respondents with higher education perceived the severity of zoonoses. Data were found statistically significant in the study ( $\rho < 0.05$ ).

Similarly, the statement ‘when I wash my hands after cleaning animal waste, I decrease my chances of getting zoonoses’ tries to measure the perceived benefits of handwashing practices. It was found that the highest number of respondents with below secondary (87.0%) and secondary and above education (96.4%) agreed on the statement, respectively, but a few respondents in both groups expressed neutrally and disagreed on the statement. Data were statistically significant ( $\rho < 0.001$ ) regarding perceived benefits of hand washing practices and level of education in the study.

Likewise, in the statement, 'I have talked with my veterinarian about the risk of diseases shared between human and animals', which tries to measure self-efficacy to controlling zoonoses, it was found that one third (30.0%) respondents with below secondary agreed, while similar number (29.0%) of respondents was neutral and 2 in 5 (41%) disagreed. Equally, 41.0 percent respondents having an education secondary and above agreed, and nearly the same (29.0% and 30.0%) were neutral and disagreed on the statement. The data shows that higher educated respondents had a higher self-efficacy. This data was found to be statistically significant between the level of education and self-efficacy to control the zoonoses ( $\rho < 0.05$ ).

In the statement 'I encourage other family members to thoroughly wash their hands after interaction with animals', which tries to measure the cues to action for handwashing practices, it was found that while higher respondents (62.0%) having a lower education sometimes encouraged their family to practice, almost one-thirds (32%) usually did so, and only 6 percent always encouraged family members to adopt the handwashing practice. Likewise, less than half (42%) of respondents having a secondary and higher education, sometime encouraged their family members into the practice, while half (50%) of the respondents typically encouraged their family members to wash their hands after interacting with animals, whereas 8 percent consistently motivated them to do so. The data was found to be highly significant in the study ( $\rho < 0.001$ ).

### **Multivariate Analysis [Logistic Regression Analysis]**

This section evaluated the net effect of education on knowledge related to zoonotic and preventive practices of livestock farmers applying multivariate analysis. Two models were run in logistic regression (first model, education variable only and, in the second model, adding other sociodemographic variables) to explore the net effect of education on the dependent variables. Control variables were used i.e., age, sex, religion, and ethnicity in the study.

#### ***Educational Effect in Knowledge on Zoonotic Rabies***

Data show that livestock farmers who had secondary education and above were noticed almost 4 times (OR=3.8; 95% CI: 1.4 -7.7) more likely to be aware of zoonotic rabies compared to those who had lower secondary education. Sex, age, religion, and ethnicity have been adjusted in the second model. Even after controlling for other variables, education remained significant in this model. For example, those respondents who had secondary or higher education were approximately 2.0 times more likely to be aware of zoonotic rabies than those who had less than secondary education (AOR=1.9; 95% CI: 1.1-5.0) in the study (Table 32).

**Table 32. Education Status and Knowledge on Zoonotic Rabies**

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	3.80**(1.4-7.7)	1.90** (1.1-5.0)
Sex	Female	-	1.00
	Male	-	1.82 (0.82 – 4.0)
Age	20-39	-	1.00
	40-59	-	0.55 (0.24 -1.30)
	60 +	-	0.158** (0.05-0.57)
Religion	Non-Hindu	-	1.00
	Hindu	-	0.79 (0.32 – 2.21)
Ethnicity	Dalit	-	1.00
	Janajati	-	1.82 (0.45-7.3)
	Brahmin/ Chhetri	-	2.08 (0.46 -9.46)
Model Summary	Constant	5.3***	4.76*
	Cox & Snell R	0.085	0.123
	Nagelkerke R Square	0.185	0.268

Note: \*  $\rho < 0.05$ , \*\*  $\rho < 0.01$ , \*\*\*  $\rho < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### ***Educational Effect in Knowledge on Zoonotic Swine Flu***

Livestock farmers who had secondary and higher education appeared almost 12 times (OR=11.8; 95% CI: 7.1-19.64) with more chances of having knowledge of zoonotic swine flu than those who had education below secondary level. Age, sex, religion, and ethnicity have been adjusted in the second model. Even after controlling for other variables, education remained significant in this model. For example, those respondents who had secondary and higher education were about 9 times more likely to be aware of zoonotic swine flu than those who had less than secondary education (AOR=9.08; 95% CI: 5.17-15.9) in the study (Table 33).

**Table 33.** *Education Status and Knowledge on Zoonotic Swine flu*

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	11.8***(7.1-19.64)	9.08*** (5.17-15.9)
Sex	Female	-	1.00
	Male	-	1.14 (0.68-1.90)
Age	20-39	-	1.00
	40-59	-	0.46** (0.26-0.79)
	60 +	-	0.24* (0.07-0.75)
Religion	Non-Hindu	-	1.00
	Hindu	-	0.88 (0.34 – 2.27)
Ethnicity	Dalit	-	1.00
	Janajati	-	0.62 (0.24-1.64)
	Brahmin/ Chhetri	-	1.67 (0.57-4.8)
Model Summary	Constant	0.453***	0.916
	Cox & Snell R	0.258	0.296
	Nagelkerke R Square	0.345	0.395

Note: \*  $\rho < 0.05$ , \*\* $\rho < 0.01$ , \*\*\*  $\rho < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### ***Educational Effect on Hand Washing Practices***

Livestock farmers who had secondary and higher education were about 11 times (OR=10.9; 95% CI: 6.3-18.7) more likely to follow regular hand washing practices after close exposure to their livestock than those who had education below the secondary level. Sex, age, religion, and ethnicity were adjusted in the second model. Even after controlling by other variables, education remained significant in this model. For example, those respondents who had secondary and higher education were almost 8 times more likely to follow regular hand washing practices with soap water than those who had an education lower than secondary level (AOR=7.8; 95% CI: 4.2-14.7) in the study (Table 34).

**Table 34. Education Status and Hand Washing Practices**

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	10.9 (6.3-18.7) ***	7.8 (4.2-14.7) ***
Sex	Female	-	1.00
	Male	-	3.5 (1.9-6.2)
Age	20-39	-	1.00
	40-59	-	0.26*** (0.14 – 0.48)
	60 +	-	0.21*** (0.07-0.62)
Religion	Non-Hindu	-	1.00
	Hindu	-	0.98 (0.4-2.3)
Ethnicity	Dalit	-	1.00
	Janajati	-	3.92** (1.46-10.6)
	Brahmin/ Chhetri	-	1.02 (0.35-2.97)
Model Summary	Constant	0.67**	0.29
	Cox & Snell R	0.227	0.336
	Nagelkerke R	0.307	0.456
	Square		

Note: \*  $\rho < 0.05$ , \*\* $\rho < 0.01$ , \*\*\*  $\rho < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### ***Educational Effect on the Practices of Children Exposure to Livestock***

Livestock farmers who had secondary and above-level education were 0.37 times (OR=0.37; 95% CI: .241- .579) less likely to be exposed to close proximity, livestock and their children than those who had education below secondary level. Sex, age, religion, and ethnicity were adjusted in the second model. Even after controlling for other variables, education remains significant in this model. Respondents who had secondary or higher education were 0.45 times (AOR=0.45; 95% CI: .27- .76) less likely to have close exposure to their livestock compared to those who had less than secondary level of education (Table 35).

**Table 35. Education Status and Practices of Children Exposure to Livestock**

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	0.37*** (.241-.579)	0.45** (.27-.76)
Sex	Female	-	1.00
	Male	-	.521** (.321-.845)
Age	20-39	-	1.00
	40-59	-	1.47 (0.83-2.57)
	60 +	-	1.59 (0.55 – 4.66)
Religion	Non-Hindu	-	1.00
	Hindu	-	1.98 (0.90 – 4.34)
Ethnicity	Dalit	-	1.00
	Janajati	-	0.19** (0.06 – 0.62)
	Brahmin/ Chhetri	-	0.42 (0.12 -1.48)
Model Summary	Constant	3.21***	7.77
	Cox & Snell R	0.051	0.118
	Nagelkerke R Square	0.071	0.163

Note: \*  $\rho < 0.05$ , \*\* $\rho < 0.01$ , \*\*\*  $\rho < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### ***Educational Effect on Practices of Pregnant Women Exposure to Livestock***

Livestock farmers having secondary and higher education were 0.322 times (OR=0.322; 95% CI: 0.21- 0.51) less likely to be exposed to livestock during pregnancy of their family members than those who had education below the secondary level. Sex, age, religion, and ethnicity were adjusted in the second model. Even after controlling for other variables, education remained significant in this model. For example, respondents who had secondary and higher education were 0.41 times less likely to exposure pregnant family members to their livestock than those who had less than secondary level of education (AOR=0.41; 95% CI: 0.24 -0.68) (Table 36).

**Table 36.** *Education Status and Pregnant Women exposure to Livestock*

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	0.322*** (0.21-0.50)	0.41** (0.24 – 0.68)
Sex	Female	-	1.00
	Male	-	0.48** (0.92-0.77)
Age	20-39	-	1.00
	40-59	-	1.41 (0.81-2.47)
	60 +	-	2.69 (0.81-8.98)
Religion	Non-Hindu	-	1.00
	Hindu	-	1.08 (0.48-2.42)
Ethnicity	Dalit	-	1.00
	Janajati	-	0.25** (0.087-0.696)
	Brahmin/ Chhetri	-	0.73 (0.23-2.34)
Model Summary	Constant	3.22***	10.3***
	Cox & Snell R	0.067	0.145
	Nagelkerke R Square	0.093	0.200

Note: \*  $\rho < 0.05$ , \*\* $\rho < 0.01$ , \*\*\* $\rho < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### ***Educational Effect on Vaccination Practices to Livestock***

Respondents who had secondary and above education were more than 5 times (OR=5.04; 95% CI: 3.20 -7.94) more likely to follow vaccination of their livestock as a preexposure prophylaxis (PEP) to prevent diseases than those who had education with below than secondary level. Sex, age, religion, and ethnicity have been adjusted in the second model. Even after controlling for other variables, education remains significant in this model (Table 37). For example, those respondents who had secondary and higher education were 3.5 times more likely to be vaccinated for their livestock compared to those who had less than secondary education (AOR=3.51; 95% CI: 2.03 - 6.05).

**Table 37. Education Status and Vaccination Practices to Livestock**

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	5.04*** (3.20-7.94)	3.51*** (2.03-6.05)
Sex	Female	-	1.00
	Male	-	2.8 ***(1.64 – 4.78)
Age	20-39	-	1.00
	40-59	-	0.32*** (0.17-0.60)
	60 +	-	0.20* (0.05-0.78)
Religion	Non-Hindu	-	1.00
	Hindu	-	1.29 (0.52-3.17)
Ethnicity	Dalit	-	1.00
	Janajati	-	11.53*** (3.17-42.0)
	Brahmin/ Chhetri	-	2.10 (0.51-8.71)
Model Summary	Constant	0.250***	0.028***
	Cox & Snell R	0.130	0.278
	Nagelkerke R Square	0.178	0.382

Note: \*  $\rho < 0.05$ , \*\* $\rho < 0.01$ , \*\*\*  $\rho < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### ***Educational Effect on Caring Practices During Livestock Parturition***

Livestock farmers who had secondary and higher education were observed more than 2 times (OR=2.39; CI: 1.33-4.31) more likely to follow gloves using practices during the caretaker in the period of parturition or aborted livestock than those who had education below the secondary level. Sex, age, religion, and ethnicity were adjusted in the second model. Even after controlling for other variables, education remained significant in this model. For example, respondents who have secondary and higher education appeared 1.78 times more likely to use gloves during the care of parturition or aborted livestock compared to those who had less than secondary education (AOR=1.78; 95% CI: 0.92-3.47) in the study (Table 38).

**Table 38.** Education Status and Caring Practices During Parturition of Livestock

Variables	Attributes	Model I	Model II
		OR (95% CI)	AOR (95% CI)
Education	Below secondary	1.00	1.00
	Secondary and above	2.39**(1.33-4.31)	1.78 (0.92-3.47)
Sex	Female	-	1.00
	Male	-	1.27 (0.68-2.34)
Age	20-39	-	1.00
	40-59	-	0.71 (0.34-1.48)
	60 +	-	1.01 (0.88-1.34)
Religion	Non-Hindu	-	1.00
	Hindu	-	1.09 (3.88-3.08)
Ethnicity	Dalit	-	1.00
	Janajati	-	1.97 (0.55-6.96)
	Brahmin/ Chhetri	-	0.94 (0.21-4.06)
Model Summary	Constant	0.108***	0.079***
	Cox & Snell R	0.023	0.052
	Nagelkerke R Square	0.041	0.093

Note: \*  $p < 0.05$ , \*\* $p < 0.01$ , \*\*\*  $p < 0.001$ , OR= Odds ratio and AOR=Adjusted odds ratio

### Provision of Health Care Facilities in Study Areas

**Public health services in study areas:** In three municipalities in three districts, various categories of healthcare facilities were observed. The government of Nepal has established different types of health care facilities; Central, District and Community level. At the community level preventive, promotive, and curative health services are available in an integrative approach (Department of Health Services, 1991). In accordance with this structure, basic health units were observed in Nasong-4, Manang; a primary health center was observed in Bahnu-5, Tanahun; and a health post was present in Kawasoti-17, Nawalpur.

The basic health unit in Nasong- 4, Manang, serves as a fundamental healthcare facility that offers a variety of primary health services, including prevention, promotion, and treatment. It acts as a crucial healthcare access point for the local community, providing care for common ailments, maternal and child health

support, immunizations, and health education, thus improving the well-being of residents. Similarly, the primary health center in Bhanu 5, Tanahun, represents a step above a health post, equipped with medical staff and facilities to address a wider array of healthcare needs, including diagnostics, treatment for complex conditions, and basic inpatient care. Its presence, like the health post in Kawasoti-17, Nawalpur (Kumarwanti Health Post), underscores the importance of community-level health posts that offer primary healthcare services through trained healthcare providers, bridging the gap between local residents and advanced medical facilities. These healthcare facilities reflect Nepal's commitment to accessible and quality healthcare, which requires ongoing support and improvement to meet the evolving health needs of population effectively.

***Veterinary health services in study areas:*** Based on field observation, in three municipalities of three districts, there was availability of veterinary health units for livestock-related health services. Veterinary paramedics provided livestock-related health service in Manang and Tanahun districts, but in Nawalpur there were veterinarians for livestock health services. They provided simple curative health services including vaccination and laboratory services to livestock. Livestock farmers frequently visited these facilities for livestock-related health issues. However, they were complaining that there are limited veterinarians and drugs for veterinary health services.

### **Cultural Attachment and Farmers' Reflection on Livestock**

In this study, the researcher sought to explore the cultural and traditional values of livestock and attempted to determine how such values could result in the possible vulnerability of zoonoses due to close exposure to livestock without proper

safety. People are intimate with their livestock for various purposes, including sociocultural and religious dynamics. Some practices in terms of the dynamics of livestock farmers in different ecological zones of Nepal have been captured in the study through the Focus Group Discussion, and the thematic analysis found its expression while documenting the data from the tools in this section (Table 39).

**Table 39.** *Traditional and Cultural Values of Livestock in Farming Communities*

Practice in Manang	<p style="text-align: center;"><b>Cultural and religious attachment with livestock</b></p> <p>- In Dashain we worship Durga and Bhimsen with sacrifice of cocks, sheep, or goats. In Tihar, we worship the cow as a symbol of the goddess Laxmi. Similarly, we worship ox, dog, and crow in the symbol of many gods and goddesses.</p> <p>- In the Naming ceremony, we need cow milk to worship the god and sheep or cocks for the funeral and marriage ceremony.</p> <p><i>Impression: People often sacrifice different kinds of animal or offer animal products to celebrate religious ceremonies.</i></p> <p style="text-align: right;">- [Thematic Perspectives of Gurung respondents]</p>
Practice in Tanahun	<p style="text-align: center;"><b>Diverse ethno-religious values of livestock</b></p> <p>- We worship goddess Durga by sacrificing the goat, cock, male buffalo, pig or pigeon. Similarly, cow milk, dung, and urine are necessary for many cultural and religious activities. We worship cow, ox, dog, and crow in Tihar.</p> <p><i>Impression: People sacrifice different animals while celebrating festivals, oppositely, there are few festivals when they worship animals.</i> - [Thematic perspective of Brahmin /Chhetri, Newar, and Kami respondents]</p> <p>- We value cock, goat, sheep and buffalo during the naming, marriage or funeral ritual. <span style="float: right;">- [Thematic perspective of Gurung respondents]</span></p> <p>- We value the pig in several socio cultural and religious ceremonies.</p> <p style="text-align: right;">- [Thematic perspectives of Magar respondents]</p> <p><i>Impression: For worship or sacrifice in several sociocultural ceremonies, animals or birds are valued for celebration.</i></p>

---

### Culture and religion driven demand of livestock

- Tharu in Kawasoti, mention that 'we use cow dung and urine in *Kriya Karma*, on *Pitri Aausi*, we cannot do without cock or pigeon or duck. We worship *Ban Devi* at Tihar with the sacrifice of cocks, pigeons, or goat.

- In *Barana Puja* (which is performed before farming), sacrifice of pigeons or cocks is performed. In *Jitiya Puja*, we worship *God* and give value to cow milk.

*Impression: Livestock are unavoidable for religious and cultural ceremonies of the Tharu ethnic people.*

- In *Kinder Puja* (worshiping every five years) the sacrifice of pigeon, cock, goat, or male buffalo is performed. At Naming ceremony, to show the family respect, cock meat is offered to the maternal family after a married woman gives birth to a child.

*Impression: Cultural ceremonies Tharu ethnic people mostly sacrifice livestock.*

- In *Chandi Puja* and *Bhakal Puja*, sacrifice of cock, pigeon, duck, or goat is carried out. - [*Thematic perspective of respondents in Tharu communities*]

- We need cock or pigeon for the shed/ farm puja, and sheep, goats, cock are used for other several ceremonies. - [*Gurung respondent in Nawalpur*]

- Kumal, Bote, Musahar, Sunar gives importance to pigeon, cock for several ceremonies. They mostly need cow milk, urine, and dung for *Kaj -Kriya*.

- [*Thematic Perspective of Kumal, Bote, Musahar and Sunar*]

---

During the focus group discussion, because livestock farmers interacted more actively, openly, and talked at length about their relationship with livestock, the researcher was able to explore their several cultural and traditional values of livestock, which represented a connection between human beings and livestock in the entire communities studied. Some sociocultural values, practices, and perception related to livestock and their zoonoses risk were captured in the form of basic themes, organizing themes and these themes are mentioned under the global themes in this text.

***Livestock for livelihood and cultural perspectives:*** Not only as an agrarian society but also because of several sociocultural perspectives, people in all three ecological regions kept livestock in their households which brought them close to livestock. During the FGD session, participants revealed the values of livestock in their own home and communities (Table 40).

**Table 40.** *Livelihood, Religion and Cultural Perspective of Livestock*

Manang	<p>- In Dashain we generally sacrifice sheep to worship the <i>Goddess Durga</i> and paste the fresh blood in our palm and get it printed on the door. On the day we celebrate <i>Aakhikutu</i> (worship the earth or nature), we worship the mountain, the big trees, and the ponds by sacrificing the sheep or goat. We believe that the gods reside there.</p> <p><i>Impression: While many ceremonies are held, livestock and their production are used for worship or sacrifice.</i></p> <p style="text-align: right;">- [FGD/ 63yrs M and 59 yrs/M]</p>
	<p>- During the marriage ceremony after the newly married couple have entered the groom's house, we worship at home by sacrificing the cock, believing that this worship protects the family, especially the newly married couple, from unseen evils and witches.</p> <p><i>Impression: During marriage, people in the Gurung community sacrifice cocks, which is believed to protect the new couple from evil spirits.</i></p> <p style="text-align: right;">- [FGD/ 49 yrs/M]</p>
	<p>- On the day of death of a family member, after the funeral ritual, it is customary that we hang a live hen upside down at the door and put a diyo (clay lamp) to conform to the blue light emitting there that the departed soul is heading towards heaven.</p> <p><i>Impression: The people of the Gurung community need livestock during funeral ceremonies.</i></p> <p style="text-align: right;">- [FGD/ 46 yr/M]</p>
Tanahun	<p>- Livestock is our prime source of income and we value livestock for various cultural and religious activities. From the cradle to the graveyard, they are useful for us. They are not only consumed for nutrition, but we also value them from several sociocultural or religious perspectives. Therefore, we keep livestock in our household.</p> <p><i>Impression: People need livestock from the cradle to the graveyard not only for food but also for religious and sociocultural practices.</i></p> <p style="text-align: right;">- [Thematic Perspective of FGD, participants]</p>

---

- We celebrate Dashain, Tihar and other several cultural festivals by sacrificing or worshipping several livestock depending on our tradition. Goats, sheep, cocks, buffaloes, and pigs are used for sacrifice, and cows, ox, and dogs are worshipped as the symbol of many gods and goddesses.

*Impression: Livestock are used for both worship and sacrifice in the name of God and Goddess.*

- [*Thematic Perspectives of FGD, participants*]

---

- Not only for milk, meat or selling for money, we keep some animals for our sociocultural purposes. We need cow milk during *Kriya-Karma*. Cow urine and dung also have cultural values in our society. During *Kinder Puja, Srithan Puja, Kul Puja, Bhakal Puja*, we cannot do without livestock like pigeons, cocks, goats, sheep, or male buffalo.

Nawalpur

*Impression: Livestock are used both for livelihood and for the cultural perspective.*

- [*Thematic perspective of FGD, participants*]

- We sacrifice those livestock and take their meat, blood as *Parsad*, and sometimes, we sacrifice those animals for *VAKAL PUJA* and for traditional healing purposes.

*Impression: Livestock is sacrificed while praying for wisdom.*

- [*Thematic perspective of FGD, participants*]

---

**Zoonoses preventive practices:** In spite of several cultural values of livestock, the economic and educational status of livestock farmers, there still exist several such practices with livestock that can make people vulnerable to the transmission of zoonoses. The participants in the FGD session disclosed some practices that were followed when taking care of their livestock (Table 41).

**Table 41. Zoonoses Preventive Practices and Life Experience with Livestock**

Manang	<p>- It might be good to take a PPE during exposure to livestock, but most of us have the habit of only washing hands after cleaning the shed. We put on slippers every time. However, we wear boots when we have wounds in our legs; at other times, we generally do not wear them.</p> <p><i>Impression: Positive perception of adopting protective measures during exposure.</i></p>
	- [Thematic perspective of FGD, participant]
Tanahun	<p>- I always wash my hands with soap and water after cleaning the shed and taking care of the livestock during parturition or abortion. I have spent 20-25 years in this profession, but I have never worn gloves and boots during those periods, but I have not felt any harm.</p> <p><i>Impression: People are reluctant to use protective measures, however, wash hands after exposure.</i></p>
	-[FGD/ 55 yrs/M]
Nawalpur	<p>- I don't know what other do but I have used boots regularly and washed my hands with soap water after cleaning the shed, milking and caring for the livestock during their parturition or abortion, although I have never received training related to livestock farming. If the animals have any disease, I will isolate the sick animals from the herd, so I feel less risk.</p> <p><i>Impression: Without formal training, the respondent had followed many preventive practices.</i></p>
	- [FGD/65yrs/M].
Nawalpur	<p>- Before the Covid-19 pandemic outbreak, I used to wear masks only when going to dusty areas, but nowadays I regularly use them when visiting the poultry farm. I feel the health benefits of this practice.</p>
	- [FGD/ 39 yrs/F].
Nawalpur	<p>- Precaution is needed, but I do not know what kind of diseases there are and how they transmit. So, it creates problems, and another thing is that we have grown up and lived with livestock by our side all our life. So, I don't feel like I will be sick living near them.</p> <p><i>Impression: People often believe that livestock does not pose a threat to people.</i></p>
	- [FGD/ 69 yrs/M]

**Perception towards zoonoses:** If farmers have knowledge of common zoonoses, they may perceive threats related to zoonoses and may adopt safety practices during close exposure with livestock. The participants of FGD explored their knowledge and perception of such threats, which are mentioned below (Table 42).

**Table 42.** *Perception towards Zoonoses*

Manang	<p>- I heard that some diseases are transferred from animals to humans e.g., dogs transfer rabies. As a child were terrified of dogs (especially stray dogs). We hear people saying that if people are bitten by dogs, they need to take a vaccine on their umbilical with large needles. Not only dogs, even cats are also responsible for the transmission of zoonoses. Scabies, lice, and ticks are also transmitted by animals.</p> <p><i>Impression: The respondents had knowledge of rabies and other zoonoses.</i> - [FGD/ 45 and 54 yrs/M]</p>
Tanahun	<p>- I don't know what zoonotic diseases are, but I have heard that the disease does transmit from dogs to humans that is, ringworm is transferred from ox and buffalo; lice and fleas are transferred from poultry. The porcine can transmit a tapeworm.</p> <p><i>Impression: Respondents believed that animals can transmit diseases to humans. However, they were not familiar with the term zoonosis.</i> - [FGD/ 47 yrs/F]</p> <p>- I do not know whether the diseases are transmitted or not from livestock to human. I don't think this will happen.</p> <p><i>Impression: Livestock do not transmit diseases to humans.</i> - [FGD/ 69 yrs/M]</p>
Nawalpur	<p>- We have experiences of rabies, FMD [they are locally called KHORYAT] and worms that are transmitted from animals to humans. We know bird flu is also transmitted through infected poultry, and pork can transmit tapeworm.</p> <p><i>Impression: They had experienced some zoonoses with a local name.</i> - [Thematic Perspective of FGD, participant]</p> <p>- I know that diseases are transmitted from animals, but I am not sure that they are transmitted through the livestock, as we care for them as our own family members.</p> <p><i>Impression: Wild animals only transmit diseases to humans, not by livestock.</i> - [FGD/ 65yrs/M]</p> <p>- I know that TB is transmitted from animals to humans. I also know that it transmits through air and breath. I saw TB transmitted from animals to humans. - [FGD/ 67yrs/M]</p>

***Demand for interventional activities:*** Most livestock farmers in Nepal adopt the farming occupation for household consumption purposes based on traditional skills. During the FGD session, they shared that most of them lacked farming related training (Table 43).

**Table 43.** *Demand for an Interventional Programme*

Manang	<p>- In reality, we farmers do not know much about zoonotic diseases. But we should be provided with training after all. What are the veterinary officials for? They should come to visit our sheds and provide us with training. But unfortunately, they are not doing this.</p>
	<p><i>Impression: As an authorized official, veterinary professionals should be aware of zoonoses.</i> - [FGD/ 54 yrs/M]</p>
	<p>- There should be training or awareness programs in place for livestock farmers on safe handling and zoonoses prevention. The municipality should facilitate farmers with safe sheds and proper use of PPE such as mask, boots, and gloves.</p>
Tanahun	<p><i>Impression: Municipalities should conduct awareness programs and provide PPE, focused on livestock farmers.</i> - [Thematic perspective of FGD, participants]</p>
	<p>- This topic should be studied at the school level. Every farmer should receive training. Farming should be commercialised and they should have their farming occupation registered with local level authorities. - [FGD/ 64 yrs/M]</p>
	<p>- Farmers should be compensated for livestock loss, and animal treatment facilities must be provided by the veterinary office itself. At present, they are forced to buy medicine at our own expense.</p>
<p><i>Impression: The government should promote farming by prioritizing activities related to it.</i> - [FGD/45 yrs/M]</p>	

Nawalpur

---

- Mass awareness programs should be conducted on every corner of the street. Training should be in place so that people can learn which diseases spread through animals and how we can stay safe from them. Such training and seminar are a must.

- *[Thematic perspective of FGD, participants]*

- We should make such disease related courses from school. But unfortunately, those who are literate do not consider keeping livestock as their occupation.

- *[FGD/ 65 yrs/M]*

- Veterinarians should be there to teach us as well. We should be informed through training which disease is caused for what reason and how it is transmitted.

*Impression: Veterinarians should conduct awareness campaigns and should also incorporate zoonotic content into the school curriculum.*

- *[FGD/ 49 yrs/F]*

---

Therefore, livestock farmers rear livestock not only for their livelihood but also for many other sociocultural perspectives. In this context, it is important for them to learn about livestock-related diseases and acknowledge their impact on human health.

## **CHAPTER V**

### **Findings and Discussion**

This chapter explores how livestock farmers in Nepal perceive and handle the risk of zoonotic diseases. It draws on data from a variety of sociodemographic factors to examine farmers' understanding, awareness, and preventive measures against these diseases. Given Nepal's heavy reliance on agriculture, especially livestock farming, a significant portion of the population is engaged in this sector, making them susceptible to zoonotic pathogens as they interact closely with animals on a daily basis. The convergent parallel mixed-methods approach supported the researcher in assessing and exploring the knowledge, perceptions, and practices of livestock farmers associated with zoonoses. From the lens of a postpositivist researcher, bilateral data were collected and given equal importance in the study. Along with several references to similar studies across the globe, the researcher used HBM constructs to determine further risk of zoonoses in farming communities of Nepal. The study was further fortified by statistical analysis.

#### **Knowledge of Zoonoses Based on Ecological Zones**

Of the total 380 respondents, 7.9 percent adopted livestock farming as a primary occupation. The majority of them were found to keep poultry; more than two-thirds kept goats/ sheep; more than half kept buffaloes; nearly one-third kept cows in their household. The least number of respondents kept pigs and yaks/ chauri in their households. Similarly, 92 percent of farmers were found to keep more than one type of livestock on the farm of co-farming, 86.3 percent of farmers kept livestock primarily for household consumption, and nearly all farmers (97%) adhere traditional farming methods.

Insurance of livestock is a new paradigm in Nepal that covers the economic burden of livestock farmers. However, due to poor advocacy by stakeholders, the insurance rate was found very low (12.1%) in the study, though the fact that the Insurance Board of Nepal has issued directives for crops and livestock insurance since 2013, believing to set a milestone in securing agricultural investment in the country through insurance (Devkota et al., 2020).

In this study, only approximately one fourth (23.42%), nearly one fifth (19.5%), and 5.3 percent of the respondents had a good knowledge about swine flu, rabies, and bird flu respectively. However, very few respondents had good knowledge about bovine tuberculosis, brucellosis, and neurocysticercosis (1.6%, 0.3%, and 0.0%), respectively. Although all these zoonotic diseases have the potential to be endemic in Nepal (ANSAB, 2015) and directly impact on the health of livestock and caregiver farmers. Due to the similarity of symptoms between zoonoses and various other human illnesses, along with their low case fatality rates and the influence of socioeconomic factors such as poverty, the farmers in the study could have overlooked diseases such as bovine tuberculosis, brucellosis and neurocysticercosis.

When comparing the knowledge among livestock farmers on the study of zoonoses in the three ecological zones, the higher respondents in Nawalpur had a better knowledge about zoonotic rabies, bovine tuberculosis, and brucellosis than the respondents in Manang and Tanahun. However, considering the respondents in terms of their number, they were very few in terms of the good knowledge they had about brucellosis and bovine tuberculosis. In Tanahun, a higher number of respondents exhibited good knowledge of swine flu and avian influenza compared to the

respondents in other districts, while none of the respondents had a good knowledge of neurocysticercosis in the study. Further discussion related to studied zoonoses is mentioned below.

***Knowledge on rabies:*** Rabies is a fatal zoonotic disease that sporadically occurs in the Hill and Terai regions of Nepal. Due to close proximity to livestock and the prevalent issue of stray dogs, almost half of the people in Nepal faces a risk, with a quarter of them being moderately susceptible to rabies (Department of Health Services, 2017a). Although 90.7 percent of the respondents in the study have heard about rabies, only one fifth (19.5%) of them had good knowledge about it. This was less knowledge than the livestock farmers in Punjab, India (Hundal et al., 2016).

When comparing the results among the study districts, it was evident that a higher percentage of the respondents in Nawalpur (39.5%) had good knowledge about rabies. However, their knowledge about the mode of transmission, symptoms, preventive measures, causes, the availability of the free anti-rabies vaccine (ARV) in the government hospital, and the prognosis of rabies showed varying levels of understanding, similar to the findings among livestock farmers in Punjab, India (Hundal et al., 2016).

Likewise, a study in Jimma, Southwestern Ethiopia found quite similar results (95.8%; n=44) with traditional farmers and (97.7%; n=44) small holder dairy farmers who knew that rabies is transmitted from dogs to humans, and 82.8 percent (n=75) of the respondents understand the severity of rabies, believing that individuals bitten by rabied dogs and not treated with ARV would die (Tesfaye et al., 2013). This shows that Ethiopian farmers had greater knowledge about the prognosis of rabies than those in this study. Viewed critically from a health educator's standpoint, rabies proves

fatal if the victim fails to undergo post-exposure prophylaxis (PEP). Nevertheless, the study revealed unsatisfactory data regarding knowledge of ARV, with only 44.3 percent awareness among participants.

Lack of awareness and misunderstanding regarding the seriousness of rabies and the availability of free anti-rabies vaccine (ARV) service can result in people declining ARV treatment. This reluctance adds to the prevalence of rabies in Nepalese communities and hampers efforts towards its eradication by 2030 from Nepal (SAARC, OIE, 2019).

***Knowledge on bovine tuberculosis:*** Out of the respondents (3.1%) who were aware of bovine tuberculosis (BTB), a greater number of respondents came from Nawalpur in contrast to the other two districts. Nevertheless, the accuracy rate for all variables was notably low across all districts surveyed. This shows that the districts had very low knowledge about BTB in compared to the livestock farmers in Punjab, India (Hundal et al., 2016), the smallholder dairy farmers in North Shewa, Ethiopia (Delelegn & Girma, 2017) and the community people in Ghana (Addo et al., 2011).

Bovine tuberculosis is a prevalent zoonotic disease associated with cattle, presents a challenge due to limited awareness among Nepalese livestock farmers. This lack of knowledge poses a significant obstacle not only for veterinarians but also for the broader community, public health efforts, and health education initiatives. A study conducted by Pandey et al. (2012) in Chitwan Nepal revealed that in 60 TB patient households 15 percent livestock had BTB, and all TB patients were engaged in feeding, milking, and other animal care roles. While one-quarter patients had the habit of raw milk consumption. Those types of practices are risky in relation to future disease transmission in the community. Gaire and Subedi also revealed similar

findings related to BTB in Nepal, where, after the intradermal cervical tuberculin test, 10 percent of the cattle were found to have mycobacterium bovis in the 50 cattle that belonged to the households of 25 tuberculosis patients (Gaire & Subedi, 2012).

However, due to the lack of proper study, we cannot say for certain which proportion of human tuberculosis had bovine origin. The prevailing belief suggests that the majority of extrapulmonary tuberculosis (EP) cases in humans originate from bovine origins (Olea-Popelka et al., 2017).

***Knowledge on brucellosis:*** Following rabies, brucellosis is regarded as the second most significant disease globally, and its endemic presence has been documented in Nepal (Acharya et al., 2017). However, the respondents exhibited the low understanding about brucellosis. To illustrate, only 1.6 percent of the respondents had heard of it and merely 0.3 percent had good knowledge of brucellosis, that was very low compared to the finding in Tajikistan, where 15.0 percent of the respondents heard about it (Lindahl et al., 2015). Ecologically, Nawalpur had a higher proportion of respondents providing the correct answer compared to the other two districts, and a pattern similarly observed in Shewa, Ethiopia (Delelegn & Girma, 2017).

The knowledge of brucellosis seems to be connected with the economic and educational status of the nations, which was proved in the comparative study on Ethiopia and Nepal. Based on the study findings, livestock farmers in Nepal were found to be vulnerable to brucellosis, and therefore proper surveillance is required in both the veterinary and public health sectors to plan for future interventional activities.

***Knowledge of avian influenza:*** Avian influenza was mostly heard zoonosis in all studied districts due to frequent outbreak. [In Nepal, avian influenza was first seen in 2009, then it was seen 237 times in different parts of the country up to fiscal years 2016/ 2017 and 1,966,745 poultry were slaughtered (Acharya et al., 2020)]. However, only 5.3 percent of the respondents had a good knowledge of it. Ecologically, most of the respondents in all studied districts heard about avian influenza but, higher respondents in Tanahun had good knowledge in comparison to those in the other two districts. This reflects the poor knowledge to compare livestock farmers in Punjab, India (Hundal et al., 2016), where 92.4 percent farmers knew about avian influenza.

***Knowledge on swine flu:*** Swine flu is a highly contagious zoonotic disease with a pandemic nature. In 2009, a pandemic outbreak that began from Mexico (Adhikari et al., 2011). People involved in pig farming or anyone who has close exposure to pigs and related professions are more vulnerable to swine flu. In this investigation, just over half (54.2%) of the participants were heard of swine flu, and only a fifth (23.42%) demonstrated a strong understanding of it, highlighting the susceptibility of farming communities to this zoonotic disease. When examining the three districts studied, respondents in Tanahun exhibited greater awareness of swine flu compared to those in Nawalpur and Manang. These results were very low in comparison to a study conducted in Punjab, India, where 93% of respondents were knowledgeable about swine flu (Hundal et al., 2016). Therefore, farmers with this type of knowledge who are close to livestock will help protect them from several zoonoses, including swine fever.

***Knowledge on neurocysticercosis (Tapeworm):*** Regarding knowledge of neurocysticercosis, very low percentage of respondents (2.7%) had heard and none of them had good knowledge in the study. This level of awareness contrasts sharply with findings from South-western Ethiopia, where two-thirds of traditional farmers (n=48) were knowledgeable about taeniasis. They acknowledged that taeniasis is transmitted to humans through the consumption of raw meat, specifically *Taenia saginata* (beef tapeworm) and *Taenia solium* (pork tapeworm) (Tesfaye et al., 2013). Despite this knowledge, more than two-thirds of traditional farmers had a habit of consuming raw meat, and among raw meat consumers, over 83% had been infected with *Taenia saginata* at least once before. Additionally, numerous patient reports from Asian countries highlight the widespread prevalence of *Taenia solium* cysticercosis, a major contributor to epilepsy in Indonesia, Vietnam, and Nepal (Rajshekhar et al., 2003). Compared to the study districts, the findings showed that a higher proportion of the respondents in Manang had a knowledge about neurocysticercosis than those in the other districts.

### **Perception Towards the Zoonoses in Farming Communities**

People perceive the surrounding environment or event on the basis of their previous knowledge or experiences. In this study, based on the constructs of health belief model (HBM), the researcher aimed to assess the zoonotic related threats on Nepalese livestock farmers in terms of their perception of zoonoses. The main essence of HBM is that the perception of the severity or risk of any health problem motivates people to take healthy actions, which minimizes the threats of disease. However, the adoption of action-oriented behaviour depends on the perceived benefits and barriers to taking that action (Acharya, 2020). The HBM elaborates that peoples' feeling for

its four constructs can predict their behaviours: perceived susceptibility, severity, benefits and barriers (Carpenter, 2010). The researcher employed the HBM as a theoretical framework, albeit without testing the theory. This model comprises four constructs used to assess zoonotic risk based on the perception of livestock farmers, which can be influenced by various sociodemographic characteristics of the respondents.

From the perspective of health and disease, if individual perceive susceptibility or severity of health problems, there is higher likelihood to prevent, control, or cure diseases such as zoonoses. Other constructs such as benefits will influence the positive adoption of healthy behaviour. However, poor socioeconomic status and cultural taboos pose obstacles to taking a healthy action. Benefits and barriers were found to be strong predictors of behaviour change than feeling of susceptibility and severity of diseases (Acharya et al., 2022; Carpenter, 2010). So, a positive association among the HBM constructs makes a synergistic impact on adopting healthy behaviour that could contribute to the building of a healthy farming community.

In this study, in a statement related to perceived susceptibility, it is likely I will get sick from livestock (i.e., rabies) sometime during my life, the vast majority of respondents (91.6%) agreed with a similar perception in all ecological zones of Nepal. These results offer the hope for public health, veterinary health and in the field of health education in Nepal, and the data were also statistically significant for their level of education ( $p < 0.05$ ). The data supported the essence of the constructs of the health belief model (HBM) and suggested that if we shift the paradigm in farming communities with better education and training, educated and trained livestock

farmers could not only establish livestock as a safer profession from the perspective of zoonoses but also contribute to the eradication of hunger from the nation.

Similarly, on the statement which was tried to measure 'perceived severity', if I got sick from livestock (e.g. rabies, brucella), the illness would be very bad, the most respondents (93.7%) agreed (with similar perception in all study districts) and they found terrified of zoonotic severity, which forced them to take a safety action (PPE or PEP) or early treatment to control the zoonoses. Data were found to be significant to their level of education ( $\rho < 0.001$ ).

Perceived benefit is a strong predictor to take a healthy action (i.e., hand washing by soap water, vaccination, etc.). More than ninety (91.1%) with a similar ratio of respondents in all districts agreed on the statement: 'when I wash my hands after cleaning up animal waste, I am decreasing my chance of getting zoonoses'. This response may be caused by various awareness programs during the COVID-19 pandemic. As a health educator, it is a great opportunity to justify that awareness programs related to health education through multimedia will be associated with changing and adopting healthy behaviours and the data were found to be statistically significant with perceived benefits and educational level of the respondents ( $\rho < 0.001$ ).

Regarding the perception with the construct of perceived barriers, the researcher offered to the respondents the statement: 'washing my hands each time after interacting with my animals will take too much time'. Almost half of the respondents (48%) perceived time barriers (agree) in the statement. When comparing the data in all study districts, a higher percentage of respondents in Tanahun (62.5%)

were found to agree on the time barrier (perceived time barrier) than those in Nawalpur and Manang.

Independent variables (education, training, media, peer group) support taking healthy action (cues to action for livestock farmers). When the researcher stated the statement, 'I encourage other family members to thoroughly wash their hands after interaction with animals', it was found that only more than half (54%) respondents would encourage their families into handwashing practices. When comparing the study districts, a similar proportion was found in Tanahun and Nawalpur (52.0 and 53.0%) compared to Manang (62.0%). This means that they were not much more aware of the importance of hand washing practices, although it is cost-effective preventive approach to prevent several lethal zoonoses. Therefore, the data in the study demand interventional activities that may support the respondents for cues to actions and the data was found to be significant with the level of education of the respondents ( $\rho < 0.001$ ).

Regarding the statement by which the researcher tried to measure the self-efficacy of livestock farmers: 'I have talked with my veterinarian about the risk of disease shared between humans and animals', it was found that only one third (34.5%) of respondents were found to be practicing those types of discussion with their veterinarian, along with similar practices in all study districts (25 -37%). Thus, the respondents had a low self-efficacy in discussing zoonoses with the veterinarian, which may increase the chances of zoonoses burden in the societies. With statistically significant data on level of education ( $\rho < 0.001$ ), we need to approach educational intervention in the farming communities of Nepal.

Similarly, in the statement, 'traditional healers cure zoonotic diseases like rabies', 88 percent of the respondents disagreed with the higher percentage in Tanahun (96.6%) than (83.1%) in Nawalpur and (68.8%) in Manang. This means that most of the livestock farmers in the study areas did not trust traditional healers during zoonotic illness.

However, qualitative data (from public health service provider) contradict the results of the survey respondents. They said: *practices influenced by their socioeconomic status.*

Initially they (community people) contact traditional healers, then only they had contact us. But it generally depends on their level of education and wealth status.

Similarly, it is not harmful if we consume recently died livestock, where, only a few respondents (8.0%) thought positively about the statement and similar results were found in respondents of Tanahun (3.4%) and Nawalpur (5.8%) about consuming recently dead animals. However, higher respondents in Manang (40.6%) adopted this practice, and FGD participants in Manang also supported this reality. They shared:

‘Due to mountainous territory, Manang’s livestock face falling injuries with several deaths and traditionally we are consume recently dead animals, which does not do any harm to us.

And similar results show in the study in the rural parish of Quito, Ecuador (Lowenstein et al., 2016) where livestock keepers were found to sell or consume animals that had recently died, but they would typically discard such animals two or three days after they had died.

So, in this study, the constructs of HBM as a behaviour change theory were instrumental in determining the perception of zoonotic related threats of livestock farmers by comparing their perception with statements related to the constructs of

HBM. This discussion answered the objective of the research; to identify the perception of threat of livestock farmers in different ecological zones in Nepal.

### **Association: Sociodemographic Variables and Zoonoses Preventive Practices**

In Nepal, farmers typically adhere to traditional methods and engage in diverse livestock farming practices, often without adequate safety precautions. However, their behaviors are shaped by their knowledge, cultural values, and perceptions within their specific context. Given the presence of various dangerous pathogens in both hosts and reservoirs, these farmers are at risk of contracting zoonotic diseases from their animals.

Adopting a post-positivist worldview, the researcher aimed to evaluate zoonotic threats to livestock farmers by observing their daily practices during close exposure to livestock. As caregivers, livestock farmers must take precautions to prevent zoonoses. Practices such as handwashing, wearing masks, gloves, and boots are effective in preventing various lethal zoonoses, such as COVID-19. This study sought to establish the connection between preventive practices for zoonoses and socio-demographic variables related to livestock farmers, and the findings are discussed below.

*Association with hand washing practices:* Hand washing with soap and water represent as an easy and cost-effective preventive practice. However, a significant number of respondents (39.2%) did not follow this practice regularly. When comparing the results in three ecological regions, similar practices were found in the study, which was vulnerable to zoonoses transmission and the data was significantly associated ( $p < 0.001$ ) with some socio-demographic variables like; age, level of education, and the purpose of farming of the respondents.

Conversely, research conducted in Chitwan, Gorkha, and Tanahun districts indicated that, greater proportion (94.0%) of the smallholder farmers engaged in handwashing with soap-water following livestock handling (Kelly et al., 2018), and in Bangladesh, all smallholder livestock farmers (100.0%) were found to adopt handwashing practices with soap-water after interacting with animals (Chowdhury et al., 2018). The reason for the better results in both studies than in mine might be the several motivational and interventional activities of the research project.

***Association with mask-wearing practices:*** The wearing of mask during close contact with livestock was not commonly practice in the study. Out of the total respondents, a few (6.6%) of them used the mask regularly. However, due to the impact of the perception of threats from the COVID- 19 pandemic, almost half (42.0%) used it occasionally, while more than half of the respondents never used a mask in the study. By comparing the sociodemographic variables, namely, the age of the respondents ( $p < 0 .001$ ), and the level of education ( $p < 0 .01$ ), the data showed statistical significance with the mask wearing practices of the respondents.

Geographically, the worst scenario was found in Tanahun of all districts: Tanahun (1%), Manang (6%) and Nawalpur (12%). This situation was highly vulnerable from the point of view of public health. This result was similar with farmers in Kars Turkey (Çakmur et al., 2015), where similar numbers of respondents to this study (6.6%) used masks regularly. However, 84% of farmers in Turkey considered that wearing a mask was necessary.

***Association with gloves wearing practices:*** The regular use of gloves during close contact to livestock was found to be low (1.8%) in this study, with more than two-thirds of respondents never using them and nearly onethird using gloves only occasionally. Data indicated an association between glove use and the age and education of the respondents ( $\rho < 0.01$ ). In Manang, a higher percentage (3.1%) of the respondents were regular users compared to those in other districts, which could contribute to zoonotic threats such as brucellosis among livestock farmers. This was a poor practice compared to the study in Kars, Turkey (Çakmur et al., 2015), where 35.8 percent farmers used gloves regularly and 92.1 percent had a positive attitude towards the practice. However, only 0.8 percent of cattle farmers in Tamale, northern Ghana used gloves during handling sick cattle (Ziblim et al., 2021).

***Association with boot-wearing practices:*** Boot wearing practices are also an important PPE. However, a large number of respondents (78.4%) in the study ignored these practices during the exposure period. While studying the data, the sociodemographic variables; aim of livestock farming, only were statistically significant ( $\rho < 0.001$ ) to their boots wearing practices in the study. This finding was poor to compare the result in Kars, Turkey (Çakmur et al., 2015) where 42.4 percent respondents wore boots regularly during the exposure period with an 89.4 percent positive perception.

Due to improper use of personal protective equipment (PPE), the findings of this study suggest that livestock farmers face zoonotic threats. Handwashing practices, considered easy and affordable PPE in farming communities, are also rejected by a significant number of respondents. These poor practices contradict the perceptions of livestock farmers in connection with the constructs of the Health Belief

Model (HBM). It was found that the respondents did not perform preventive practices for zoonoses and had a positive perception of the practices. The reason for this may be the social desirability bias and socioeconomic status of the respondents. For example, respondents may have a positive perception about wearing boots while handling livestock; however, they may not have enough money to afford a pair of boots. To improve the regular use of PPE, stakeholders should implement motivational or intervention activities in the farming communities of Nepal based on the concept of One Health Approach (OH), along with the upliftment of the socioeconomic status of respondents.

### ***Farm and Household Sanitation in Farming Communities***

This research exposed numerous risk factors associated with conventional livestock farming practices in Nepal. Factors such as socioeconomic status, level of education, and sociocultural practices influenced farm and household sanitation within farming communities.

During the evaluation of household and toilet sanitation, most of the households and their toilets observed clean and acceptable conditions (97.9%, 90.3%), respectively. However, 10 percent of the toilets still suffered poor sanitation in the study. This result was found to be similar with the study of National Management Information Project (NMIP, 2014), where 7 percent toilets were not properly maintained by the household members in Nepal.

Toilet sanitation is a component of WASH. Maintaining or sustaining toilet hygiene is determined not only by public awareness, but equally by the impact of easy access to water supply in communities and households. In Gandaki province, 89.68 percent of households had access to water compared to 87.39 percent in Nepal

in 2018. WASH is a priority programme of Nepal and has set a target of providing basic WASH services to the entire population by 2020 and then improving the level of service level by the end 2030 (Budhathoki, 2019). However, the quality of the WASH services is not yet satisfactory in Nepal.

### ***Livestock Caring, Waste Management and Production Consumption Practices***

Zoonotic diseases like rabies, avian influenza, swine flu, neurocysticercosis, bovine tuberculosis, and brucellosis are prevalent in Nepal (ANSAB, 2015). Apart from these, numerous other zoonotic diseases are transmitted to humans primarily through direct contact during animal care or other close exposure without proper personal protective equipment (PPE).

The majority of the study respondents (88.0%) disposed of dead animals in the digging hole, while the remaining few threw these carcasses into the nearest river. This practice was found to be similar to the study areas of Kelly et al. (2018) where 18 percent farmers disposed of animal waste (such as placenta) on the ground, in water, or on a tree according to their traditional practice. Such practices were found to be vulnerable to zoonoses transmission. Geographically, 100, 89 and 19 percent of respondents disposed of dead animals in digging holes in Tanahun, Nawalpur and Manang respectively. But 81 and 10 percent farmers threw dead animals into the nearest river in Manang and Nawalpur, respectively. Those practices are responsible for air or water pollution and their further consequences such as air and water borne diseases.

There may be several factors influencing the close contact of children with livestock. In the study, children of the participants often spent time near livestock either to ease the burden on parents or simply as a recreational activity. More than

two-thirds of the respondents in the study revealed that their children were close to livestock. However, in terms of their sociodemographic variables such as younger, male, and higher educated respondents, such exposure to their livestock was avoided. Data were found associated with age ( $\rho < 0.05$ ), sex ( $\rho < 0.001$ ) and level of education of the respondents ( $\rho < 0.001$ ). Ecologically, a similar (88% and 85%) situation was found in Manang and Tanahun in terms of child exposure to livestock. However, in Nawalpur, those practices were found to be lower (45%) than in other districts. Not only in Nepal, similar practices have been recorded in other parts of the globe, mainly in poor or developing countries. Chowdhury et al. (2018) showed the similar finding (70.0%) in the suburban regions of Bangladesh, the children of respondent farmers were frequently in close proximity to their animals. This similarity with studies conducted in Nepal could be attributed to the influence of education and economic status among livestock farmers in both countries.

The data also reveal that not only children, but also pregnant women have been exposed to livestock. Nearly two-thirds (65%) of the livestock farmers disclosed that pregnant women also had close exposure to livestock as a caretaker role. However, younger, male, and higher educated respondents avoided these practices, and data was found to be statistically significant with these variables [age ( $\rho < 0.01$ ), sex, and level of education ( $\rho < 0.001$ )]. Likewise, by the logistic regression model, it also shows the positive effect of education on avoiding contact to pregnant women and livestock (OR=0.322; 95% CI: 0.21-0.51) in the study. Practice as caregivers, during pregnancy was found to be higher in Manang (97%) than in Tanahun (87%) and Nawalpur (37%). Due to poor immunity during pregnancy, such types of close contact create a higher vulnerability to the health of mother, foetus, or younger

children from the zoonoses. Similarly, approximately one-third of households leave their livestock astray (especially goats/ sheep and poultry), and similar practices were found in all studied districts. Such practices were similar with farming communities of rural Cambodia (Osbyer et al., 2015) where pigs were raised in a free-range system by 20 percent households while 99 percent and 71 percent of the households followed the same practice with poultry and ruminants, respectively.

Various socioeconomic factors, including culture, economy, and education, influence the consumption habits of meat from sick or recently deceased animals. For instance, a notable portion of respondents in this study (17%) still adhered to this practice, with the data revealing a significant correlation with the age of respondents ( $p < 0.001$ ). Of such respondents, these practices were found to be higher in Manang (72%) than in Tanahun (14%) and (10%) Nawalpur. On the contrary, farmers in Kars Turkey had better knowledge about managing the sick and dead animals (Çakmur et al., 2015) than those in this study.

Close exposure to livestock as a caretaker during parturition or aborted livestock is a possible situation for zoonoses transmission. However, the majority of the respondents in this study (86%) were exposed with bare hands to their livestock. However, caring practices with gloves found a positive association with the variables on age and education of the respondents ( $p < 0.01$ ). The logistic regression analysis also shows the positive effect of education on the care of the livestock with gloves during the parturition and abortion period (OR=2.39; CI: 1.33-4.31) in the study. In comparative study of districts, higher respondents in Nawalpur (22.7%) used gloves during these situations than the respondents in Tanahun and Manang, and similar practices were also found in livestock farmers in Punjab (Hundal et al., 2016) where

around half percent respondents experienced history of abortion and retained placenta of their livestock. However, around a third of them (35.6%) disposed of the infected placenta and (39.6%) aborted the fetus with bare hands. Not only that, they also cleaned the feces of diarrheic animals (56.4%), gave an intrauterine medication (23.2%) and assisted during calving (93.6%) with bare hands, creating vulnerabilities of the zoonoses.

Most communicable diseases, including those transmitted from animals (zoonoses), can effectively be controlled through affordable single-dose vaccinations. However, challenges such as poverty and low literacy rates contribute to significant losses among farmers in the livestock sector. This research highlights inadequate vaccination coverage in study areas, where only one third of farmers administer vaccinations to their livestock for pre-exposure prophylaxis. Statistical analysis indicates significant association between vaccination practices and factors such as age, gender, and education level of respondents ( $p < 0.001$ ). Logistic regression analysis reveals that education positively influences livestock vaccination practices (OR=5.04; 95% CI: 3.20-7.94) within the study population. Notably, vaccination practices were higher (78.26%) in suburban areas of Bangladesh compared to the current study findings (Chowdhury et al., 2018). So, based on those evidence, (Table no. 34; 35; 36; 37; and 38), to protect livestock farmers from zoonoses, they need to be acknowledged with zoonoses preventive practices by applying several educational interventional approaches.

As a researcher, I observed that although the perception of threats regarding zoonoses was high, somehow poor preventive practices were vulnerable to farmers. According to the Health Belief Model (HBM), people who perceive themselves as

susceptible to a disease and understand the severity of the consequences are more likely to adopt healthy practices. However, the findings of the study were not supported by the HBM. This may be due to factors such as low socioeconomic status or social desirability bias of respondents.

### **Health Care Seeking Behavior of the Respondents**

Health care seeking behaviour depends on the decision-making process of the individual or a group of people during their illness. It may be influenced by several factors such as education and wealth or the norms and values of entire communities. In the context of Nepal, especially in rural communities, it is natural for an individual to believe during their life in traditional health practices such as worshipping gods and drinking enchanted water if, right from the inception of their life, they are accustomed to such traditional beliefs. Therefore, during their lifetime, their health-seeking behaviours might be influenced by such types of tradition.

However, in this study, it was found that most of the livestock farmers had adopted modern therapy during the illness of family members or livestock, which may be the impact of communication and accessibility of modern therapy to their surroundings. For example, in the study, 91.6 percent of the respondents visited the health institution and health care workers during their illness, and a similar number of respondents (92.9%) would also contact the veterinarian during animal health problems. On the contrary, some households (8.4%) and (7.1%) still believe in traditional healer such as Dhami / Jhankri or in herbal therapy during human and livestock illness, respectively.

When comparing health-seeking behaviour among the three districts studied, similar behaviours were found in Tanahun and Nawalpur where almost all the

livestock farmers (97- 99%) initially consulted the health and veterinary units during human and livestock disease. However, in Manang, only less than one fifth (16%) of the farmers contacted health institutions primarily for modern therapy, and most of the farmers still followed traditional healing practices initially during their illness. This number in the study was found higher than the study by (Chowdhury et al., 2018) in suburban Bangladesh where 17.39 percent of farmers used different herbal preparations such as Chinese rose or garlic pest extracts in addition to saline as primary treatment of diarrheic animals, and similar results is show by Tesfaye et al. (2013) in south-western Ethiopia, where 77.7 percent of the respondents mentioned that traditional medicine was an effective treatment for *T. Saginata* (beef tapeworm).

But interestingly, in Manang almost half (41%) livestock farmers initially contacted the veterinarian for animal health. This number is likely three times greater compared to farmers who visited the health institution for human illness.

However, key informants in the study (health care service provider) perceived the issue differently with similar experiences related to health care seeking behaviours during human illness in all three study districts. They stated:

Depending on the nature of health problems, people will visit both traditional or modern therapists. However, most people first visited traditional healers or adopted self-used herbal therapy and if those practices did not alleviate the problem, people visited health institutions. They also perceived that these practices depend mainly on the education or financial status of families.

Therefore, to control or prevent zoonoses, we need to establish and sustain both types of health services (human and animal health) based on the concept of an OH approach under the one umbrella. Local municipalities which self-govern all types of public services; this type of practices is possible in the federal system in

Nepal. So, as advocates or experts we need to do something in the field of zoonoses control in Nepal.

### **Reflection Towards One Health Approach**

Close contact between humans, animals, and the surrounding environment increase the risk of transmitting zoonotic diseases between them. The One Health (OH) approach highlights the collaboration between public health, animal health, and environmental sector, to combat these diseases effectively (Gayathri, 2020). In this study, the researcher sought to identify the knowledge on the OH approach among health service providers in both fields, and equally tried to assess the program implementation situation based on the OH approach. However, most of the health service providers in both fields had little knowledge of the approach (OH). Most of them carried out the health program vertically in their institution. But they all accepted the OH approach as an important tool to control zoonoses. Due to the emerging approach, not only in community-level health service providers, but also veterinary medical students in Nepal demonstrated only satisfactory results related to OH concept (Subedi et al., 2022). Therefore, as an emerging approach, OH; we need to articulate local knowledge that could facilitate the empowerment of livestock farmers and health service providers for a transformative grass-root solution against zoonoses.

Acharya et al. (2019) note that the Government of Nepal (GoN) has initiated measures to address emerging issues like antimicrobial resistance, highly pathogenic avian influenza (HPAI), and rabies through the One Health (OH) approach. However, they highlight numerous challenges in implementation. Additionally, Relief International, in collaboration with partners like the Asia Network for Sustainable

Agriculture and Bio-Resources (ANSAB), executed the OH Asia Program between 2014 and 2017 across three Nepalese districts; Chitwan, Banke, and Rupandehi. Their aim was to mitigate the impact of zoonotic diseases in rural Nepal by fostering behavioral changes and enhancing awareness. These types of programs evaluate the zoonotic vulnerabilities and effectiveness of collaborative programs (OH) with a clear way forward.

As an innovative paradigm, the OH approach creates the hope of controlling zoonoses. In Nepal, the government recently approved the OH Strategy, 2019 with an emphasis on coordination and collaboration with stakeholders, integrated disease surveillance and laboratory services, preparedness and response, communication and advocacy as major components (Ministry of Agriculture and Livestock Development, 2019) which might play a role as a milestone for promoting cross-disciplinary collaboration involves reducing the existing barriers between human health and veterinary sectors, and ecological, evolutionary, and environmental sciences to address zoonotic diseases in Nepal.

### **Association: Education and Zoonotic Knowledge**

Education is a stronger predictor of positive change. From the perspective of education, farmers were classified into three groups and higher respondents belonged to basic-level education. Based on knowledge of zoonoses, only a few respondents had a good knowledge of bovine TB (1.6%), and brucellosis (0.3%). However, none of the respondents had good knowledge about neurocysticercosis. Therefore, the researcher excluded the data for further discussion in this section.

Among the three zoonotic diseases analysed, respondents had a good knowledge of swine flu (23.42%), rabies (19.5%) and bird flu (5.3%). However, a

significant number of respondents also possessed some knowledge in the study. In comparing knowledge (including some and good knowledge) with educational status, it was found that higher respondents (99.4%) had information about zoonotic rabies who had a secondary and higher education than those who had up to the basic level (85.4%) and were not read and write (68.8%) respondents. Data were highly associated with their level of education ( $p < 0.001$ ) in the study and similar association was also found in knowledge of the symptoms of rabies and the level of education in the study. Logistic regression analysis also found that the respondents with higher education were almost 4. times more likely to be aware of zoonotic rabies than respondents with a lower level of education (OR= 3.8; 95% CI: 1.4-7.7).

Similarly, most of the respondents in all education categories knew the mode of transmission and preventive measures of rabies. However, those with education levels higher than secondary (95.7%) were more informed than those who were not read and write (90.9%) and or had education up to the basic level (89.4%). Knowledge of preventive measures yielded similar results in the study.

Rabies, a disease preventable by vaccination is offered free of charge by the government of Nepal. However, respondents in this study who lacked literacy were unaware about free anti rabies vaccine services, whereas approximately one-third (31.2%) of those with basic education and nearly two-thirds (61.0%) of those with secondary education or higher were knowledgeable about these services. The data was found to be statistically significant in terms of the level of education and ARV services in the study ( $p < 0.001$ ).

Similarly, respondents with a higher level of education in the study were found to have greater knowledge on the prognosis of rabies, indicating a significant

association between respondents' education levels and their understanding on zoonotic rabies ( $\rho < 0.001$ ).

Many empirical studies also show similar results with positive association of training and education with zoonoses related to the knowledge, practices, and attitude of livestock farmers. Kanda et al. (2015) discovered that education had a positive impact on rabies prevention and pet care practices among children in a resource-limited setting in Sri Lanka. Their findings highlighted that an intervention program effectively raised awareness of rabies among students in a short timeframe, with school teachers playing a crucial role in delivering the message of rabies prevention as part of the school curriculum. In the Philippines, a successful pilot rabies information and education campaign has been incorporated into the curriculum of elementary schools across a region. Similarly, in Nigeria, there is a strong recommendation for providing comprehensive rabies education for children (Dzikwi et al., 2012; Lapid et al., 2012).

In this study, a higher percentage of respondents (23.42%) demonstrated good knowledge of the swine flu. Furthermore, compared to educational levels, a significantly higher proportion of respondents with higher education (84.2%) were aware of the swine flu, compared to those with education up to the basic level (33.2%) and were not read and write respondents (6.2%) ( $\rho < 0.001$ ). Logistic regression analysis also observed that respondents with secondary and higher education were more than 12 times more likely to be informed about zoonotic swine flu compared to those with lower education levels (OR=11.8; 95% CI: 7.1-19.64). Swine flu is a highly contagious zoonosis. The results of knowledge of the symptoms of swine flu differ significantly in the study. Data shows that higher respondents

(78.8%) had knowledge about symptoms of swine flu who had an education up to the basic level than those having secondary and higher education (77.7%) groups. Similarly, nearly equal (77.3 and 78.4%) of the respondents had knowledge about the mode of transmission who had an education up to basic level and secondary and above. However, illiterate respondents had no idea about it. But data were found to be statistically significant in the study ( $\rho < 0.001$ ).

However, a higher percentage of respondents (100.0%) who had no formal education were found to have knowledge of preventive measures, 80.3 percent of respondents from up to basic level and nearly similar (76.3%) from education with secondary and above knew the preventive methods of swine flu.

Similarly, 5.3 percent of the respondents had a good knowledge of zoonotic bird flu. A higher percentage of respondents (97.6%) with higher education heard about bird flu than those who had up to basic level education (95.0%) and those having no education (87.5%), which was found statistically significant in the study ( $\rho < 0.05$ ). Interestingly, regarding symptoms of bird flu on poultry, higher respondents (67.7%) having had a up to basic level education had better knowledge than those who were not read and write (64.3%) and those with education with secondary and above (54.0%). The data was seen statistically significant ( $\rho < 0.05$ ) in the study.

The exposure to infected poultry without safety measures is one way of bird flu transmissions to human. Knowledge of this indicator found that the higher respondents (90.7%) having higher education had such knowledge than the respondents who had an education up to the basic level (70.9%) and who were not read and write (21.4%). This was statistically significant ( $\rho < 0.001$ ) in the study. Similarly, more than half (54.7%) of the respondents who had a secondary and higher

level of education had a knowledge on preventive methods of bird flu, in comparison to one third respondents (33.3%) with up to basic level education and 14.3 percent who were not read and write, and data were found statistically significant ( $p < 0.001$ ) in the study.

Hundal et al. (2016) showed the similar results among goat farmers in Punjab, India. Before training (intervention), only 2.4% of farmers had high-level knowledge, while after intervention, 76.8% possessed high-level knowledge ( $p < 0.01$ ). Among respondents, 17.6%, 31.2%, and 42.4% had education up to middle, matric, and senior secondary levels respectively, with 8.8% being graduates. Ngowi et al. (2008) conducted a randomized community-controlled trial to assess the effectiveness of health and pig-management education intervention, which successfully reduced the incidence rate of porcine cysticercosis caused by *Taenia solium*.

This discussion explores the effect of education on knowledge related to zoonoses among livestock farmers. Higher educated respondents generally exhibited greater awareness of zoonoses in the study. Therefore, to enhance zoonotic-related knowledge among livestock farmers, it is imperative to employ educational strategies, including curriculum-based training for current and prospective farmers.

### **Health Education and Zoonoses in Curriculum**

Curriculum is an educational framework which not only helps in instructions for the teachers and in upgrading students but also helps to achieve the educational objectives set by the nation. So, we need to design curriculum which is a child-centered and life-centered, which can contribute to achieve the student's aspirations of life. In the context of Nepal, we found that the national curriculum at the school level

has a gap in the design of many life-saving skills and preventive practices related to health and well-being.

In Nepal as an agrarian country, most of the students come to school from farming communities and many of them will adopt a farming profession in the future. However, they are missing opportunities to gain knowledge related to the safer farming profession from the perspective of zoonoses due to the lack of a proper curriculum.

Out of the total of respondents, 42 percent were found to have received zoonoses-related information from curriculum or textbook during their school life. However, due to the lack of core curriculum on health education or specific content related to zoonoses, only a few respondents had good knowledge of many common zoonoses [i.e., swine flu 23.42%, rabies 19.5%, bird flu 5.3% etc.], and unsafe practices in the perspective of zoonoses were rampant [regular hand washing with soap water 60.8%, mask using 6.6%, gloves using 1.8%, boots using 1.3%, children exposure to livestock 66.8%, pregnant women exposure to livestock 65.3%, sick animals consuming practices 16.8%, take care with gloves during parturition or aborted livestock 14.5% and prophylaxis vaccination to livestock 35.5%]. However, most of these variables were significantly associated with their level of education.

Not only that, participants in the FGD also called for training programs for livestock farmers and proposed the inclusion of zoonotic-related courses in school curriculum and similar issues were also shared by (Awasthi et al., 2017) and they mentioned that school curriculum of Nepal does not adequately provide life skills information for students. Therefore, based on this reality, the researcher concluded that in order to protect livestock farmers from zoonoses and promote a safer farming

profession, it is necessary to incorporate health education with zoonotic content into the core curriculum at the school level. In addition, providing per-professional training for individuals aspiring to enter livestock farming is essential.

### **Cultural Values of Livestock**

Animals play flexible and often ambiguous roles in human society (Berger, 1980). They serve as objects of worship and sacrifice, companions, sources of entertainment, and food. This complex relationship between humans and animals has deep historical roots, exemplified in the ancient Hindu epic Mahabharata. In this epic, Yudhisthira, known for his adherence to truth, displays a unique bond with a dog, demonstrating love and responsibility towards it, as recounted by Bagale et al. (2020).

The researcher in the study explored the cultural and traditional values of livestock and tried to determine the possible vulnerabilities of zoonoses due to close exposure to livestock and livestock farmers. People have intimacy with livestock for various purposes. Not only for livelihood (e.g., food security or source of income), they also keep livestock for various sociocultural perspectives. Most of the respondents in the study belong to Hinduism, and their culture and religions were found bonded with livestock and livestock production.

Dashain and Tihar are great Hindu festivals which people celebrate by sacrificing or worshiping animals as a symbol of God and goddess. Respondents in the study equally value the livestock for other several sociocultural practices which they practice in their societies by tradition. However, none of the respondents disclose vulnerabilities in zoonoses through close exposure to livestock. The participants in the FGDs clearly explored the values of livestock in their communities and also said that ‘we need animals (i.e., cows) from the womb to the tomb’.

Respondents in Manang disclosed that they celebrate most of the socio-cultural festivals (i.e., Dashain, Tihar) by worshiping goddesses with sacrifices of the livestock (i.e., cock, goat, sheep) or worshiping many live animals as a symbol of goddess (ox, cow, dog etc). Not only in the naming ceremony, they need cow milk and sheep or cocks also for funeral and marriage ceremony and the data were also supported by the FGD participants under the global themes '*cultural and religious attachment with livestock*' in the study. They mentioned:

In Dashain, we generally sacrifice sheep to worship Goddess Durga and paste the fresh blood in our palm and get it printed on the door. On the day we celebrate Aakhikutu (worship the earth or nature), we worship the mountain, big trees, ponds by sacrificing the sheep or goat. We believe that gods reside there.

During the marriage ceremony after the newly married couple has entered the groom's house, we worship at home by sacrificing cocks, believing that this worship protects the family, especially the newly married couple, from unseen evils and witches.

On the day of death of a family member, after the funeral ritual, it is customary that we hang a live hen upside down at the door and put a diyo (clay lamp) to conform to the blue light emitting there that the departed soul is heading towards the heavens.

Similar practices were found in the study done by (Coertze, 1986) in South Africa. Where the ritual significance of cattle can also be seen in funeral ceremonies of black people. If an important (elite) person in the communities dies, the dead body should be buried in the hide of a black bull. Thus, they are keeping bulls with close exposure.

Respondents in Tanahun also explored the values of livestock in their cultural and religious rituals. They stated:

We worship the Goddess Durga by sacrificing the goat, hen, male buffalo, pigs, or pigeon. Cow milk, dung, and urine are necessary for many cultural and religious ceremonies. We worship cow, ox, dog and crow in Tihar.

FGD participants also supported their claim under the global themes, *diverse ethno -religious values of livestock*, in the study, and similar practices were also found in south Africa. Coertze (1986) explored that Bantu people in the south eastern Africa must present (gift) dowry to their daughter with cows when she gets married, and this cow should never be sold or slaughtered. So they kept cows in their home with close exposure.

The respondents from Nawalpur also valued the livestock for many cultural and religious practices. Most of the respondents in Nawalpur were from Tharu and other ethnic (janajati) communities. They used cow milk, dung, and urine in *Kiriyaa Karma*. In *Pitri Ausi*, they need a cock or a pigeon or a duck. They worship *Ban Devi* at Tihar with the sacrifice of the cock, pigeons, or goat. In *Baarana Puja* (which is worshipped before cultivation), they sacrifice the pigeons, or the cock. During *Jitiya Puja*, devotees worship God and emphasize the value of cow milk. At *Kindar Puja* (worshiping every five years) sacrifices of the pigeon, cock, goat or male buffalo are performed. At the Naming ceremony, they need cock meat to respect the maternal family. In *Chandi Puja and Bhakal Puja*, sacrifice of the cock, pigeon, duck, or goat is performed. Kumal, Bote, Musahar, Sunar value pigeons or cocks on several ceremonies. They need cow milk, urine, and dung during the *Kaaj -Kiriyaa*.

FGD participants in Tharu communities also explored similar practices under the global themes, *culture and religion driven demand of livestock and livestock for livelihood and cultural perspective* in the study:

Not only for milk, meat or selling for money, we keep some animals for our sociocultural purposes. We need cow milk during *Kriya-Karma*. Cow urine and dung also have cultural values in our society. During *Kinder Puja*, *Srithan Puja*, *Kul Puja*, *Bhakal Puja*, we cannot do without livestock like pigeons, cocks, goats, sheep, or male buffalo.

We sacrifice those livestock and take their meat and blood as *Parsad*, and sometimes we sacrifice those animals for *VAKAL PUJA* and for traditional healing purposes.

Religiously, Muslim people also highly value livestock for their festivals.

During Eid al-Adha celebration, they must sacrifice livestock, either cattle, sheep, goat, buffalo or camel (Ibrahim et al., 2019).

So, not only from occupational perspective, but the respondents also keep livestock for other several sociocultural importance. However, they had a low knowledge about host and reservoir (i.e., dog for rabies, goat, sheep for brucellosis, etc.) characteristics of livestock. These situations create threats to zoonoses in farming communities. Bagale et al. (2021) also investigated that Hindu ethnic communities who engage in the worship of live animals and have frequent interactions with them. However, they found that these communities often lack clear understanding of zoonotic diseases transmitted by animals and their potential implications for public health. Therefore, this discussion discloses the association of sociocultural values with livestock in farming communities. However, the prevalence of zoonoses in societies, low knowledge of common zoonoses, and unsafe practices during care of livestock and many sociocultural values related to livestock, livestock farmers facing vulnerabilities to zoonoses and addressed the objective of exploring the cultural and traditional values of livestock and their zoonotic risk in farming communities in Nepal.

## Chapter VI

### Conclusions, Implications, and Recommendations

#### Conclusions

Embarking on the research work by spotting the threat of zoonoses to the livestock farmers as the research problem, the study aimed to assess the knowledge, threat perception, and preventive practices related to zoonoses among livestock farmers in different ecological zones of Nepal. The study adopted a convergent parallel QUAN + qual research design and applied the Health Belief Model (HBM) to examine the zoonotic risk in the farming communities of Nepal with One Health approach, and post-positivism as philosophical foundation.

While describing the knowledge, perceived threats and preventive practices related to zoonoses among livestock farmers in different ecological zones of Nepal, it was found that out of six zoonotic diseases, swine flu, rabies, bird flu, bovine tuberculosis, brucellosis, and neurocysticercosis, higher respondents had good knowledge on the first three zoonotic diseases. Ecologically as well, higher respondents had good knowledge on zoonotic swine flu, rabies, and bird flu. The three districts in the ecological regions covered by the research were Manang in the mountain region, Tanahun in the hill region, and Nawalpur (Nawalparasi -East) in the Terai region. However, the respondents possessed considerably low knowledge on these diseases. This knowledge gap may heighten a significant threat to the health and well-being of both farmers and their communities.

Similarly, the respondents had good perception of zoonotic risks based on the constructs of HBM in the study. However, the preventive practices observed among livestock farmers such as hand washing, mask, gloves and boots wearing practices,

vaccination to livestock were suboptimal. More respondents washed their hands with soap water than they wore mask, gloves and boots while handling livestock. Sick animal and raw meat consumption practices still exist in the research site, which is a matter of concern from the perspective of zoonosis spread. Exposure of children and pregnant women to livestock is also a part of the respondents' daily life. The gap between good perception and their poor preventive practices might be the results of social desirability bias of the respondents, and may call for the need of qualitative studies to delve deeper into the reasons behind this behaviour. Perceived barriers such as time constraints and the cost of veterinary services may have obstructed them from taking necessary preventive actions.

Next, on examining the association between preventive practices on zoonoses and socio-demographic variables such as age, sex, and education, the variables were found to have positive association with most such practices. This means more educated respondents, for example, were involved in zoonosis preventive practices. Regarding integrating One Health approach into health programs within local level health facilities, most of the health service providers still had a low knowledge about the OH approach and were found to be conducting their programs vertically in the research site.

On determining the association and effect of level of education of the respondents on their knowledge and perception of zoonoses, it was revealed that education and training were major factors for ensuring healthy practices. The statistical analysis showed that education had a significant association and effect on developing the knowledge, positive perception and preventive practices against

zoonosis. Therefore, educational programs in farming communities are pivotal in increasing awareness and self-efficacy among farmers in Nepal.

After exploring the cultural and traditional values of livestock in the life of the farmers, the researcher found culture significant in livestock farming communities, with livestock being integral to their daily lives and cultural practices. However, they were not cautious about zoonotic threats caused by livestock.

In conclusion, the key message from this study is that despite Nepal being an agrarian country with a significant population engaged in livestock farming, there is a noticeable lack of knowledge and zoonotic preventive practices among farmers regarding various zoonotic diseases that are endemic in their regions. This research underscores the importance of targeted health education, improved access to veterinary and public health services, and culturally sensitive interventions to address the knowledge gaps and mitigate zoonotic threats among livestock farmers in Nepal. Further research in this area could explore the reasons behind the observed poor preventive behaviours compared with perception towards the zoonoses and evaluate the effectiveness of educational programs in promoting preventive practices. Additionally, revision in existing curriculum in the school system and training in farming communities might significantly contribute to controlling or preventing zoonoses in farming communities.

### **Implications**

Based on the research findings, the researcher claims that the study can be worthy of mention. Given the scarcities of academic study in the field of zoonoses from the perspectives of livestock farmers, the researcher has proposed the following

implications for the curriculum designers, health education practitioners, stakeholders, policy makers, academicians, and future researchers.

### ***Pedagogical Implications***

Based on the research findings, the existing school-level curriculum in Nepal was found to lack zoonoses related contents. Therefore, this research might have implication in the following ways.

Firstly, as an agrarian country in Nepal, it is important to incorporate some life skill-based contents related to zoonoses in the school and university-level curriculum, which can impact people not only in the short term but may have a positive impact in the future on those who will be involved in livestock as a profession. The emphasis on zoonotic control programs through health education in the curriculum, at least from the secondary level education is worth considering. This serves as an easy and cost-effective strategy.

Secondly, the study may offer direction in the implementation of training programs in farming communities through the training curriculum, which make farmers more confident in handling livestock and preventing zoonoses.

### ***Policy Implications***

The study may assist all levels of government to promptly develop and implement proactive policies, plans, strategies, and actions regarding zoonoses control in the context in which the study suggests that zoonoses pose significant threat particularly to livestock farmers.

With practicing the federal system, most of the public institutions are centred in local municipals. This is an opportunity to develop and implement the zoonotic

control programs based on OH approach against the zoonoses at local level government.

The common goal of any health policy is to reduce diseases and treatment cost with focus on safety and well-being of the people. From the public health perspective, primary prevention has proven to be more cost-effective in the long run than secondary and tertiary prevention. So, this study can guide in designing zoonoses control strategies with proactive approach through several preventive programs on a regular basis under the OH approach.

The study shows that farmers had a low knowledge about livestock insurance program. Therefore, the government needs to reform their insurance policy which assures the access of marginal livestock farmers to the optimal compensation when they lose their livestock. Similarly, since there was low coverage of livestock vaccination and low knowledge about free availability of ARV services to prevent rabies, government is required to rethink and revise the existing plan and policy for minimising these gaps. In this context, government could adopt a communication strategy that focuses on zoonoses for the general population through mass media such as radio FM, TV or other social media platforms. This strategy should aim to regularly promote government health programs and services such as the provision of free anti-rabies vaccines in government health facilities.

### ***Research Implications***

The study shows that livestock had multiple utilities in farming communities, for example, as a source of livelihoods, for household consumption, and other several socio-cultural, religious or ethno-medical applications. So, for the future research scholars who are interested in studying these areas with more specific objectives, the

findings of this study may guide them into digging out the association of animals and human beings in the societies. This study could be motivational to all such researchers at bringing forth further knowledge in this sector.

The study also points to the importance of all levels of government engaging in research activities to determine the actual incidence and prevalence status of zoonoses and their impact on vulnerable population. The research gaps suggested in the limitation of the study can be closed by the future researchers so that they can come up with interventional research work based on One Health Approach in the farming community of Nepal.

### ***Theoretical Implications***

By applying the constructs of HBM (susceptibility, severity, benefit, barriers, cues to action, and self-efficacy), the researcher in this study successfully determined the zoonoses-related threats to livestock farmers in Nepal. HBM assumes that people will adopt a healthy behaviour when they experience negative health conditions or have positive expectations for taking a recommended healthy action (Conner & Norman, 2006). Zoonoses-related perceptions rated in line with the constructs of HBM and preventive practices of the respondents were compared in the study. The respondents were found to have possessed poor practice compared to their strong perception of zoonoses. This might be influenced by their poor socio-economic status or social desirability bias. So, based on the findings of this empirical study, HBM as a behaviour change theory might be reconsidered with cogent evidence following numerous other studies in future like the present one.

## References

- Acharya, D. (2020). *Information, education and communication for enrolment in health insurance in Nepal* [Tribhuvan University]. <https://elibrary.tucl.edu.np/handle/123456789/9538>
- Acharya, D., Devkota, B., & Kreps, G. L. (2022). *Does perceived susceptibility and severity of health problems serve as drivers for household enrolment in health insurance ? A case study from Nepal. March 2021*, 839–853. <https://doi.org/10.1002/hpm.3377>
- Acharya, K., Acharya, N., Phuyal, S., & Subramanya, S. H. (2020). Human infection with avian influenza A virus in Nepal: requisite for timely management and preparedness. *VirusDisease*, 31(3), 244. <https://doi.org/10.1007/S13337-020-00593-Z>
- Acharya, K., Kaphle, K., Shrestha, K., Garin-Bastuj, B., & Smits, H. L. (2016). Review of brucellosis in Nepal. *Epidemiology and Health*, 38(ID: e2016042), 10. <https://doi.org/https://doi.org/10.4178/epih.e2016042>
- Acharya, K. P. (2016). Brucellosis in Nepal - a potential threat to public health professionals. *Current Health Sciences Journal*, 42(4), 396. <https://doi.org/10.12865/CHSJ.42.04.10>
- Acharya, K. P., Karki, S., Shrestha, K., & Kaphle, K. (2019). One health approach in Nepal: Scope, opportunities and challenges. *One Health*, 8(April). <https://doi.org/10.1016/j.onehlt.2019.10010>
- Acharya, K. P., Niroula, N., & Kaphle, K. (2017). Review of brucellosis in Nepal. In *Epidemiology and health* (Vol. 39, p. e2017018). NLM (Medline). <https://doi.org/10.1016/j.ijep.2017.01.001>

org/10.4178/epih.e2017018

- Addo, K., Mensah, G., Nartey, N., Nipah, G., Mensah, D., Aning, K. G., & Smits, H. (2011). Knowledge, attitudes and practices (KAP) of herdsmen in Ghana with respect to milk-borne zoonotic diseases and the safe handling of milk. *Journal of Basic Applied Sciences*, *01*(10), 1556–1562.
- Adhikari, B. R., Shakya, G., KC, K. P., Shrestha, S. D., Upadhyay, G. R., & Dhungana, B. P. (2011). Outbreak of pandemic influenza A/H1N1 2009 in Nepal. *Virology Journal* *2011 8:1*, *8*(1), 1–8. <https://doi.org/10.1186/1743-422X-8-133>
- Agergaard, J., Subedi, B. P., & Brøgger, D. (2022). Political geographies of urban demarcation: Learning from Nepal’s state-restructuring process. *Political Geography*, *96*(January). <https://doi.org/10.1016/j.polgeo.2022.102605>
- Agriculture and Forestry University. (2015). *Course Bulletin Faculty of Animal Science* (pp. 1–202). Curriculum Development Center, Agriculture and Forestry University, Rampur, Chitwan.
- Akinade, A. J., Akinade, B., Joseph, A., & Akinade J.A. (2015). *Zoonotic diseases prevention and control: The role of awareness and educational programmes*. <https://www.researchgate.net/publication/287331661>
- American Psychological Association. (2020). Publication manual of the American Psychological Association. *American Psychological Association (7th Ed)*. <https://apastyle.apa.org/products/publication-manual-7th-edition>
- Aryal, R. (2013). *Havoc of bird flu in poultry farm industry of Nepal | Rameshtalks*. <https://rameshtalks.wordpress.com/2013/08/01/havoc-of-bird-flu-in-poultry->

farm-industry-of-nepal/

Asian Network for Sustainable Agriculture and Bioresources (ANSAB). (2015).

*Baseline survey and pre-KAP (knowledge, attitude and practice) study in Chitwan, Rupandehi and Banke districts for One Health Asia programme (OHAP) in Nepal.* <https://ansab.org.np/storage/product/ansab-ohap-pre-kap-baseline-report-1579846344.pdf>

Awasthi, K. R., Adefemi, K., Awasthi, M. S., Chalise, B., Kiran, D., & Awasti, R.

(2017). Public health interventions for control of malaria in the population living in the Terai region of Nepal. *JNHRC*, 15(3). <https://doi.org/10.3126/jnhrc>

Bagale, K. B., Adhikar, R., Acharya, D., Gaire, B., & Pokhrel, B. (2021).

Ethnocultural influences for zoonoses transmission in multi-ethnic communities in Nepal. *Journal of Health Promotion*, 9(2631–2441), 19–31. <https://doi.org/10.3126/jhp.v9i01.40959>

Bagale, K. B., & Adhikari, R. (2019). Risk of zoonoses among livestock farmers in

Nepal. *Journal of Health Promotion*, 7(September), 99–110. <https://doi.org/10.3126/jhp.v7i0.25520>

Bagale, K. B., Adhikari, R., & Acharya, D. (2022). Educational association with

zoonotic related knowledge and practices of livestock farmers in selective districts of Nepal. *Journal of Health Promotion*, 10(1), 127–142. <https://doi.org/10.3126/jhp.v10i1.50993>

Bagale, K. B., Adhikari, R., & Acharya, D. (2023). Regional variation in knowledge

and practice regarding common zoonoses among livestock farmers of selective districts in Nepal. *PLoS Neglected Tropical Diseases*, 17(2), 1–17. <https://doi.org/10.1371/journal.pntd.1010101>

[doi.org/10.1371/journal.pntd.0011082](https://doi.org/10.1371/journal.pntd.0011082)

- Bagale, K. B., Adhikari, R., Acharya, D., Devkota, B., & Shrestha, S. (2023). Demand of One Health Activities by Community-Level Service Providers in Selected Districts of Nepal. *Asian Journal of Population Sciences*, 2(January), 54–67. <https://doi.org/10.3126/ajps.v2i1.51090>
- Bagale, K. B., Adhikari, R., Acharya, D., & Kreps, G. L. (2023). Implications from the health belief model concerning zoonoses-related threat perceptions held by livestock farmers in Nepal. *World Medical and Health Policy*, July 2022. <https://doi.org/10.1002/wmh3.563>
- Bagale, K. B., Gaire, B., & Adhikari, R. (2020). Zoonotic risk for pet owners in Kathmandu, Nepal. *Global Journal of Medical Research: G Veterinary Science and Veterinary Medicine*, 20(2).
- Berger, J. (1980). "Why Look at Animals" In J. Berger *About cooking London: Writers and Readers* (pp. 1–28).
- Bryman, A. (2018). Quantitative and qualitative research: further reflections on their integration. *Mixing Methods: Qualitative and Quantitative Research*, 57–78. <https://doi.org/10.4324/9781315248813-3>
- Budhathoki, C. B. (2019). Water supply, sanitation and hygiene situation in Nepal: A Review. *Journal of Health Promotion*, 7, 65–76. <https://doi.org/10.3126/JHP.V7I0.25513>
- Çakmur, H., Akoğlu, L., Kahraman, E., & Atasever, M. (2015). Evaluation of farmers' knowledge-attitude-practice about zoonotic diseases in Kars, Turkey. *Kafkas Journal of Medical Sciences*, 5(3), 87–93. <https://doi.org/10.5505/KJMS>.

2015.83436

- Carpenter, C. J. (2010). *A meta-analysis of the effectiveness of health belief model variables in predicting behavior*. 25(8), 661–669. <https://doi.org/10.1080/10410236.2010.521906>
- Cediel, N., Luis, C. V., Jaime, R., Libardo, R., & Meneghi, D. D. (2013). Setting priorities for surveillance, prevention, and control of zoonoses in Bogotá, Colombia. *Revista Panamericana de Salud Publica = Pan American Journal of Public Health*, 33(5), 316–324. <https://doi.org/10.1590/S1020-49892013000500002>
- Center for Disease Control and Prevention (CDC). (2018a). *One Health*. <https://www.cdc.gov/onehealth/index.html>
- Center for Disease Control and Prevention (CDC). (2018b). *Rabies-free countries and political units*. <http://medbox.iab.me/modules/en-cdc/www.cdc.gov/importation/rabies-free-countries.html>
- Central Bureau of Statistics. (2012). *National Population and Housing Census 2011. Vol.1. Government of Nepal National Planning Commission Secretariat*. <https://unstats.un.org/unsd/demographic-social/census/documents/Nepal/Nepal-Census-2011-Vol1.pdf>
- Central Bureau of Statistics. (2022). Preliminary report of national census, 2021. In *Government of Nepal National Planning Commission Secretariat Central Bureau of Statistics*. <https://censusnepal.cbs.gov.np/>
- Champion, V. L., & Skinner, C. S. (2008). The health belief model. In K. Glanz, K. Viswanath, & B. K. Rimer (Eds.), *Health behaviour and health education:*

*theory, research and practice* (4 th, pp. 45–65). San Francisco, CA: John Wiley & Sons, Inc. Chen,.

Chowdhury, T., Marufatuzzahan, Shanzana, P., & Zahan, F. N. (2018). Knowledge, awareness, and risk of zoonotic diseases among the smallholder livestock farmers in suburban areas of Sylhet, Bangladesh. *Advances in Biology & Earth Sciences*, 3(1), 69–84. [www.researchgate.net/publication/324574256](http://www.researchgate.net/publication/324574256)

Coertze, R. D. (1986). Livestock in the social and cultural life of African communities. *South African Journal of Ethnology*, 9(3), 129–135.

Conner, M., & Norman, P. (2006). *Predicting health behaviour: Research and practices; A social cognition approach, (2nd ed.)*. Open University Press.

Conner & Norman. (2006). *P R E D I C T I N G Health Behaviour Mark Conner and Paul Norman* (M. C. and P. Norman (ed.); Second). Open University Press.

Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (Third Edit). SAGE Publications, Inc; 3rd edition. <https://www.amazon.com/Research-Design-Qualitative-Quantitative-Approaches/dp/141296556X>

Creswell, J. W., & Creswell, J. D. (2017). *Research design: qualitative, quantitative, and mixed methods approaches*. SAGE Publications, 2017. [https://books.google.com.np/books/about/Research\\_Design.html?id=335ZDwAAQBAJ&redir\\_esc=y](https://books.google.com.np/books/about/Research_Design.html?id=335ZDwAAQBAJ&redir_esc=y)

Crewswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*. <https://us.sagepub.com/en-us/nam/designing-and-conducting-mixed-methods-research/book241842>

- Curriculum Development Center (CDC). (2019). *National curriculum framework, 2076*. MoEST, CDC, Sanothami, Bhaktapur. <http://nepaknol.org.np/cdc/elibrary/pages/view.php?ref=2451&k=b2f7a0b986>
- Curriculum Development Division. (2016). *Curriculum: Veterinary Science* (First Revi, pp. 1–79). Council for Techniacl Education and Vocational Training, Curriculum Development Division. [http://ctevt.org.np/uploads/docs/2021-01-24\\_TSLC in Vetarinary Science\\_Post SLC intake, Revised 2016.pdf](http://ctevt.org.np/uploads/docs/2021-01-24_TSLC in Vetarinary Science_Post SLC intake, Revised 2016.pdf)
- David, H. (2010). *An introduction to triangulation*. [http://www.unaids.org/en/media/unaids/contentassets/documents/document/2010/10\\_4-Intro-to-triangulation-MEF](http://www.unaids.org/en/media/unaids/contentassets/documents/document/2010/10_4-Intro-to-triangulation-MEF)
- Delelegn, M., & Girma, Y. (2017). Assessment of community knowledge, attitude and practice on milk borne zoonoses disease in Debre- Birhan town, north Shewa, Ethiopia. *Journal of Public Health and Epidemiology*, 10(4), 123–131. <https://doi.org/10.5897/JPHE2017.0983>
- Denis, D. J. (2018). SPSS Data Analysis for Univariate, Bivariate, and Multivariate Statistics. In *SPSS Data Analysis for Univariate, Bivariate, and Multivariate Statistics*. <https://doi.org/10.1002/9781119465775>
- Denscombe, M. (1998). *A good research guide for small-scale social research projects*. (Fourth). Open University Press McGraw-Hill Education McGraw-Hill House Shoppenhangers Road Maidenhead Berkshire England SL6 2QL. [www.openup.co.uk](http://www.openup.co.uk)
- Department of Health Services. (1991). National health policy, 2048. *Department of Health Services*. <https://www.lawcommission.gov.np>

- Department of Health Services. (2014). *National health policy 2074 – Department of health services*. <https://dohs.gov.np/national-health-policy-2074/>
- Department of Health Services. (2017a). *Annual report F/Y 2072/073. Department of health services*. <https://dohs.gov.np/annual-report-2072073-new-published/>
- Department of Health Services. (2017b). Annual Report Nepal(2015/16). In *Government of Nepal Ministry of Health Department of Health Services Kathmandu* (Vol. 40, Issue 43). <http://xlink.rsc.org/?DOI=c1dt90165f>
- Department of Health Services. (2019). National health policy. In *Department of Health Services*. <https://dohs.gov.np/national-health-policy-2076>. <https://www.lawcommission.gov.np>
- Devkota, D., Ghimire, Y. N., Timsina, K. P., Kandel, G., Adhikari, S. P., Subedi, S., & Poudel, H. K. (2020). Livestock insurance adoption in Nepal : lessons learned. <https://www.researchgate.net/publication/342131232>, June.
- Devleesschauwer, B., Aryal, A., Sharma, B. K., Ale, A., Declercq, A., Depraz, S., Gaire, T. N., Gongal, G., Karki, S., Pandey, B. D., Pun, S. B., Duchateau, L., Dorny, P., & Speybroeck, N. (2016). Epidemiology, impact and control of rabies in Nepal: A systematic review. *PLoS Neglected Tropical Diseases*, *10*(2), 1–18. <https://doi.org/10.1371/journal.pntd.0004461>
- Dhakal, S., Joshi, D. D., Ale, A., Sharma, M., Dahal, M., Shah, Y., Pant, D. K., & Stephen, C. (2014). Regional variation in pig farmer awareness and actions regarding Japanese encephalitis in Nepal: Implications for public health education. *PLoS ONE*, *9*(1). <https://doi.org/10.1371/Journal.Pone.0085399>
- Dharmarajan, G., Li, R., Chanda, E., Dean, K. R., Dirzo, R., Jakobsen, K. S., Khan, I.,

- Leirs, H., Shi, Z.-L., Wolfe, N. D., Yang, R., & Stenseth, N. C. (2022). The animal origin of major human infectious diseases: What can past epidemics teach us about preventing the next pandemic? *Zoonoses*, 2(1), 1–13. <https://doi.org/10.15212/zoonoses-2021-0028>
- Doyle, L., Brady, A. M., & Byrne, G. (2016). An overview of mixed methods research – revisited. *Journal of Research in Nursing*, 21(8), 623–635. <https://doi.org/10.1177/1744987116674257>
- Dzikwi, A. A., Ibrahim, A. S., & Umoh, J. U. (2012). Knowledge and practice about rabies among children receiving formal and informal education in Samaru, Zaria, Nigeria. *Global Journal of Health Science*, 4(5), 132. <https://doi.org/10.5539/GJHS.V4N5P132>
- Food and Agricultural Organization (FAO). (2018). *The monetary impact of zoonotic diseases on society Nigeria Evidence from four zoonoses*. <https://www.fao.org/3/i9001en/I9001EN>
- Food and Agriculture Organization (FAO). (2021). *FAO in Nepal - at a glance*. <https://www.fao.org/nepal/fao-in-nepal/nepal-at-a-glance/en/>
- Fox, N. J. (2008). Post-positivism. In *The SAGE Encyclopedia of Qualitative Research Methods* (Issue April).
- FSPH. (2006). *Fast Facts; Bovine Tuberculosis (TB)*. [http://www.cfsph.iastate.edu/FastFacts/pdfs/bovine\\_tuberculosis\\_F.pdf](http://www.cfsph.iastate.edu/FastFacts/pdfs/bovine_tuberculosis_F.pdf)
- Gaire, T. N., & Subedi, S. (2012). *Bovine tuberculosis In DOTS implemented area of Nepal scenario of zoonotic disease of Nepal*. <https://www.amazon.com/Bovine-Tuberculosis-DOTS-Implemented-Nepal/dp/365913192X>

- Garcia, H. (2018). *Louis Pasteur and the germ theory of disease – StMU research scholars*. <https://stmuscholars.org/germ-theory-of-disease/>
- Gayathri, S. L. (2020). One Health: An inevitable approach for the current scenario. In . (Ed.), *Zoonoses, recent approaches to contain the global zoonotic burden* (First, pp. 55–60). Meat Technology Unit Kerala Veterinary and Animal Sciences University Indian Veterinary Association, CVAS, Mannuthy, Kerala.
- George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference. 11.0 update* (4th.). file:///C:/Users/Dell/Downloads/george4answers.pdf
- Guba, E. G. (1990). The alternative paradigm dialog. In *the paradigm dialog* (pp. 17–27). Saga Publications, Newbury park, California.
- Gutiérrez, R. A., Naughtin, M. J., Horm, S. V., San, S., & Buchy, P. (2009). A(H5N1) virus evolution in South East Asia. *Viruses*, *1*(3), 335–361. <https://doi.org/10.3390/v1030335>
- Hayden, J. (2019). *Introduction to health behavior theory (3rd.ed.)*. Burlington, MA: Jones & Bartlett Learning. <https://www.amazon.com/Introduction-Health-Behavior-Theory-Joanna-ebook/dp/B078RQFFGP>
- Hennink, M. M., Kaiser, B. N., & Weber, M. B. (2019). What Influences Saturation? Estimating Sample Sizes in Focus Group Research. *Qualitative Health Research*, *29*(10), 1483–1496. <https://doi.org/10.1177/1049732318821692>
- Hill, L., Turner, L. W., Hunt, S. B., & Perko, M. (2008). Managing diabetes: Use of the transtheoretical model. *Journal of the Arkansas Medical Society*, *January 2008*. <https://www.researchgate.net/publication/249992209%0AManaging>

- Hundal, J. S., Sodhi, S. S., Gupta, A., Singh, J., & Chahal, U. S. (2016). Awareness, knowledge, and risks of zoonotic diseases among livestock farmers in Punjab. *Veterinary World*, 9(2), 186–18691. <https://doi.org/10.14202/vetworld.2015.186-191>
- Ibrahim, A., Budisatria, I. G. S., Widayanti, R., & Artama, W. T. (2019). The impact of religious festival on roadside livestock traders in urban and peri-urban areas of Yogyakarta, Indonesia. *Veterinary World*, 12(9), 1408–1415. <https://doi.org/10.14202/vetworld.2019.1408-1415>
- Janz, N. K., & Becker, M. H. (2016). *The health belief model: A decade later: 11*(1), 1–47. <https://doi.org/10.1177/109019818401100101>
- Joshi, D. D., Maharjan, M., Vang Johnsen, M., Willingham, A. L., Gaihr, Y., & Sharma, M. (2004). Taeniasis/ cysticercosis situation in Nepal. *Southeast Asian J Trop Med Public Health*, 35(1).
- Kanda, K., Obayashi, Y., Jayasinghe, A., de S. Gunawardena, G. S. P., Delpitiya, N. Y., Priyadarshani, N. G. W., Gamage, C. D., Arai, A., & Tamashiro, H. (2015). Outcomes of a school-based intervention on rabies prevention among school children in rural Sri Lanka. *International Health*, 7(5), 348–353. <https://doi.org/10.1093/INTHEALTH/IHU098>
- Kang, G. J., Gunaseelan, L., & Abbas, K. M. (2014). Epidemiological modeling of bovine brucellosis in India. *Proceedings : ... IEEE International Conference on Big Data. IEEE International Conference on Big Data, 2014*, 6. <https://doi.org/10.1109/BIGDATA.2014.7004420>
- Kawahara, T. (2007). Intelligent transcription system based on spontaneous speech

- processing. *Proceedings - Second International Conference on Informatics Research for Development of Knowledge Society Infrastructure, ICKS 2007*, 19–24. <https://doi.org/10.1109/ICKS.2007.13>
- Kelly, T. R., Bunn, D. A., Joshi, N. P., Grooms, D., Devkota, D., Devkota, N. R., Paudel, L. N., Roug, A., Wolking, D. J., & Mazet, J. A. K. K. (2018). Awareness and practices relating to zoonotic diseases among smallholder farmers in Nepal. *EcoHealth*, *15*(3), 656–669. <https://doi.org/10.1007/S10393-018-1343-4>
- Kidd, P., Reed, D., Weaver, L., Westneat, S., & Rayens, M. K. (2003). The transtheoretical model of change in adolescents: Implications for injury prevention. *Journal of Safety Research*, *34*(3), 281–288. [https://doi.org/10.1016/S0022-4375\(03\)00029-X](https://doi.org/10.1016/S0022-4375(03)00029-X)
- Lacey, C. (2010). Research and evaluation in education and psychology (3rd ed.) by Donna M. Mertens - A book review. *Qualitative Report*, *15*(5), 1304–1305. <https://doi.org/10.46743/2160-3715/2010.1348>
- Lapiz, S. M. D., Miranda, M. E. G., Garcia, R. G., Daguro, L. I., Paman, M. D., Madrinan, F. P., Rances, P. A., & Briggs, D. J. (2012). Implementation of an intersectoral program to eliminate human and canine rabies: The Bohol Rabies Prevention and Elimination Project. *PLOS Neglected Tropical Diseases*, *6*(12), e1891. <https://doi.org/10.1371/JOURNAL.PNTD.0001891>
- Lindahl, E., Sattorov, N., Boqvist, S., & Magnusson, U. (2015). A study of knowledge, attitudes and practices relating to brucellosis among small-scale dairy farmers in an urban and peri-urban area of Tajikistan. *PLoS ONE*, *10*(2), 1–10. <https://doi.org/10.1371/journal.pone.0117318>

- Lowenstein, C., Waters, W. F., Roess, A., Leibler, J. H., & Graham, J. P. (2016). Animal husbandry practices and perceptions of zoonotic infectious disease risks among livestock keepers in a rural Parish of Quito, Ecuador. *The American Journal of Tropical Medicine and Hygiene*, 95(6), 1450–1458. <https://doi.org/10.4269/AJTMH.16-0485>
- Mckenzie, J. S., Dahal, R., Kakkar, M., Debnath, N., Rahman, M., Dorjee, S., Naeem, K., Wijayathilaka, T., Sharma, B. K., Moidanwal, N., Halimi, A., Kim, E., Chatterjee, P., & Devleesschauwer, B. (2016). *One Health research and training and government support for One Health in South Asia*. <https://doi.org/10.3402/iee.v6.33842>
- Merrill, R. M. (2017). *Historic development of epidemiology*. L. Mawhiney & Alakel (Eds.), *Introduction to Epidemiology* (Seventh Ed). Michael Brown [Jones & Bartlett Learning] 5 Wall Street Burlington, MA 01803 978-443-5000.
- Ministry of Agriculture and Livestock Development. (2017). *Livestock statistics of Nepal* (Issue July). retrieved: [https://nepalindata.com/media/resources/bulkuploaded/Livestock\\_Statistics\\_of\\_Nepal\\_2017\\_Eng\\_Dec17](https://nepalindata.com/media/resources/bulkuploaded/Livestock_Statistics_of_Nepal_2017_Eng_Dec17)
- Ministry of Agriculture and Livestock Development. (2019). *One Health Strategy in Nepal*. Ministry of Agriculture and Livestock Devison (MoALD), Nepal. <https://publichealthupdate.com/one-health-strategy-2076/>
- Ministry of Agriculture and Livestock Development. (2021). *National Livestock Health Policy*. <https://moald.gov.np/publication-types/policy/>
- Ministry of Water Suply. (2020). *Open defecation free Nepal, narrative of the journey*. National sanitation and hygiene co-ordination committee, Nepal.

Sewerage management and environmental sanitation section, Ministry of Water Supply.

Mishra, J., Mishra, P., & Arora, N. K. (2021). Linkages between environmental issues and zoonotic diseases: with reference to COVID-19 pandemic. *Environmental Sustainability*, 4(3), 455–467. <https://doi.org/10.1007/s42398-021-00165-x>

Montaño, D. E., & Kasprzyk, D. (2008). *Theory of reasoned action, theory of planned behavior, and the integrated behavioral model* (4th ed., Issue July 2014). Jossey-Bass A Wiley Imprint 989 Market Street, San Francisco, CA 94103-1741—[www.josseybass.com](http://www.josseybass.com).

Morris, J., Marzano, M., Dandy, N., & O'Brien, L. (2012). Theories and models of behaviour and behaviour change. *Forestry, Sustainable Behaviours and Behaviour Change: Theories*, 1–27.

National Management Information Project. (2014). *National coverage and functionality status of water supply and sanitation in Nepal*. Department of Water Supply and Sewerage, Kathmandu.

Ngowi, H. A., Carabin, H., Kassuku, A. A., Mlozi, M. R. S., Mlangwa, J. E. D., & Willingham, A. L. (2008). A health-education intervention trial to reduce porcine cysticercosis in Mbulu District, Tanzania. *Preventive Veterinary Medicine*, 85(1–2), 52–67. <https://doi.org/10.1016/J.PREVETMED.2007.12.014>

Niroula, N. (2016). Risks of zoonoses. *The Kathmandu Post*. <https://kathmandupost.com/opinion/2016/07/29/risks-of-zoonoses>

Olea-Popelka, F., Muwonge, A., Perera, A., Dean, A. S., Mumford, E., Erlacher-Vindel, E., Forcella, S., Silk, B. J., Ditiu, L., El Idrissi, A., Raviglione, M.,

- Cosivi, O., LoBue, P., & Fujiwara, P. I. (2017). Zoonotic tuberculosis in human beings caused by *Mycobacterium bovis*—a call for action. *The Lancet Infectious Diseases*, *17*(1), e21–e25. [https://doi.org/10.1016/S1473-3099\(16\)30139-6](https://doi.org/10.1016/S1473-3099(16)30139-6)
- Orji, R., Vassileva, J., & Mandryk, R. (2012). Towards an effective health interventions design: An extension of the health belief model. *Online Journal of Public Health Informatics*, *4*(3), 40–41. <http://ojphi.org>
- Osbjør, K., Boqvist, S., Sokerya, S., Kannarath, C., San, S., Davun, H., & Magnusson, U. (2015). Household practices related to disease transmission between animals and humans in rural Cambodia. *BMC Public Health* *2015 15:1*, *15*(1), 1–10. <https://doi.org/10.1186/S12889-015-1811-5>
- Pandey, G., Dhakal, S., Sadaula, A., KC, G., Subedi, S., Pandey, K., & Dhakal, I. (2012). Status of tuberculosis in bovine animals raised by tuberculosis infected patients in Western Chitwan, Nepal. *International Journal of Infection and Microbiology*, *1*(2), 49–53. <https://doi.org/10.3126/ijim.v1i2.7407>
- Pant, G. R. (n.d.). *Rabies control strategy in SAARC*. Retrieved October 21, 2021, from <https://pdffox.com/rabies-control-strategy-in-saarc-pdf-free.html>
- Pant, G. R., Lavenir, R., Wong, F. Y. K., Certoma, A., Larrous, F., Bhatta, D. R., Bourhy, H., Stevens, V., & Dacheux, L. (2013). Recent emergence and spread of an arctic-related phylogenetic lineage of rabies virus in Nepal. *PLoS Neglected Tropical Diseases*, *7*(11). <https://doi.org/10.1371/journal.pntd.0002560>
- Park, K. (2009). *Park's textbook of preventive and social medicine*. (20th ed.). M/s Banarsidas Bhanot. <https://www.worldcat.org/title/parks-textbook-of-preventive-and-social-medicine/oclc/794303015>

- Phakiti, A. (2014). Quantitative research instruments and techniques. In *Experimental Research Methods in Language Learning : Research Methods in Linguistics* (pp. 115–142). Bloomsbury Academic. <https://doi.org/10.5040/9781472593566>
- Preissle, J., Rebecca M, G.-K., Rohan, E. A., Boehm, J. E., & DeGroff, A. (2015). Putting Ethics on the Mixed Methods Map. In S. Hesse-Biber & R. B. Johnson (Eds.), *The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry* (pp. 144–163). Oxford Library of Psychology. <https://doi.org/10.1093/oxfordhb/9780199933624.013.46>,
- Prochaska, J. O., & Diclemente, C. C. (2005). The transtheoretical approach. In J. C. Norcross & M. R. Goldfried (Eds.), *Handbook of Psychotherapy Integration* ((2nd ed.), pp. 147–171). New York: Oxford University Press. <https://doi.org/10.1046/j.1365-2648.1995.21010191-9.x>
- Rai, S. K. (2018). Changing trend of infectious diseases in Nepal. *Advances in Experimental Medicine and Biology*, 1052, 19–38. [https://doi.org/10.1007/978-981-10-7572-8\\_3](https://doi.org/10.1007/978-981-10-7572-8_3)
- Rajshekhar, V., Joshi, D. D., Doanh, N. Q., Van De, N., & Xiaonong, Z. (2003). Taenia solium taeniosis/cysticercosis in Asia: Epidemiology, impact and issues. *Acta Tropica*, 87(1), 53–60. [https://doi.org/10.1016/S0001-706X\(03\)00055-X](https://doi.org/10.1016/S0001-706X(03)00055-X)
- SAARC, OIE, W. (2019). *Enhancing progress towards rabies elimination ‘ Zero by 30 ’ in SAARC Region. June*. [https://www.saohnet.org/wp-content/uploads/2019/12/Enhancing-Progress-towards-Rabies-Elimination-Zero-by-30-in-SAARC-Region\\_V3.5\\_20191122.pdf](https://www.saohnet.org/wp-content/uploads/2019/12/Enhancing-Progress-towards-Rabies-Elimination-Zero-by-30-in-SAARC-Region_V3.5_20191122.pdf)
- Sah, K., Poudel, I., Subedi, S., Singh, D. K., Cocker, J., Kushwaha, P., Colston, A.,

- Donadeu, M., & Lightowlers, M. W. (2017). A hyperendemic focus of *Taenia solium* transmission in the Banke District of Nepal. *Acta Tropica*, *176*, 78–82. <https://doi.org/10.1016/J.Actatropica.2017.07.022>
- Salehi, K., & Golafshani, N. (2010). Commentary: Using mixed methods in research studies: An opportunity with its challenges. *International Journal of Multiple Research Approaches*, *4*(3), 186–191. <https://doi.org/10.5172/mra.2010.4.3.186>
- Shojaeizadeh, D., Hashemi, S. Z., Moeini, B., & Poorolajal, J. (2011). The effect of educational program on increasing cervical cancer screening behavior among women in Hamadan, Iran: Applying health belief model. *Journal of Research in Health Sciences*, *11*(1), 20–25. <https://doi.org/10.34172/JRHS11210>
- Shrestha, A. (2019). First bird flu death reported in Nepal. *The Himalayan*. <https://thehimalayantimes.com/nepal/first-bird-flu-death-reported-in-nepal/>
- Singh, K. (2007). *Quantitative social research methods*. New Delhi: Sage Publications India Pvt. Ltd.
- Subedi, D., Gautam, A., Sapkota, D., Subedi, S., Sharma, S., Abdulkareem, M., Kandel, M., Ghimire, H., & Odetokun, I. A. (2022). Knowledge and perception of veterinary students on One Health : A first nationwide multi-institutional survey in Nepal. *8*(1), 34–42. <https://doi.org/www.doi.org/10.14202/IJOH.2022.34-42>
- Susanti, A., Soemitro, R. A. A., Suprayitno, H., & Ratnasari, V. (2019). Searching the appropriate minimum sample size calculation method for commuter train passenger travel behavior survey. *Journal of Infrastructure & Facility Asset Management*, *1*(1), 47–60. <https://doi.org/10.12962/jifam.v1i1.5232>

- Tanlaka, E. F., Ewashen, C., & King-Shier, K. (2019). Postpositivist critical multiplism: Its value for nursing research. *Nursing Open*, 6(3), 740–744. <https://doi.org/10.1002/nop2.306>
- Taylor, L. H., Latham, S. M., & Woolhouse, M. E. (2001). Risk factors for human disease emergence. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 356(1411), 983–989. <https://doi.org/10.1098/RSTB.2001.0888>
- Tesfaye, D., Fekede, D., Tigre, W., Regassa, A., & Fekadu, A. (2013). Perception of the public on the common zoonotic diseases in Jimma, Southwestern Ethiopia. *International Journal of Medicine and Medical Sciences*, 5(6), 279–285. <https://doi.org/10.5897/IJMMS2013.0931>
- Tribhuvan University Institute of Agriculture and Animal Science. (2020). *IAAS Curriculum*. Tribhuvan University, Institute of Agriculture and Animal Science. <https://www.iaas.edu.np/assets/img/BScAg-Curriculum-Revised-2020.pdf>
- UNICEF, 2004, as cited in W. aid. (2006). *Community lead Total Sanitation in Nepal*. [https://www.communityledtotalsanitation.org/sites/communityledtotalsanitation.org/files/media/Getting\\_us\\_back\\_on\\_track\\_Nepal.pdf](https://www.communityledtotalsanitation.org/sites/communityledtotalsanitation.org/files/media/Getting_us_back_on_track_Nepal.pdf)
- World Health Organisation (WHO). (2012). *Strategic framework for elimination of human rabies transmitted by dogs in the South-East Asia Region*. [http://www.searo.who.int/entity/emerging\\_diseases/links/Zoonoses\\_SFEHRTD-SEAR.pdf](http://www.searo.who.int/entity/emerging_diseases/links/Zoonoses_SFEHRTD-SEAR.pdf)
- World Health Organization. (2011). Strengthening response to pandemics and other public-health emergencies. *International Health Regulations, 2005*, 198. [http://apps.who.int/iris/bitstream/10665/75235/1/9789241564335\\_eng.pdf?ua=1](http://apps.who.int/iris/bitstream/10665/75235/1/9789241564335_eng.pdf?ua=1)

World Health Organization. (2014). *A brief guide to emerging infectious diseases and zoonoses*. WHO Regional Office for South-East Asia. <https://apps.who.int/iris/handle/10665/204722>

World Health Organization. (2020). *Zoonoses: key facts*. <https://www.who.int/news-room/fact-sheets/detail/zoonoses>

World Society for the Protection of Animals (WSPA). (2009). *Zoonotic diseases, human health and farm animal welfare*. <https://www.ciwf.org.uk/media/3756123/Zoonotic-diseases-human-health-and-farm-animal-welfare-16-page-report.pdf>

Ziblim, S.-D., Suara, S. B., & Jemilatu, A. (2021). Knowledge, attitude, and practices towards zoonotic diseases among cattle farmers in rural communities in Tamale, Northern Region of Ghana. In *International Journal of Medical Research & Health Sciences* (Vol. 10, Issue 2).

## Appendices

### Appendix I

#### *Livestock Status of Nepal*

Province	Cattle		Buffalo		Goat		Sheep		Pig		Yak/ Chauri		Total Livestock
	No. of Holding Household	No. of Heads	No. of Holding Household	No. of Heads	No. of Holding Household	No. of Heads	No. of Holding Household	No. of Heads	No. of Holding Household	No. of Heads	No. of Holding Household	No. of Heads	
1	<b>538420</b>	1601707	<b>233801</b>	455638	<b>500960</b>	2277659	<b>10072</b>	48365	<b>262612</b>	458723	<b>1294</b>	13007	4855099
Madhesh	<b>331388</b>	697881	<b>258917</b>	424711	<b>425747</b>	1306800	<b>3576</b>	12118	<b>10844</b>	27839	<b>0</b>	0	2469349
Bagmati	<b>328964</b>	832320	<b>313394</b>	588984	<b>451191</b>	2484855	<b>6481</b>	39836	<b>42187</b>	84763	<b>1121</b>	11354	4042112
Gandaki	<b>184815</b>	476367	<b>269199</b>	526689	<b>258113</b>	1283467	<b>8102</b>	67954	<b>41864</b>	81939	<b>837</b>	10664	2447080
Lumbini	<b>361505</b>	1040251	<b>316748</b>	675601	<b>437434</b>	1835436	<b>28093</b>	134320	<b>71174</b>	134424	<b>3</b>	11	3820043
Karnali	<b>207844</b>	717636	<b>99205</b>	170314	<b>158617</b>	994927	<b>30618</b>	223272	<b>12498</b>	27417	<b>2716</b>	13083	2146649
Sudur Paschim	<b>327576</b>	1064235	<b>177556</b>	332452	<b>231191</b>	1041986	<b>11522</b>	87019	<b>33823</b>	55038	<b>228</b>	746	2581476

(MoLD, 2017)

## Appendix II

### Research Tools

त्रिभुवन विश्वविद्यालय  
शिक्षाशास्त्र संकाय  
ग्राजुएट स्कुल अफ एजुकेशन, एम. फिल/पिएच.डी.एकिकृत कार्यक्रम  
किर्तिपुर, काठमान्डौ, नेपाल

#### सुचित मन्जुरी

नमस्कार,

म त्रि वि वि शिक्षाशास्त्र संकाय ग्राजुएट स्कुल अफ एजुकेशन, एम फिल. पिएच डी. एकिकृत कार्यक्रम अन्तर्गत पिएच डी शोधार्थी बिध्यार्थी हुं। म जनावरबाट मानिसमा सर्न सक्ने रोगहरु सम्बन्धमा पशुपालक किसानहरुमा भएको ज्ञान धारणा तथा अभ्यास सम्बन्धि अध्ययन गर्ने उद्देश्यले आएको हुं । तपाईं यस अन्तर्वार्तामा सहभागि हुनु हुनेछ भन्ने मैले विश्वास लिएको छु । मैले तपाईंसंग जनावरहरुबाट मानिसलाई सर्नसक्ने रोगहरुको बारेमा केहि प्रश्नहरु सोध्नेछु । तपाइले दिनु भएको उत्तरबाट यस क्षेत्रको वास्तविक अवस्था पत्ता लगाउन सहयोग पुग्नेछ । जसले भविश्यमा यस क्षेत्रका किसानको स्वास्थ्य अवस्थालाई सुरक्षित गर्ने बिभिन्न शैक्षिक कार्यक्रमहरु तथा नीति निर्माणमा सहयोग पुग्नेछ । तपाइले दिनुभएका सम्पूर्ण सुचनाहरु गोप्य राखिनेछ र तपाईंलाई ईच्छा नभएमा अन्तरवार्ताको जुनसुकै समयमा पनि यसलाई बन्द गर्न सक्नु हुनेछ । यस अन्तर्वार्तामा सहभागि हुनको लागि तपाइलाई बाध्य गरिने छैन र यस बापत तपाईंलाई ब्यक्तिगत रुपमा कुनै फाईदा वा बेफाईदा हुने छैन । तर मलाई आशा छ तपाईं यसमा सहभागि भइ यस अध्ययनलाई सहयोग गर्नुहुनेछ ।

**के तपाइ यस अन्तर्वार्ता सम्बन्धि केहि कुराहरु सोध्न चाहनु हुन्छ ?**

उत्तरदाताको मन्जुरी छ भने उत्तरदाताको दस्तखत े.....

उत्तरदाताको मन्जुरी छैन .....

उत्तरदाताको मन्जुरी भएमा अन्तर्वार्ता शुरु गर्ने ।

**उत्तरदाता : पशुपालन कार्यमा सक्रिय परिवारको सदस्य ।**

अन्तरवार्ता लिनेको नाम : ..... अन्तर्वार्ता मिति : .....

अन्तर्वार्ताको समय .....

**Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices  
Against Zoonoses in Nepal From One Health Perspectives**

Respondent No: .....

Field District [.....] Municipality [.....] Ward: / Toll [.....]

**Part – I Sociodemographic Questionnaire**

Date : .....

S. N.	Questions	Response	Code
A 1	Sex	Female Male	1 2
A 2	Age (Complete years)	----- year	
A 3	Religion	Hindu Buddies Christian Muslim/Islam Others	1 2 3 4 99
A 4	Ethnicity	Dalit Janajatis Madhesi Muslim Brahmin / Chhetri Other .....	1 2 3 4 5 99
A 5	What is the main source of income in your family?	Livestock / poultry Government services Foreign employee Trade Agro farming Other .....	1 2 3 4 5 99
A 6	Average monthly income by livestock in the family?	.....	
A 7	Type of Family	Single Joint	1 2
A 8	Educational status of the respondents	.....	
A 9	Purpose of livestock keeping	Household consuming For Sale / Commercial farming	1 2
A 10	Have you got livestock related training/ education?	Yes No	1 2
A 11	If yes, type of education / training	Academic Vocational Short Course	1 2 3
A 12	Type of livestock farming	Single Mixed	1 2

A 13	Name of keeping livestock/ poultry: [MRQ]	Cow Buffalo Goat/ Sheep Pigs / Pigs groups Poultry /Duck Chauri/Yak Other .....	1 2 3 4 5 6 99
A14	During the last illness of your family members, where did you visit at first for the management of illness?	Modern therapy Conservative therapy By Dhami/Jhankri /Lama/purohit	1 2 3
A 15	What are the causes because of which people suffer from diseases? [MRQ]	Micro-organism / poor hygiene Ghost God unhappy Risky behaviour (alcoholism, tobacco, junk food habit, non-active lifestyle etc) Others .....	1 2 3 4 99
A 16	Do you know people can get diseases from animals?	Yes No	1 2
A 17	During the last illness of any of your livestock, where did you visit at first for the management of illness? [MRQ]	Consult the vet. Conservative therapy Dhami/ Jhankri /Lama/ Purohit	1 2 3
A 18	Have you been supported by the state for your livestock farming?	Yes No	1 2
A 19	Did you take insurance for your livestock?	Yes No	1 2
A 20	Have you heard about the following zoonotic diseases? [ MRQ]  <i>[If heard, you will be asked about the diseases in Part II]</i>	Rabies Brucellosis Swine flu Bird flu Neurocysticercosis (NCC) Bovine TB I don't know	1 2 3 4 5 6 89
A 21	If you have heard about the diseases, what is the sources of knowledge and information related to zoonosis? [MRQ]	Radio/TV /Newspaper / poster Health Workers/ Doctors Veterinarians FCHVs Relatives / friends From school curriculum Others .....	1 2 3 4 5 6 99

**Part II Knowledge Measuring Questionnaire**

❖	Zoonotic Rabies Related Knowledge		
S. N	Questionnaire	Response [Based on part I]	Code
B 1	If you have heard about rabies, it is caused by:	Bacteria Virus Fungus I don't know	1 2 3 89
B 2	Diagnostic symptoms of Rabies are: [MRQ]	Hydro phobia Difficult in swollen & salivation Restlessness I don't know	1 2 3 89
B 3	How does rabies get transmitted?	Droplet infection Simple touching with infected animals Bite by rabid animals or contact with saliva through rabies infected animals in broken skin of people I don't know	1 2 3 89
B 4	What is the preventive measure of rabies?	Wear mask and boot Immediately wash the wound with soap water and contact health facilities Contact with dhama /jhankri/ lama/purohit I don't Know	1 2 3 89
B 5	Do you know that the government provide anti rabies vaccine free of cost?	Yes No I don't know	1 2 89
B 6	What is the chance of recovery from rabies?	It is curable It is 100 % fatal disease I don't Know	1 2 3
Zoonotic Brucellosis Related Knowledge:			
B 7	If you have heard about the brucellosis it is related to:	Bacteria Virus Fungus I don't know	1 2 3 89
B 8	What is the common symptom of brucellosis in human?	Diarrhoea / Vomiting Difficult to swollen & salivation High grade fever, body and joint-pain I don't know	1 2 3 89
B 9	How does brucellosis get transmitted?	Bycontacting the body secretion with infected animals and consuming raw milk Simply by touching infected animals Droplet infection I don't know	1 2 3 89
B 10	What are the preventive measures of Brucellosis? MRQ	To consume well cooked meat & milk product To wear gloves, masks and other protective materials during the care of aborted and parturitated animals. To avoid touching livestock I don't know	1 2 3 89

❖	Zoonotic Swine Flu Related Knowledge		
B 11	If you have heard about swine flu, it is related to:	Bacteria Virus Fungus I don't know	1 2 3 89
B 12	How does swine flu get transmitted?	Like a normal flu [droplet infection....] By consuming raw milk By consuming cold drinks I don't know	1 2 3 89
B 13	What is the common symptom of swine flu?	Coughing, sneezing, fever, running nose etc Weight loss of the patients' Diarrhoea / vomiting I don't know	1 2 3 89
B 14	What are the best preventive measures of swine flu infection? [MRQ]	Avoiding unnecessary touching nose/ face/mouth Avoiding unnecessary travel Wearing masks I don't know	1 2 3 89
❖	Zoonotic Bird Flu (H5N1) Related Knowledge:		
B 15	If you have heard about bird flu, it is related to:	Bacteria Virus Fungus I don't know	1 2 3 89
B 16	How does bird flu get transmitted? [MRQ]	By close contact with infected avian without safety By consuming raw poultry meat /eggs By contacting stool of infected birds I don't know	1 2 3 89
B 17	What are the common symptoms of bird flu in poultry? [MRQ]	Greenish diarrhoea Nasal discharge Coughing and sneezing Swelling of the head, eyelid, wattles, hocks and comb I don't know	1 2 3 4 5
B 18	What are the preventive measures of bird flu in human? [MRQ]	Consumption of well-cooked poultry product Washing the hands before and after handling poultry Wearing gloves, masks and other protective materials during exposure to poultry I don't know	1 2 3 89
	Zoonotic (Neurocysticercosis NCC) Related Knowledge:		
B 19	If you have heard about NCC, it is related to:	Bacteria Virus Helminthic I don't know	1 2 3 89
B 20	How does NCC get transmitted?	By consuming raw meat/ vegetable By faeco-oral route By walking bare footed I don't know	1 2 3 89
B 21	Which is the common symptom of NCC?	Abdominal discomfort High grade fever Headache / Seizure	1 2 3

		I don't know	89
B 22	What is the preventive measure of NCC?	Wear boot and mask Apply the proper food hygiene practices Take a prophylaxis vaccine I don't know	1 2 3 89
<b>Zoonotic Tuberculosis (Bovine Tuberculosis) Related Knowledge:</b>			
B 23	If you have heard about bovine TB, it is related to:	Bacteria Virus Fungus I don't know	1 2 3 89
B 24	What are the common symptoms of bovine TB in animals? [MRQ]	Loss of weight Fever Persistent cough I don't know	1 2 3 89
B 25	How does bovine TB get transmitted to human? [MRQ]	By consuming contaminated, unpasteurized dairy product By droplet infection in infected animals By direct contact with wound I don't know	1 2 3 89
B 26	What are the preventive measures of bovine TB, in human beings? [MRQ]	Avoid contaminated, unpasteurized dairy product Wear masks, boots and gloves during caring animals Take BCG vaccine according to schedule I don't know	1 2 3 89

### Part III – Observation Checklist: (Observe or Ask)

S. N.	Practices	√ the correct practice / Option			
		Daily	Occasionally	Never	
1.	Practicing hand washing with Soap water after contact with livestock or poultry:				
2.	Mask wearing practices during close exposure to livestock				
3.	Gloves wearing practices during close exposure to livestock				
4.	Boots wearing practices during close exposure to livestock				
5.	Availability of soap, masks, gloves and boots during the interview period	Soap	Masks	Gloves	Boots
6.	Distance between farm /shed and home (in meters- Approximately)	.....Meter (by observation)			
7.	Cleanness of shed / farm	Well clean	Acceptable	Poor	
8.	Sick animal/ bird consuming practices	Yes	No		
9.	Practice of feeding raw milk	Yes	No		
10.	Practice of feeding raw meat / blood	Yes	No		
11.	Dead animal / bird disposal practices	Burn down	Bore hole	Throw the river	

12.	Observation of home environment	Clean	Acceptable	Poor
13.	Observation of the toilet	Clean	Acceptable	Poor
14.	Children exposure to livestock	Restricted	Not restricted	
15.	Pregnant women exposure to livestock	Restricted	Not restricted	
16.	Vaccination practices for healthy livestock	Yes	No	
17.	Practices of straying pigs / poultry etc	Yes	No	
18.	Caring practices during abortion and delivery of animals	With gloves	Bare hands	

**Note: [Operational definition]**

<b>Well clean / Well manage</b>	<b>Acceptable</b>	<b>Poor</b>
<b>Shed:</b> – Not any dung & urine deposit in shed, timely cleaning, proper water facilities.	Not well but cleaning at least 2 times / day	Dung and urine are deposited in shed for some days
<b>Home environment</b> – Not any dust or rubbish in home surrounding /dispose in proper places/ cleanness of water tap / cleanness from the gate to the house	Not well but cleaning daily	Unmanageable & not clean
<b>Toilet:</b> Water seal, water, soap & detergent facilities, well locked, separate sandal	Water seal/ water soap /detergent outside the toilet/ well locked	There is lack of water and soap, not locked, stool outside the pan

**Part: IV: Perception of Livestock Farmers: [Likert scale, Based on HBM]**

S. N	Variables	Measure Scale				
<b>Perception related</b>						
1.	It is believed that humans and animals can pass diseases to one another.	SD	D	N	A	SA
2.	Traditional healers cure zoonotic diseases like rabies.	SD	D	N	A	SA
3.	It is not harmful if we consume recently dead animals or poultry.	SD	D	N	A	SA
<b>Susceptibility and Severity</b>						
4.	It is likely I will get sick from livestock (i.e., Rabies) sometime during my life.	SD	D	N	A	SA
5.	If I got sick from livestock (e.g., Rabies, brucella) the illness would be very bad.	SD	D	N	A	SA
<b>Protective</b>						
6.	I encourage other family members to thoroughly wash their hands after interacting with animals.	N	S	U	A	
<b>Benefits Related</b>						
7.	When I wash my hands after cleaning up animal waste, I am decreasing my chances of getting zoonoses.	SD	D	N	A	SA
8.	By talking with my veterinarian about the risk of zoonotic disease I am doing something to care for myself and my animals.	SD	D	N	A	SA
<b>More barriers related</b>						
9.	Washing my hands each time after interacting with my animals will take too much time.	SD	D	N	A	SA
10.	Regular veterinary visits are too expensive	SD	D	N	A	SA
11.	Regular veterinary visits are not important.	SD	D	N	A	SA
<b>Cues to action</b>						
12.	When I encounter information about zoonotic disease, I am likely to stop and think about it.	SD	D	N	A	SA
13.	I have talked with my veterinarian about the risks of diseases shared between humans and animals.	SD	D	N	A	SA
<b>Self-efficacy Related</b>						
14.	Veterinarian will share with me information on zoonoses before I ask.	SD	D	N	A	SA

[SD = strongly disagree / D = Disagree / N = Neutral / A = Agree / SA = strongly agree  
N = Never / S = Sometimes / U = Usually / A = Always]

**Open ended questions:**

1. Are there any uses of livestock or their production that are necessary in your religious or sociocultural practices, such as birthing, rice feeding (weaning), healing practices, death-related customs, or any others that you follow?

Thank you!

**Key Information Interview Guidelines:****[Health Service Provider]**

Name of the Institution:

Post:

Experience:

Date of Interview:

1. What were the common zoonotic diseases observed in your area last year?  
.....
2. Where do community people first contact when they get zoonotic diseases? What are the influencing factors for that?  
.....
3. Did your institution conduct a mass campaign programme regarding zoonosis awareness last year? If so, which organization (s) provided support for the programme (local level, province, federal government or I/NGOs)  
.....
4. In your opinion , what actions should be taken by government or other organizations, at various levels such as local, provincial, federal, or international / nongovernmental (I/NGOs), to control zoonoses?  
.....
5. Were there any collaborative programs related to zoonosis prevention conducted in your catchment areas, which brought together the public health, animal health, and environmental sectors?  
.....
6. What educational interventions and strategies could be employed to reduce the incidences of zoonotic diseases?  
.....

**Thank you!**

**Key Information Interview (KII) Guidelines**

**[Veterinary professional]**

Name of the Institution:

Post:

Experience:

Date of Interview:

1. What were the main zoonotic diseases related to livestock, reported in your community during the fiscal year 2075/076 (2019/2020)?

Disease	Morbidity	Mortality

2. Has there been any report of livestock-related disease outbreaks in your community in the last five years?

Disease	Morbidity	Mortality

3. Did your institution conduct a mass animal screening programme last year? If so, which organization provided support for the programme: the local government, provincial government, federal government or non-governmental organizations (I/NGOs)?.....

4. "Do you believe that a collaborative program involving public health, animal health, and environmental sectors is necessary for preventing zoonotic diseases in your community?"  
.....

5. In your opinion, what measures should governments and other organizations take to control zoonotic diseases at various levels, including local, provincial, federal government, and international non-governmental organizations (I/NGOs)?  
.....

6. What educational interventions and strategies could be employed to reduce the incidences of zoonotic diseases? .....

**Thank you!**

### **Key Information Interview (KII) Guidelines:**

Chairperson of local farmer's co-operative / local farmer group

Name of the co-operative:

Established:

Post: Chairperson / Member

Date of Interview:

1. What types of activities is your co-operative conducting in the livestock related fields?.....
2. What types of zoonotic problems are common in your community?
3. I. In farmers ..... II. In livestock .....
4. Do you know how many members of your group have received education or training regarding livestock farming before starting their farming occupation?  
.....
5. In your opinion, what measures should governments and other organizations take at various levels (local, provincial, federal, or by international/ non-governmental organizations) to effectively control zoonotic diseases?  
.....
6. Are there any organizations working in your community to promote or prevent health issues both of human and animals? If so, could you please provide information about their activities and initiatives?  
.....
7. What educational interventions and strategies could be employed to reduce the incidences of zoonotic diseases?  
.....

**Thank you!**

**Focus group guideline:**

1. How familiar are you with the terms 'zoonoses' and 'zoonotic disease'? Can you mention any examples of them?
2. Any incidence of zoonoses outbreaks in your community? Mention the morbidity and mortality bases out of your memory.

**Follow-up questions:**

3. What are the sociocultural and religious significance of livestock in your society?  
[Like: On birthing, rice feeding, wedding ceremony, death rituals, livestock scarifie during worship the god, raw meat, raw blood consumption practices, use of urine, dung, feather, skin, tooth in your sociocultural practices]
4. If you are sick of diseases, where will you prefer to seek care?
5. What do you think about consuming raw milk, blood, meat of sick /or dead animals?

**Perception measuring questions:**

6. What are some of the potential causes of human diseases? What educational interventions and strategies could be employed to reduce the incidences of zoonotic diseases?
7. What do you think about safety practices during exposure to livestock?
8. What do you think about traditional healing practices during zoonotic sickness, for example dog bite?

**Exiting question:**

Is there anything else you'd like to add about the relationship between livestock, our sociocultural practises, and the zoonotic risks from livestock?

**Thank you!**

## Appendix III

### Letter from GSE, TU



## TRIBHUVAN UNIVERSITY

FACULTY OF EDUCATION  
GRADUATE SCHOOL OF EDUCATION  
M.Phil. Ph.D. Integrated Programme  
KIRTIPUR, KATHMANDU

Faculty of Education  
Dean's Office  
M. Phil  
Kirtipur

18 March , 2020

### TO WHOM IT MAY CONCERN

This is to certify that Mr. Kosh Bilash Bagale, the 2<sup>th</sup> batch student at Tribhuvan University for Doctor of Philosophy in Health Education is conducting a research work on **Livestock farmers in Nepal :Knowledge, practice and perceived Threats of Zoonoses** under the supervision of Prof. Dr. Ramesh Adhikari. He is going to visit your Rural Municipality / Municipality/Institution/Department to receive necessary data and information to complete his research work. We would highly appreciate it if you could kindly provide him with an access to the relevant information. Your support and cooperation would certainly encourage our students enhance their knowledge in development.


Thanking you for your cooperation.

Prof. Binod Prasad Dhakal, Ph.D.

Director

## Appendix IV

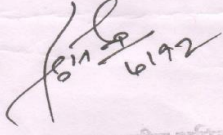
## Letter from Bhanu Municipality, Tanahun

	<b>भानु नगरपालिका</b> <b>नगर कार्यपालिकाको कार्यालय</b> <b>फुसेटार, तनहुँ</b> <b>गण्डकी प्रदेश, नेपाल</b>	२०७५०७१२
पत्र संख्या :-..... चलानी नं :- २१०	०७५०७८ २०७३	मिति :-.....

श्री वडा नं ५ को कार्यालय,  
 भानु नगरपालिका, तनहुँ ।  
 श्री पुरनडिही नगर अस्पताल,  
 भानु नगरपालिका, तनहुँ ।  
 श्री स्वास्थ्य शाखा, श्री पशु शाखा, भानु नगरपालिका, तनहुँ ।


विषय : आवश्यक सहयोग सम्बन्धमा ।

प्रस्तुत विषयमा त्रिभुवन विश्वविद्यालय शिक्षाशास्त्र संकाय, ग्राजुएट स्कुल अफ एजुकेशनबाट "Livestpck Farmers in Nepal ; Knowledge, Practice and Perceived Threats of Zoonoses" विषयमा विध्यावारिधि शोध कार्यको लागि यस नगरपालिका अन्तरगत वडा नं. ५ का पशुपालक किसानहरु, पशु तथा दुग्ध सहकारीका सदस्यहरु, स्वास्थ्य संस्था तथा पशु कार्यालयका स्वास्थ्यकर्मी तथा चिकित्सकहरुबाट तथ्यांक संकलनको लागी उक्त विश्वविद्यालयका शोधार्थी श्री कोष विलास बगालेलाई आवश्यक सहयोग गरिदिनुहुन अनुरोध गर्दछु ।

  
 प्रमुख प्रशासकीय अधिकारी

## Appendix V

## Letter from Kawasoti Municipality, Nawalpur

  
**कावासोती नगरपालिका**  
**१७ नं. वडा कार्यालय**  
 कावासोती, पर्वीभद्रासोती (पूर्व न.प.)  
 मधेशकी अक्षांश रेखा  
 २०७३


च नं. ३९९  
 प.सं. ०३३/०३८

मिति : २०७३/०९/२६

विषय: सिफारिस सम्बन्धमा ।




श्री जो जस सम सम्बन्धित छ ।

उपरोक्त सम्बन्धमा विभिन्न विषयविशयमा शिक्षाशास्त्र महान प्याजपट स्कूल अथ एडुकेसनबाट  
 "Live stock Farmers in Nepal, Knowledge, Practice and Perceived  
 Threats of Zoonoses" विषयमा विद्यावतीसँग शोध कार्यको लागि नम नवलपुर जिल्ला  
 कावासोती नगरपालिका वडा नं. १७ कावासोतीका पशुपालक किसान, कृषि तथा पशुसम सम्बन्धित  
 सहकारीका सदस्यहरु, स्वास्थ्य चौकी तथा पशुपट्टी कार्यालयमा कार्यरत अधिकारीका स्वास्थ्यकर्मीहरुसँग  
 तय्याद संकलन गर्ने कार्य उक्त विषयका शोधार्थी श्री जोसँग विद्यावतीसँग मिति २०७३/०८/१२ देखी  
 २०७३/०९/२६ सम्ममा सम्पन्न गरेको व्यंगेय सिफारिसका साथ अनुदीध छ ।

  
 यहाँ भवियेन  
 उपायुक्त महता  
 कावासोती  
 २०७३

## Appendix VI

## Letter form Nasong Rural Municipality, Manang

**नासों गाउँपालिका**  
**गाउँ कार्यपालिकाको कार्यालय**

धारापानी, मनाङ  
गण्डकी प्रदेश, नेपाल

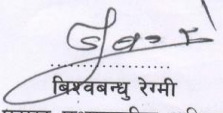
पत्र संख्या : ०७७०७८  
चलानी नं. : ६२२

मिति: २०७७/१२/१०

विषय:-आवश्यक सहयोग गरिदिन हुनु।

श्री ४ नं. वडा कार्यालय  
नासों गा.पा. ,ओडार मनाङ ।

प्रस्तुत विषयमा त्रिभुवन विश्वविद्यालय शिक्षाशास्त्र संकाय, ग्राजुएट स्कूल अफ एजुकेशनबाट **Livestock Farmers in Nepal ; Knowledge, Practice and Perceived threats of Zoonoses** विषयमा विद्यावारिधि शोध कार्यको लागि यस गाउँपालिका अन्तरगत वडा नं.४ का पशुपालक किसानहरु , पशुसंग सम्बन्धित सहकारीका सदस्यहरु तथा स्वास्थ्य तथा पशु कार्यालयका स्वास्थ्यकर्मीहरु तथा चिकित्सकहरुबाट तथ्यांक संकलनको लागि उक्त विश्वविद्यालयका सोधार्थी श्री कोष विलास बगालेलाई आवश्यक सहयोग गरिदिनुहुन अनुरोध छ ।

  
बिस्वबन्धु रेग्मी  
प्रमुख प्रशासकीय अधिकृत

प्रमुख प्रशासकीय अधिकृत

---

नासों गाउँपालिका, गाउँ कार्यपालिकाको कार्यालय, धारापानी, मनाङ  
सम्पर्क नं. ०१-६२२७४४९, ६२०१४४९  
वेबसाईट: [www.nashongmun.gov.np](http://www.nashongmun.gov.np) ईमेल : [nashongrm@gmail.com](mailto:nashongrm@gmail.com)

## Appendix VII

## Prioritized Zoonotic Diseases in Nepal

नेपाल सरकार  
स्वास्थ्य तथा जनसंख्या मन्त्रालय  
स्वास्थ्य सेवा विभाग  
इपिडिमियोलोजी तथा रोग नियन्त्रण महाशाखा

डे.क. काठमाडौं  
स्वास्थ्य तथा जनसंख्या मन्त्रालय  
स्वास्थ्य सेवा विभाग  
डे.क. काठमाडौं

४२११४१९  
४२१८५२१  
४२५५७९६  
४२६२२६८  
पबली, टेकु,  
काठमाडौं

पत्र संख्या:  
चलानी नं.: ५८६

मिति: २०७८।०२।२८

श्री सबैमा

विषय: प्राथमिकिकरण भएका जुनोटिक रोगहरु स्वीकृत भएको सम्बन्धमा

प्रस्तुत विषयमा स्वास्थ्य तथा जनसंख्या मन्त्रालयको निर्देशन अनुसार मिति २०७८।०२।२७को स्वास्थ्य सेवा विभागको को निर्णय अनुसार प्रथम जुनोटिक रोगहरुको प्राथमिकिकरण राष्ट्रिय कार्यशाला गोष्ठीले प्राथमिकिकरण गरेको तपशिलका जुनोटिक रोगहरु स्वीकृत भएको जानकारीका लागि अनुरोध छ।

**तपशिल:**

- १ इन्फ्लुएन्जा (जुनोटिक इन्फ्लुएन्जा, सिजनल इन्फ्लुएन्जा)
- २ रेबिज
- ३ कोरोना भाईरस (सार्स, मर्स, सार्स कोभ २)
- ४ लेप्टोस्पाईरोसिस
- ५ ब्रुसेल्लोसिस
- ६ सालमोनेलोसिस
- ७ लेस्मिनियासिस
- ८ जुनोटिक क्षय रोग
- ९ सिस्टिसर्कोसिस/हाईडाटिडोसिस
- १० टोकजोप्लास्मोसिस

०७८  
१०/१२  
०८८/१२/२८

डा. कृष्ण प्रसाद पौडेल  
निर्देशक




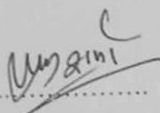
## Appendix VIII

### *Published Articles as a First Author*

- Bagal, K. B.,** Adhikari, R., Acharya, D., Devkota, B., & Shrestha, S. (2023). Demand of One Health Activities by Community-Level Service Providers in Selected Districts of Nepal. *Asian Journal of Population Sciences*, 2(January), 54–67. <https://doi.org/10.3126/ajps.v2i1.51090>
- Bagale, K. B.** (2020). Is Menstruation Still a Dark Side of the Society in 21th Century in Nepal? *Siddhajyoti Interdisciplinary Journal*, 1, 148–155. <https://doi.org/10.3126/sij.v1i0.34929>
- Bagale, K. B.,** Adhikar, R., Acharya, D., Gaire, B., & Pokhrel, B. (2021). Ethnocultural influences for zoonoses transmission in multi-ethnic communities in Nepal. *Journal of Health Promotion*, 9(2631–2441), 19–31. <https://doi.org/10.3126/jhp.v9i01.40959>
- Bagale, K. B.,** & Adhikari, R. (2019). Risk of zoonoses among livestock farmers in Nepal. *Journal of Health Promotion*, 7(September), 99–110. <https://doi.org/10.3126/jhp.v7i0.25520>
- Bagale, K. B.,** Adhikari, R., & Acharya, D. (2022). Educational association with zoonotic related knowledge and practices of livestock farmers in selective districts of Nepal. *Journal of Health Promotion*, 10(1), 127–142. <https://doi.org/10.3126/jhp.v10i1.50993>
- Bagale, K. B.,** Adhikari, R., & Acharya, D. (2023). Regional variation in knowledge and practice regarding common zoonoses among livestock farmers of selective districts in Nepal. *PLoS Neglected Tropical Diseases*, 17(2), 1–17. <https://doi.org/10.1371/journal.pntd.0011082>
- Bagale, K. B.,** Adhikari, R., Acharya, D., & Kreps, G. L. (2023). Implications from the health belief model concerning zoonoses-related threat perceptions held by livestock farmers in Nepal. *World Medical and Health Policy*, July 2022. <https://doi.org/10.1002/wmh3.563>
- Bagale, K. B.,** Gaire, B., & Adhikari, R. (2020). Zoonotic risk for pet owners in Kathmandu, Nepal. *Global Journal of Medical Research: G Veterinary Science and Veterinary Medicine*, 20(2).

## Appendix IX

### Plagiarism Test Report

	<h1 style="margin: 0;">Tribhuvan University</h1> <h1 style="margin: 0;">Central Library</h1> <p style="margin: 0;">Kirtipur, Kathmandu, Nepal</p>																			
Ref. No. ....		Date: 05/03/2024																		
<p><b>Plagiarism Test Report</b></p>																				
<p>The Ph.D. Thesis titled "Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal From One Health Perspectives" submitted by Kosh Bilash Bagale for a plagiarism test on May 03, 2024, has been checked by the iThenticate plagiarism checker software. The software found an overall similarity index of 6% based on the following criteria.</p>																				
<p><b>Criteria:</b></p> <table border="0" style="width: 100%;"> <tr> <td style="width: 40%;">▪ Quotes</td> <td style="width: 20%;">-</td> <td style="width: 40%;">Excluded</td> </tr> <tr> <td>▪ Bibliography</td> <td>-</td> <td>Excluded</td> </tr> <tr> <td>▪ Exclude Sources Matches</td> <td>-</td> <td>1%</td> </tr> <tr> <td>▪ Exclude Words Matches</td> <td>-</td> <td>10 Words</td> </tr> <tr> <td>▪ Abstract</td> <td>-</td> <td>Included</td> </tr> <tr> <td>▪ Methods and Materials</td> <td>-</td> <td>Included</td> </tr> </table>			▪ Quotes	-	Excluded	▪ Bibliography	-	Excluded	▪ Exclude Sources Matches	-	1%	▪ Exclude Words Matches	-	10 Words	▪ Abstract	-	Included	▪ Methods and Materials	-	Included
▪ Quotes	-	Excluded																		
▪ Bibliography	-	Excluded																		
▪ Exclude Sources Matches	-	1%																		
▪ Exclude Words Matches	-	10 Words																		
▪ Abstract	-	Included																		
▪ Methods and Materials	-	Included																		
<p>Note: Kindly be advised that the similarity index produced by software may not comprehensively reflect the caliber and criteria of the document. Consequently, it is highly advisable for the appropriate authority to manually assess the examined file to ascertain its adherence to the essential benchmarks of being articulate, well-investigated, and upholding academic integrity.</p>																				
																				
<p>.....</p> <p>Bijaya Sharma (Library Officer)</p>																				
<p>Phone: 4331317/18, 4330834, 4333077 E-mail : info@tucl.tu.edu.np Website : www.tucl.tu.edu.np</p>																				

5/3/24, 5:26 PM Summary Report

**Livestock Farmers' Knowledge, Perceived Threats...**  
 By: Kosh Bilash Bagale  
 As of: May 3, 2024 5:15:13 PM  
 51,086 words - 196 matches - 4 sources

Similarity Index  
**6%**

Mode: Summary Report ▾

sources:

1,211 words / 2% - from 28-Mar-2023 12:00AM  
[www.nepjol.info](http://www.nepjol.info)

1,128 words / 2% - Internet  
[Kosh Bilash Bagale, Ramesh Adhikari, Devaraj Acharya. "Regional variation in knowledge and practice regarding common zoonoses among livestock farmers of selective districts in Nepal". PLOS Neglected Tropical Diseases](#)

578 words / 1% - from 16-Aug-2023 12:00AM  
[nepalhean.org](http://nepalhean.org)

320 words / 1% - Internet from 19-Dec-2022 12:00AM  
[elibrary.tucl.edu.np](http://elibrary.tucl.edu.np)

paper text:

Livestock Farmers' Knowledge, Perceived Threats, and Preventive Practices Against Zoonoses in Nepal  
 From One Health Perspectives Kosh Bilash Bagale

A Dissertation for the Degree of Doctor of Philosophy in Health Education Submitted to  
 Graduate School of Education Office of the Dean Faculty of Education Tribhuvan University Kritipur,  
 Kathmandu, Nepal February, 2024 Abstract Majority of Nepalese people are involved in agriculture.  
 Vulnerabilities among farmers to zoonoses are conspicuously present because such diseases are  
 neglected. The study intended to assess the risks of zoonoses among livestock farmers against their  
 existing zoonoses-related knowledge, threat perception, and preventive practices. It employed a QUAN +  
 qual convergent parallel research design, guided by Health Belief Model and One Health approach along  
 with post-positivist philosophical foundation. Livestock farmers, health post and veterinary in-charges, and  
 concerned co-operative members were the population. A total of 380 samples were taken for quantitative  
 data while 14 interviews and discussions [8 KII, 6 FGD] were conducted for qualitative information. This  
 study revealed that the respondents exhibited good knowledge on zoonotic swine flu (23.4%), rabies  
 (19.5%), and bird flu (5.3%). However, only a small percentage of the respondents had good knowledge of

//aoi.ithenticate.com/en us/report/108188189/summary

1/92