

**SCHOOL OF PUBLIC HEALTH
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**FACTORS LEADING TO LIVESTOCK LOSSES AND ITS INFLUENCE
ON THE PSYCHOSOCIAL WELLBEING OF LIVESTOCK FARMERS
IN TWO DISTRICTS IN GHANA**

BY

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DECLARATION

I declare that this research work was conducted by me Mr. Francis Sena Kwaku Nuvey under the supervision of Dr. Priscilla Awo Nortey and Dr. Adolphina Addo-Lartey and that no previous submissions of this work has been made. The materials and related work consulted as a pool of knowledge to guide this work have been acknowledged duly within the text of this write-up.

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ABSTRACT

Introduction

Against the backdrop of the Sustainable Development Goals 1, 2 and 3, which aim to improve global health, food security, and reduce poverty, agriculture for most is crucial to achieving self-sustainability in Africa. However, the increased occurrence of adverse events including droughts and conflicts, with losses to farmers, threatens efforts to achieve the set goals. These losses can affect livestock farmers' psychosocial wellbeing and productivity. Identifying, therefore, the drivers of livestock farmers' wellbeing is essential to meeting the set goals, in areas most affected by climate change including Ghana. This study assesses the sources of livestock losses to farmers and its influence on livestock farmers' psychosocial wellbeing.

Methods

This was a cross-sectional survey of 287 randomly selected livestock farmers and in-depth interviews with 19 purposively selected key informants, in the Bunkpurugu-Yunyoo and Kwahu Afram Plains Districts in Ghana. The mental health, resilience, quality of life, and food security, of the livestock farmers, were assessed as dimensions of psychosocial wellbeing, using four standardized questionnaires. Psychosocial wellbeing was estimated as the mean of individual dimension scales' percentage scores. Descriptive analyses were done, and general linear models fitted to identify the predictors of psychosocial wellbeing. Values of $\alpha < 0.05$ were statistically significant. The interview transcripts were coded deductively, using NVivo software.

Results

An average livestock farmer was 46.9 (SD = 11.7) years old and had 50 head of cattle. About 85% (240/287) of the farmers lost cattle within one year. Of these affected farmers, the leading sources of livestock loss were from animal diseases (91%), theft (50%) and pasture shortages (27%). About 55% (154/287) had a poor quality of life and 41% were severely food insecure.

Although 70% of the livestock farmers were highly resilient, 60% had poor mental health. Psychosocial wellbeing was poor in the majority (55%) of the farmers and was predicted positively by a farmers' age, level of education and experience with raising livestock. The number of adverse events experienced, the proportion of livestock loss, number of support sources and a farmers' self-described illness status, were negatively associated with psychosocial wellbeing [$F(6,280) = 26.51, p < 0.001, R^2 = 0.36$]. Qualitative findings revealed a limited access to veterinary services, and irresponsibility of some farmers, who buy veterinary drugs from unlicensed sources to self-treat sick animals, as key contributors to livestock losses. Some affected farmers often sell diseased cattle for meat in the market, to recover some losses.

Conclusion

The major sources of livestock losses to farmers are from livestock diseases, theft and, pasture shortages. The majority of the farmers have poor psychosocial wellbeing that is affected negatively by the adverse events they face. The practice of self-treatment, and sale of diseased animals by farmers could be an adaptive strategy to cope with the lack of access to veterinary services. Further research is required to evaluate the performance of veterinary services in Ghana, to work on reducing livestock losses, psychosocial problems and risk to human health due to potential high-risk meat from diseased cattle entering the food chain.

DEDICATION

I dedicate this research to God Almighty for His grace and abundance upon me, to my parents Mr. John T. K. Nuvey and Mrs. Regina A. Nuvey, my brother John and sisters Mary, Marian and Vincentia and to my mentors Prof. Kennedy Kwasi Addo, Prof. Bassirou Bonfoh and Dr. Gladys Dzansi.

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TABLE OF CONTENTS

DECLARATION	ii
ABSTRACT.....	iii
DEDICATION.....	v
ACKNOWLEDGEMENT	vi
TABLE OF CONTENTS.....	vii
LIST OF FIGURES	viii
LIST OF TABLES.....	ix
LIST OF ABBREVIATIONS.....	x
OPERATIONAL DEFINITION OF TERMS	xii
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement.....	4
1.3 Justification for the study.....	5
1.4 Conceptual framework.....	6
1.5 Research questions.....	8
1.6 Objectives of the study.....	8
Main objective	8
Specific objectives.....	8
1.7 Research hypotheses	8
CHAPTER TWO	9
LITERATURE REVIEW	9
2.1 Sources of livestock losses to farmers	9
2.2 Level of attachment of livestock farmers to livestock	12
2.3 Psychosocial wellbeing of the livestock farmers	15
2.3.1 Stress, depression and anxiety in livestock farmers	15
2.3.2 Resilience and coping strategies of livestock farmers	17
2.3.3 Quality of life implications of the loss of livestock	19
2.3.4 Level of food insecurity in pastoral communities.....	21
2.4 Social support availability for livestock farmers	23
2.5 Summary of the reviewed literature.....	25

CHAPTER THREE	26
METHODS	26
3.1 Study design.....	26
3.2 Study area.....	26
3.3 Study Variables	29
3.4 Study population	31
3.4.1 Inclusion criteria.....	31
3.4.2 Exclusion criteria.....	31
3.5 Sample size	31
3.6 Sampling technique.....	32
3.7 Data collection instruments.....	33
3.7.1 Structured questionnaire.....	34
3.7.2 Interview guide for leaders of livestock farmers.....	35
3.7.3 Interview guide for veterinary officers.....	35
3.8 Data collection procedure	35
3.9 Data management and analysis	36
3.9.1 Analysis of the Attachment to a livestock scale.....	37
3.9.2 Analysis of the Depression Anxiety and Stress Scale – 21 (DASS-21).....	37
3.9.3 Analysis of the 14-Item Resilience Scale (RS-14).....	38
3.9.4 Analysis of the WHOQOL – BREF	38
3.9.5 Analysis of the Food Insecurity Experience Scale (FIES).....	39
3.9.6 Analysis of psychosocial wellbeing	40
3.10 Validity and reliability	41
3.11 Pre-testing of Structured Questionnaire	42
3.12 Ethical Considerations	42
CHAPTER FOUR.....	43
4.1 QUANTITATIVE RESULTS	43
4.11 Socio-demographic characteristics of livestock farmers.....	43
4.12 Factors that lead to livestock losses to pastoralists	48
4.13 Level of attachment of pastoralists with their livestock.....	50
4.14 Availability of social support services to livestock farmers	51
4.15 Proportion of pastoralists with psychosocial problems.....	52
4.16 Bivariate and multivariate analysis of independent and dependent variables.....	55

4.2	QUALITATIVE RESULTS	71
4.21	Study participants.....	71
4.22	Emotional attachment between cattle farmers and livestock	72
4.23	Factors leading to livestock losses and management of losses	74
4.24	Psychosocial wellbeing implications of livestock losses	76
4.25	Support availability to livestock farmers	77
	CHAPTER FIVE	82
	DISCUSSION	82
5.1	Factors that lead to livestock losses to farmers.....	82
5.2	Emotional attachment of livestock farmers to livestock.....	84
5.3	Psychosocial wellbeing of livestock farmers	84
5.4	Sources of support and support available to pastoralists	87
5.5	Study limitations	89
	CHAPTER SIX	90
	CONCLUSIONS AND RECOMMENDATIONS	90
6.1	Conclusions.....	90
6.2	Recommendations.....	91
	BIBLIOGRAPHY	93
	APPENDICES	108
	Appendix 1: Informed Consent.....	108
	Appendix 2: Data Collection Instruments.....	110
	Appendix 3: Ethical Clearance Letter	122
	Appendix 4: Renewal of Ethical Clearance Letter	123
	Appendix 5: Description of Standard Tools	124
	Appendix 6: Sampling frame of livestock farming communities in BY and KAPS Districts	129
	Appendix 7: Pilot study results	131
	Appendix 8: Themes and word cloud from qualitative analysis.....	132
	Appendix 9: List of communities and number of livestock farmers sampled	133

LIST OF FIGURES

Figure 1: Conceptual framework for factors influencing livestock farmers' psychosocial wellbeing.....	7
Figure 2: Map of Ghana showing the study area	27
Figure 3: Ethnic groupings of livestock farmers in the BY and KAPS Districts	46
Figure 4: Symptoms reported by livestock farmers in the BY and KAPS Districts.....	46
Figure 5: Distribution of crops cultivated by livestock farmers by district	47
Figure 6: The leading sources of livestock losses to pastoralists in the BY and KAPS Districts	49
Figure 7: Level of the emotional attachment of livestock farmers with their cattle by district	50
Figure 8: Support services required by livestock farmers to reduce losses	52
Figure 9: Psychosocial wellbeing dimensions of livestock farmers by study site.....	54
Figure 10: Psychosocial wellbeing and wellbeing dimensions of livestock farmers	55
Figure 11: Word cloud showing key issues of concern to study participants.....	132

LIST OF TABLES

Table 1: List of variables in the quantitative study	30
Table 2: Socio-demographic characteristics of livestock farmers by district (N = 287)	45
Table 3: The persons livestock farmers turn to help deal with adversity (N=287).....	47
Table 4: Adverse events that affected livestock farmers between 2012 and 2017 (N=287) ..	48
Table 5: Clinical signs and symptoms presented by cattle before losses (N=218).....	50
Table 6: Sources of support available to livestock farmers to deal with adverse events (N=287).....	51
Table 7: Summary of psychosocial wellbeing and wellbeing dimension scores.....	53
Table 8: Factors influencing the mental health of livestock farmers	56
Table 9: Predictors of the mental health of livestock farmers in Ghana.....	58
Table 10: Factors influencing the resilience levels of livestock farmers	59
Table 11: Predictors of the resilience of livestock farmers in Ghana	61
Table 12: Factors influencing the quality of life of livestock farmers.....	63
Table 13: Predictors of the quality of life of livestock farmers in Ghana.....	64
Table 14: Factors influencing the food security level of livestock farmers.....	65
Table 15: Predictors of the food security of livestock farmers in Ghana	66
Table 16: Simple regression analyses of loss sources predicting farmers' psychosocial wellbeing.....	67
Table 17: Backward elimination regression analysis for loss sources predicting farmers' psychosocial wellbeing	68
Table 18: Backward elimination regression analysis for factors predicting farmers' psychosocial wellbeing	70
Table 19: Summary of in-depth interview participants (N = 24).....	71
Table 20: Validity and reliability of data collection instruments.....	131

LIST OF ABBREVIATIONS

AAS	African Academy of Sciences
AESA	Alliance for Accelerating Excellence in Science in Africa
aOR	Adjusted Odds Ratio
ASPIRE	African Science Partnership for Intervention Research Excellence
BY	Bunkpurugu-Yunyoo
CBPP	Contagious Bovine Pleuropneumonia
CCPP	Contagious Caprine Pleuropneumonia
CI	Confidence Interval
cOR	Crude Odds Ratio
DALY	Disability Adjusted Life Years
DASS	Depression Anxiety and Stress Scale
DESA	United Nations Department of Economic and Social Affairs
ECF	East Coast Fever
FAO	Food and Agricultural Organization of the United Nations
FIES	Food Insecurity Experience Scale
FMD	Foot and Mouth Disease
GSS	Ghana Statistical Service
IFAD	International Fund for Agricultural Development
ILO	International Labour Organization
IQR	Inter Quartile Range
KAPS	Kwahu Afram Plains South
MBC	Mamoun Beheiry Center for Economic, Social Studies and Research in Africa
MoFA	Ministry of Food and Agriculture
NCD	Non-Communicable Diseases
NEPAD	New Partnership for Africa's Development

NIMH	National Institute of Mental Health
OECD	Organization for Economic Co-operation and Development
PI	Principal Investigator
PPR	Peste des Petits Ruminants
RS	Resilience Scale
QOL	Quality of Life
RVF	Rift Valley Fever
SD	Standard Deviation
SDGs	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
SSA	sub-Saharan Africa
UK	United Kingdom
UNICEF	United Nations International Children's Emergency Fund
VSD	Veterinary Services Department
WFP	World Food Programme
WHO	World Health Organization
WHOQOL	World Health Quality of Life Instruments
WISP	World Initiative for Sustainable Pastoralism

OPERATIONAL DEFINITION OF TERMS

1. **Adverse events:** Refers to occurrences including animal disease epidemics, climate vagaries like drought and floods, and conflict, in pastoral areas
2. **Animal disease epidemic:** This refers to the occurrence in a farm of more than one case of particular animal diseases, which can result in substantial livestock fatalities
3. **Conflict:** Refers to a disagreement on principles between two or more groups of people coupled with violent clashes that lead to loss of livestock
4. **Food insecurity:** Inadequate access to good quality food at the appropriate times capable of meeting the nutritional requirements of individuals
5. **Level of attachment to livestock:** Refers to the level of bonding that exists between pastoralists and their livestock, including how they perceive the animals
6. **Mental health:** Refers to the presence or absence of negative emotions of stress, depression and anxiety which may affect the normal functioning of an individual
7. **Northern belt:** Refers to the stretch of agricultural land in the Savannah belt of Ghana where livestock rearing represents the main economic activity of the populace
8. **Livestock farmer:** A person who raises livestock (cattle, sheep or goat) as the main source of livelihood and moves to a certain extent to obtain adequate pasture for the livestock
9. **Psychosocial wellbeing:** Refers to the level of wellness of a pastoralist on the psychological and social dimensions of health, encompassing levels of resilience, problems of stress, depression and anxiety, quality of life and food security.
10. **Quality of Life:** A person's sense of well-being, due to satisfaction or dissatisfaction with areas of one's life which are important to him/ her
11. **Resilience:** Factors inherent in an individual either acquired or developed overtime that enables the person to deal competently with adversity

- 12. Southern belt:** Refers to low lying, mostly flattened land located in the south-eastern part of the Volta lake basin in Ghana, where livestock activities are the main economic activity
- 13. Social support:** Refers to the established structures and services provided within pastoral communities to render assistance to pastoralists in times of threat to livestock rearing.
- 14. One Health:** Refers to a health initiative that integrates policy interventions for human, animals, and the environment in order to collectively improve the health outcomes of humans, animals and the environment (Mazet et al., 2009).

CHAPTER ONE

INTRODUCTION

1.1 Background

Agricultural activities represent the main livelihood source for a vast majority of people in developing countries. It is mainly operated on a subsistence basis and contributes to the local and global economy through trade. Livestock also serves as a key protein source in the human diet with pastoralists being the main livestock producers in the Sahel West African region (Kamuanga, Somda, Sanon, & Kagone, 2008). In spite of the contribution of agriculture to the economies of developing countries, it also presents psychosocial problems to farmers through different forms of adverse events (Padhy, 2018). Psychosocial problems may arise when adverse events confronting persons are left unaddressed, thereby affecting their normal functioning. According to the World Health Organization (WHO), psychosocial wellbeing may entail the mental health, resilience, quality of life and, food security of persons (WHO, 2013).

There has been a shift in the burden of diseases over the past decade, whereby communicable diseases lead non-communicable diseases (NCDs) as the major cause of morbidity and mortality globally. Comparatively, African countries are the most affected with the burden of diseases, experiencing a double high burden of both communicable and non-communicable diseases in 2016 (WHO, 2018a). Even though mental health problems constitute one of the NCDs with high burden in both developed and developing countries, it has received less focused attention over the past decades (WHO, 2011). It is estimated that each year, more than 450 million persons suffer from mental illnesses globally and about 75% of persons with mental disorders in developing countries receive no treatment (WHO, 2012). Additionally, mental disorder-related deaths occur mainly through suicides, which accounted for close to 1 million deaths in 2016 and is more commonly observed in males than in females globally (WHO, 2018b).

In Africa, mental disorders are one of the major non-communicable diseases after injuries, cardiovascular and chronic respiratory diseases with a high disease burden in 2016 (WHO, 2018a). However, even though the prevalence of mental health problems is known to have increased in Africa by over 50% over the past decade, specific prevalence data for mental disorders is lacking. There still exists major weaknesses in mental health service delivery on the continent compared to other developed counterparts in Europe and America, who have robust systems for routine mental health data collection (Sankoh, Sevalie, & Weston, 2018).

In Ghana, as in other African nations, data on mental illness prevalence is generally estimated, due to limited empirical evidence (Sankoh et al., 2018). In 2007, it was estimated that about 3 million Ghanaians were living with mental disorders ranging from mild to the severe forms, with a treatment gap of more than 95% (WHO, 2007). A nationally representative survey conducted in Ghana between 2009 and 2010 found about 20% of the general population to have psychological distress (Sipsma et al., 2013). In 2012, Ghana passed the Mental Health Act 2012 (Act 846), with the goal of improving upon the mental healthcare delivery (Walker & Osei, 2017). However, after its enactment, the implementation of the Act has been slow due to limited resources allocation with implications on the access to mental healthcare delivery (Osei, 2018).

The mental health of individuals is a key predictor of productivity at the workplace. According to the International Labour Organization (ILO), occupational pressures are the leading source of psychological problems in adults. High-stress levels also negatively affect productivity (ILO, 2016). Due to the gamut of stressors that farmers face, the ILO classified agriculture as one of the most stressful occupations globally (ILO, 2011). Suicide deaths are commonly found among farmers. Studies have shown a generally higher prevalence of suicides among farmers than in the general population (Behere & Bhise, 2009; Hillel, Kraus, & Spencer-Thomas, 2017; McIntosh et al., 2016). Both livestock and crop farmers face multiple adverse events at work including droughts, disease outbreaks, and conflict, which negatively affect their productivity.

Against this background, the United Nations' Sustainable Development Goals (SDGs) One (1) through Three (3) were formulated, to improve the health outcomes, including mental health, improve food security, and reduce poverty globally. In spite of the strategies implemented to attain the set indicators to these goals, the United Nations Department of Economic and Social Affairs' (DESA) report on the SDGs revealed a slow progress on attainment of some of the indicators in Africa. It proposed that proper execution of agricultural practices would be a key solution to self-sustainability on the continent (DESA, 2016).

However, the Food and Agricultural Organization (FAO) reveal that agricultural production in sub-Saharan Africa (SSA) is disproportionate with the increasing human population growth, thus presenting a growing sense of food insecurity (FAO, 2017). This is in spite of an abundance of natural resources on the continent, including about 60% of the world's arable land. Nonetheless, there have been some gains particularly in hunger reduction in West Africa recently (FAO, 2015). According to the Organization for Economic Co-operation and Development (OECD) and the FAO, West Africa produced over 60% of the total value of agricultural output in SSA for the past two decades (OECD/FAO, 2016). Even though the crop sector's share of the output is higher than the livestock sector's, the potential to increase livestock production to meet the increasing demand exists (Kamuanga et al., 2008).

Despite the need to improve livestock production, empirical studies on factors influencing the psychosocial wellbeing of livestock farmers in Africa and especially Ghana is limited. There is a paucity of information regarding the occurrences leading to livestock losses and their influence on the psychosocial health of livestock farmers. This study, therefore, intends to address this gap. Identifying the root causes of losses and their influence on the wellbeing of livestock farmers is key to attaining the required productivity and food security.

1.2 Problem Statement

The Food and Agricultural Organization of the United Nations (FAO) estimates that global hunger has been rising over the years and currently exceeding 800 million people in the world in 2017. It noted in its 2018 report on food security and nutrition in the world that two regions, Africa and South America, continue to record increasing levels of undernourishment and severe food insecurity in all their sub-regions (FAO, IFAD, UNICEF, WFP, & WHO, 2018).

This growing food insecurity situation on the African continent and other parts of the world has mainly been attributed to intense climatic variabilities, conflict, and violence (FAO et al., 2018). The negative impact of climatic change is manifest in most parts of the globe. In Africa, drought and rainfall events are increasingly becoming extreme and intense, affecting negatively agricultural productivity. For livestock farmers, animal diseases outbreaks are expected to occur more frequently and become more difficult to control (FAO, 2018). In fact, studies have already shown limited access to veterinary services and climate-driven movement of livestock, as factors leading to increasing incidence and persistence in diseases among livestock in Africa (Bett, Jost, Allport, & Mariner, 2009; Mbyuzi, Komba, Kimera, & Kambarage, 2014).

Livestock farmers in Africa face multiple adverse events including livestock disease outbreaks, drought, and conflict, which have increased in occurrence recently (De Haan, Dubern, Garancher, & Quintero, 2016; FAO, 2017). In a time of these threats, livestock dependent populations often lose their livestock (Leff, 2009) and enter into a traumatic situation which can lead to social and mental health issues (Kolstrup, Kallioniemi, Lundqvist, Kymäläinen, & Stallones, 2013). These have negatively affected livestock production in SSA (WISP, 2008).

According to Gerber, Mooney, Dijkman, Tarawali, & de Haan (2010), the productivity in the livestock sector is comparatively low, with an increasing gap between demand for livestock and livestock products, and what is actually being produced in West Africa. The ideal situation is a vibrant agricultural sector capable of supplying the food needs for households. With the

demand for livestock expected to double by 2050, there is a need to improve livestock production without which food insecurity will increase substantially (FAO, 2017).

However, livestock production in Ghana has since 2009 fallen from 32% to 22% in 2013 (FAO, 2015), even though over 40% of households in Ghana are involved in livestock rearing (Ghana Statistical Service (GSS), 2012). Some factors contributing to this decline include the increased incidence of adverse events leading to losses. The FAO assert that livestock losses affects farmers' productivity leading to food insecurity (FAO et al., 2018). Estimates by the Ministry of Food and Agriculture (MoFA), showed cattle production in Ghana increased only by 7.6% between 2000 and 2010 (MoFA, 2011). Over the same period, Ghana's population grew by more than 30% (GSS, 2012). The consequences of low productivity may include high meat imports, high meat prices, loss of foreign exchange, and poor psychosocial wellbeing. For the case in point, the production gap reflected in total beef imports into Ghana exponentially increasing by 1,876.4 percent, from a little over 600 metric tons in 2000 to about 12,500 metric tons in 2010 (MoFA, 2011). There is thus the urgent need to identify the sources of livestock losses, to inform appropriate interventions, and improve livestock production levels in Ghana. Identifying the these sources of losses and drivers of farmers' wellbeing is key to meeting the SDGs 1, 2 and 3.

1.3 Justification for the study

Owing to the growing concern of the inevitability of food insecurity in many developing nations and Ghana, it is imperative that empirical research is conducted to help identify the contributing factors in the Ghanaian context, and how to address them. To this end, this study can provide evidence on the key adverse events that lead to livestock losses in Ghana, thereby improving the productivity of farmers. In addition, by employing the One Health concept, we can identify how the loss of livestock affects the livestock farmers psychologically and socially so that appropriately targeted interventions can be implemented.

1.4 Conceptual framework

The dependent variable in this study is the psychosocial wellbeing of livestock farmers, measured as a composite indicator comprising of four dimensions: mental health, resilience, quality of life and food security (Figure 1). The influence of independent variables including the number of adverse events experienced, the proportion of livestock lost, available support to farmers, farmer factors including level of attachment with livestock, herd size and self-reported health, and some socio-demographic characteristics, on livestock farmers' wellbeing, were assessed.

The occurrence of adverse events such as livestock disease epidemics, conflict, and droughts in pastoral communities often lead to loss of livestock. On their own, the number and frequency of these adverse events experienced can directly affect negatively, the psychosocial wellbeing of livestock farmers. If they do lead to losses, the influence on a farmers' wellbeing may depend on the proportion of the livestock lost. The magnitude of this influence of livestock loss on the psychosocial wellbeing, however, may depend on certain enabling or hindering factors. Enabling factors (coloured blue in Figure 1) such as support availability, large herd size, experience with raising livestock and additional income sources may reduce the effect of losses on farmers' wellbeing. Whereas hindering factors (coloured red in Figure 1) such as the level of attachment between a pastoralist and the livestock, rearing livestock in arid districts, and presence of self-reported ill-health conditions in the farmer, may amplify the negative effect of losses on psychosocial wellbeing.

Additionally, studies among livestock farmers who lost their animals have identified some socio-demographic characteristics including age, sex, marital status, household size, and educational level to be associated with psychosocial wellbeing during losses.

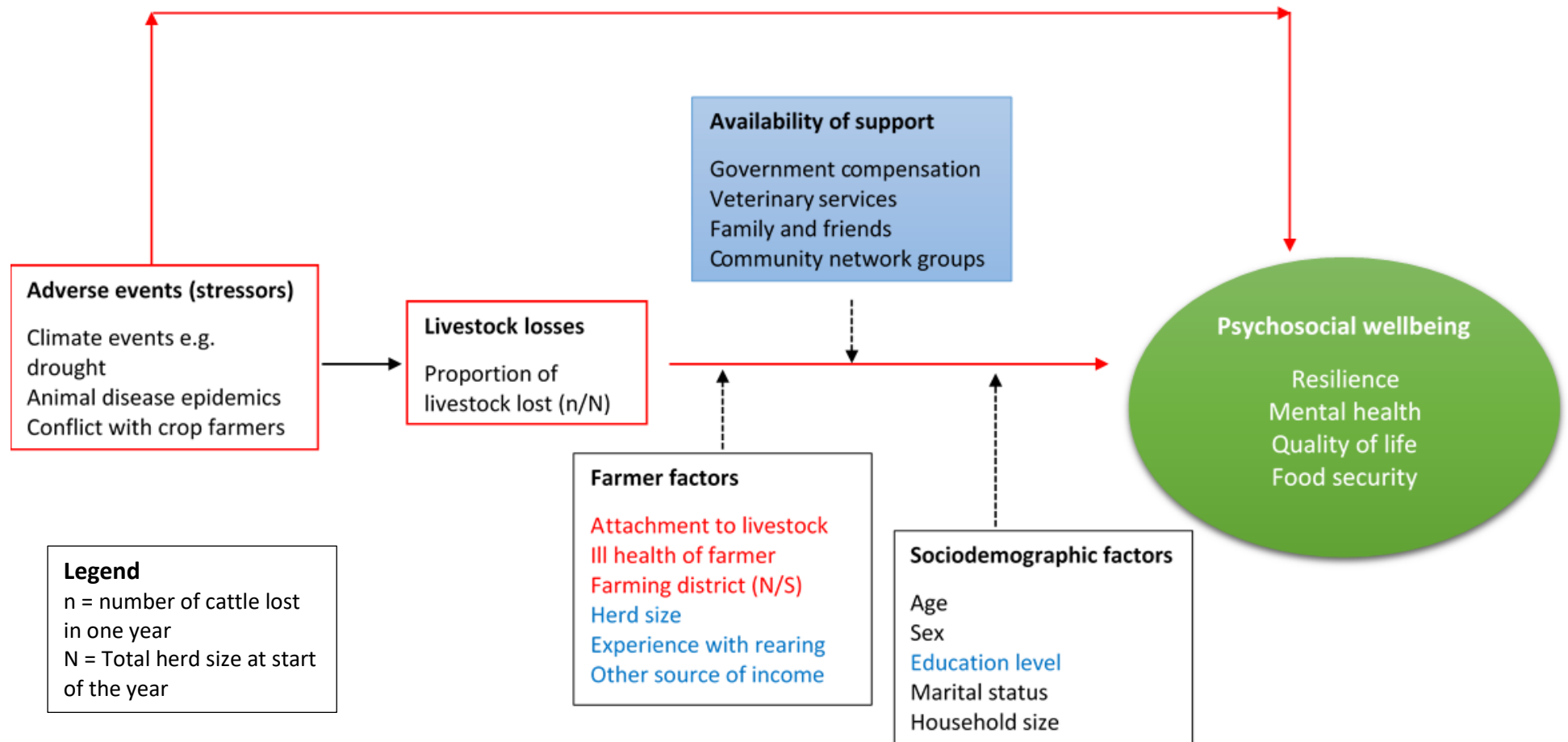


Figure 1: Conceptual framework for factors influencing livestock farmers' psychosocial wellbeing

1.5 Research questions

The research questions this study sought to answer include:

1. What are the sources of livestock losses to farmers?
2. How attached are livestock farmers to their livestock?
3. What proportion of livestock farmers have psychosocial problems?
4. What form of support do livestock farmers who suffer losses get to help them in dealing with their losses?

1.6 Objectives of the study

Main objective

To determine the main sources of livestock losses and identify its influence on the psychosocial wellbeing of livestock farmers in Ghana.

Specific objectives

1. To identify the sources of livestock losses to farmers
2. To assess the level of attachment between livestock farmers and their livestock
3. To determine the proportion of livestock farmers with psychosocial problems
4. To assess the availability of social support services to livestock farmers

1.7 Research hypotheses

H₁: There will be a difference in the psychosocial effect of livestock losses on pastoralists in the Northern and Southern belts in Ghana.

H₂: There will be a negative relationship between the proportion of livestock lost and psychosocial wellbeing of livestock farmers.

H₃: There will be a positive relationship between the number of support services available to farmers and their psychosocial wellbeing.

CHAPTER TWO

LITERATURE REVIEW

2.1 Sources of livestock losses to farmers

Livestock farmers are often exposed to adverse events including disease outbreaks, conflicts, droughts, and rustling of animals, which have increased in recently (De Haan et al., 2016; FAO/MBC, 2017; Leff, 2009). The occurrence of these adverse events is often predicted by negative climate change, where increased incidences of droughts and intensity of rainfall, lead to unfavourable grazing conditions and consequential losses of livestock (Tseren, 2018). These changes in rainfall and drought patterns are usually also site-dependent. Whereas some studies indicate a general increase in drought periods and decrease in rainfall periods in Africa, others also report that rainfall patterns have increased in some African countries (Lind et al., 2016; Thornton, van de Steeg, Notenbaert, & Herrero, 2009). Some of these key stressors occur only during wet seasons, while others during the dry seasons. Ultimately, the productivity of the herd is affected and these may linger for long periods in subsequent years (Verchot et al., 2007).

Experience of stressors in agriculture and livestock farming, in particular, may or may not lead to losses but influences the wellbeing of farmers. A large survey involving about 4,000 farmers in Australia found that farmers experienced multiple stressors in their work (Peel & Schirmer, 2016). The high cost of farm inputs, drought, poor telecommunication infrastructure, and water unavailability were identified as the main barriers to the successful operation of farms and negatively influences their perceived overall wellbeing (Peel & Schirmer, 2016).

A case study by Grace et al. (2017), in Kenya found the presence of animal diseases leading to livestock losses, with huge proportions of household incomes lost to managing these diseases. In a similar study in Kenya, Dzingirai et al. (2017), observed that the Rift Valley Fever (RVF) outbreaks had a greater impact on pastoralists; from restrictions on livestock trade in markets, livestock mobility, and human and livestock mortalities. In a study among Turkana pastoralists

in Kenya, livestock diseases were also found to lead to significant losses of livestock. Diseases including Mange, Peste des petits ruminants (PPR) and Contagious Caprine Pleuropneumonia (CCPP), occurred in epidemics leading to high fatalities on many farms (Bett et al., 2009). Some sources of the epidemics were linked to seasonal movement of pastoralists where they contract infections from other places, and congregation of livestock, among others. These situations often reduce the pastoralists' access to veterinary services. Farmers resort to self-treatment of cattle diseases, thereby exacerbating their effect on their herds (Bett et al., 2009).

Additionally, in the Monduli district of Tanzania, a study conducted among pastoralists found that all respondents in the study experienced massive deaths of their cattle. Epidemics of cattle diseases including contagious bovine pleuropneumonia (CBPP), Bovine cerebral theileriosis and other tick-borne cattle diseases led to livestock losses. Severe water and grass shortages also contributed to the livestock deaths (Kimaro, Mor, & Toribio, 2018).

A study in the Manyara and Morogoro regions of Tanzania, by Chengula, Mdegela, & Kasanga (2013) found animal disease outbreaks and droughts as main constraints to pastoralists. The top three diseases based on the proportion of livestock losses caused were ECF, CCPP, and CBPP. Many of the farmers in this study treat livestock diseases by themselves, citing the high cost of veterinary services, purchase of fuel and drugs, as reasons for the practice. They also found that veterinary drugs were freely available on open markets to farmers. Veterinary services were mainly rendered by livestock field officers who reported difficulties in providing services to the livestock farmers (Chengula et al., 2013). Similar findings were made by Onono, Wieland, & Rushton (2013), whereby pastoralists ranked key constraints to cattle production as water shortage, lack of veterinary extension services, animal diseases and poor livestock markets. Diseases reported by the respondents were Foot and Mouth Disease (FMD), East Coast fever (ECF) and CCPP. The majority of the pastoralists grew crops including cereals, tubers, and legumes. These factors significantly affected their livelihoods (Onono et al., 2013).

Furthermore, Leff (2009) in his study of a pastoralist-dominated region between Sudan, Uganda, and Kenya border region found that nearly half of respondents witnessed a violent event during their lifetime. He also found conflicts to increase in occurrence during periods of drought in the pastoral communities studied. Some areas in Turkana County reported that droughts accounted for 70% loss of livestock holdings of many pastoralists (Leff, 2009).

In a study by Manu, Andu, Tarla, & Agharih (2014) on the socio-economic effect of cattle theft on the pastoralists in Cameroon, they found that pastoralists lost on average 9 ± 16 cattle per year to theft. Majority of the respondents (41%) had no formal education and almost all respondents (99%) were married. About 30% of the pastoralists were also involved in cropping.

A study conducted by Opiyo, Wasonga, & Nyangito (2014) found that majority of pastoral households (49%) were seriously affected by droughts, 27% by disease outbreaks, 19% by conflict and 4% by flooding. Also, a study conducted in Boranaland, a major pastoral settlement in Ethiopia, identified major stressors of the livestock dependent populations to include conflict and droughts (Berhanu, 2011). In another Ethiopian study in the Afar, Oromiya and Somali regions, it was found that the main causes of livestock losses were disease outbreaks, starvation from food and water, cattle theft and predation by wildlife. The losses to diseases were significantly high during the normal season and losses to starvation during droughts (Catley, Admassu, Bekele, & Abebe, 2014).

Finally, Goldman & Riosmena (2013) conducted a study in two Maasai districts; one located northwards and the other in the southern belt, in Tanzania. They found in this study that pastoralists lost on average 55% of their livestock during drought episodes in both districts. The average proportion of cattle lost in the more arid Longido (northwards) district (87%) was more than 8 times that of Monduli (southern) district (10%) during droughts. Consequently, the mean number of cattle consisting of herd holdings in the two districts were 208.5 and 60.9 cattle in Monduli and Longido respectively (Goldman & Riosmena, 2013).

2.2 Level of attachment of livestock farmers to livestock

There is increasing recognition of the importance of the bond between humans and animals on the wellbeing of humans. Beck (2014), posits that humans have a higher tendency of attraction to animals compared with other inanimate objects. Walsh (2009) also found that the majority of households in the United States had some companion animal, with dogs, cats, horses, and birds being the most common ones. Other companion animals include fish, turtles, rabbits, and farm animals. According to Walsh (2009), more than 90% of households studied consider pets as their friends. These perceptions of animals as companions is often considered a preserve of household pets. However, recently, research focus is gradually drifting towards the potential roles of farm animals beyond providing food and income, to more social and risk buffering functions (Moyo & Swanepoel, 2010) and companionship roles (Petitt, 2013; Wilkie, 2010).

Agricultural activities in their nature often mean more to farmers beyond just a livelihood source. In a qualitative study among farmers in Newdegate, Australia, Ellis & Albrecht (2017) revealed that farmers valued the act of farming as an important part of their identity, sense of being and family. Some respondents in the study identified farming as essential to their health and wellbeing with many ascribing special meaning and significance to their farming experiences. Some health professionals in the study further indicated that poor climatic experiences stressed farmers thereby affecting their mental health and wellbeing with recovery predicated mainly by positive weather events like rainfall (Ellis & Albrecht, 2017).

Similarly, a case study utilizing a participant observation approach to explore livestock farmers' emotional attachment to the cattle in the Alps of Switzerland found that cattle were kept physically close to their caretakers at all times. The caretakers of cattle not only keep their own animals but also that of close family and friends. The farmers move the cattle depending on the season in order to gain access to pasture. The cattle are often released in the evening after milking to graze overnight until morning when they are moved to the pen for milking.

The researcher found that, herders exhibited an intimate understanding of the cattle, adopting approaches that make the cattle move to their preferred directions, compared to the author's inexperienced attempts. The herders also adopt spoken words to get the cattle to do what they want. Even though it was difficult to tell the understanding of the cattle, they always complied with exactly what was expected. The researcher also observed that the herders use domination of the cattle to get them to obey their commands. The cattle had names given to them. Milking of the cows often involves intimacy and bonding through stroking and caressing. Having to sell or slaughter a cow was difficult, painful and distressing. Farmers see the cattle as more than commodities and means of survival, but as pets and even family (Hoffet, 2015).

Furthermore, Kaarlenkaski (2014), in his study sampled narratives written about farmers' life experiences with cattle rearing in a competition organized in Finland. The participants submitted almost 3000 narratives. The author set an inclusion criterion and selected 146 scripts as the primary research material for analysis. The participants were between 10 and 87 years old and majority were women. The participants constantly in their narrations perceive cattle as more than animals and as individual persons. Some others consider them as friends and family members with whom they can share their worries. Many of the participants articulate that cattle tend to know their herders, and may even comprehend human speech. They also feel that cattle keepers have the ability to decipher the messages from the cattle including their gesticulations and behaviours. The narratives suggest that women tend to communicate better with cows than men. Several participants speak to their cattle and believe the cattle listen. Milking of cattle appeared to strengthen their emotional attachment to livestock (Kaarlenkaski, 2014).

Macgregor & Waldman (2017), who submitted that the lifestyle of pastoralists is closely linked to their cattle at the economic, social, political, and interactional level, further elucidated the bond livestock farmers have with their animals. According to them, intimacies exist between humans and animals. To buttress this, they cited the Maasai in East Africa who constantly

monitor their cattle, touch them and communicate with them by singing, whistling and calling out to them among other forms of communication (Macgregor & Waldman, 2017).

From the foregoing, it appears keeping livestock, especially cattle provides for some emotional dividends to farmers aside their economic and asset roles. Some studies have shown good physiological health and psychosocial wellbeing as some of the benefits derived from the association of humans with companion animals (Odendaal & Meintjes, 2003; Walsh, 2009). Additionally, research findings show that persons with serious psychiatric disorders who worked with farm animals for 12 weeks in addition to other standard psychiatric care, had an improvement in their confidence, coping and quality of life compared those who received only standard psychiatric care (Berget, Ekeberg, & Braastad, 2008). Their loss, therefore, could lead to stressful conditions for those affected. For instance, Searless (1960) as cited in Walsh (2009) found that the loss of companion animals often precipitated the manifestation of severe psychological symptoms in families with a history of schizophrenia.

This beneficial role of livestock to farmers' wellbeing may also be reciprocal when there is bonding between farmers and livestock. In a study conducted among sheep farmers in Norway, findings showed that farmers with stronger attachment to livestock had greater negativity towards carnivores that cause livestock losses (Vittersø, Kaltenborn, & Bjerke, 1998).

More so, in a study to assess farmers' attitude to animal welfare and health among 108 farmers involved in livestock production in Sweden, the farmers perceived animal welfare as comprising animal health and comfort. The mean age of the farmers in the study was 51 years. Even though the average attitude scores showed that farmers cared much about the wellbeing of their animals, the majority of the farmers asserted that they seldom call on veterinary officers to attend to their cattle (Hansson & Lagerkvist, 2012).

2.3 Psychosocial wellbeing of the livestock farmers

Few studies have assessed the psychosocial wellbeing of livestock farmers, especially in Africa. This study evaluates the psychosocial wellbeing as a composite indicator made up four dimensions namely; stress, depression and anxiety domain, resilience domain, quality of life domain and food security domain. Some studies that considered overall psychosocial wellbeing and the individual dimensions of psychosocial wellbeing, are presented in this review.

Evidence exists that farmers' wellbeing is influenced by the magnitude of stressful events they experienced. The findings of a survey among farmers in Australia showed that there are incremental reductions in average wellbeing scores of farmers with every increase in the severity of stressful events experienced (Peel & Schirmer, 2016). The authors concluded that addressing challenges faced would not only improve productivity but also farmers' wellbeing.

In a longitudinal qualitative inquiry into the psychosocial effect of the foot and mouth disease epidemic which occurred in 2001 in the UK, the researchers found many of the affected livestock keepers to have poor psychosocial wellbeing as majority were distressed, anxious and experienced anhedonia, insomnia and social isolation (Mort, Convery, Baxter, & Bailey, 2005).

2.3.1 Stress, depression and anxiety in livestock farmers

In many instances, stressful life events in pastoralists have been shown to be closely associated with psychological problems and the occurrence of these events often lead to loss of livestock to pastoralists (Lesorogol, 2004). Studies conducted in pastoral and agro-pastoral settings have shown high levels of stress, anxiety and depression in farmers who lose their livestock (Mclaren & Challis, 2009; Mort et al., 2005; Taylor, Agho, Stevens, & Raphael, 2008). Hadley et al (2008) also observed that stress, anxiety, and depression were highly correlated with stressful life events and food insecurity. They found food insecurity, exposure to stressful life events and low socio-economic status as independent predictors of high levels of depression, anxiety, and stress among the respondents (Hadley et al., 2008).

Similarly Peck et al. (2002), also conducted a study on the psychological effects of disease outbreaks on livestock keepers but with a different approach. In this study, the authors compared a badly affected area with an area unaffected by the 2001 UK's foot and mouth disease outbreak. They found that about two-thirds more of farmers in the affected region had mental health problems compared to those unaffected. They observed a statistically significant relationship between losing livestock and having psychological problems i.e. depression ($p < 0.001$). In addition, a national study conducted in Australia among horse owners following an equine influenza outbreak also showed "extremely high levels of non-specific psychological distress" among affected persons following the equine influenza outbreak (Taylor et al., 2008).

Furthermore, a cross-sectional analysis of Australian farmers' wellbeing revealed that profitability in farming significantly improved wellbeing scores of farmers. Thus, as profit margins increase and level of losses decrease, the farmers' mean perceived wellbeing index scores increase incrementally. In the study, farmers who recorded profits had higher personal wellbeing scores and less psychological distress. Farmers who made large losses, however, had higher levels of distress even when compared to persons with a clinical diagnosis of mental illnesses (Peel, Berry, & Schirmer, 2015). Similarly, a cohort study conducted in New South Wales, Australia, among rural farmers and other rural workers found that comparatively, the farm-workers in remote areas reported decreased access to health services. They had worse physical and mental health, and wellbeing index scores irrespective of their financial status and physical injuries sustained in the line of work (Brew, Inder, Allen, Thomas, & Kelly, 2016).

Finally, a study conducted in Zimbabwe found that the loss of livestock to wildfires was a precursor for grief and trauma to the affected households (Nyamadzawo, Gwenzi, Kanda, Kundhlande, & Masona, 2013). The wildfires killed some livestock and destroyed pasturelands so that even animals who survived had less feed and fetch lower prices on the market. This negatively affected the livelihoods of affected livestock farmers (Nyamadzawo et al., 2013).

2.3.2 Resilience and coping strategies of livestock farmers

Resilience encompasses the capacity to predict, successfully cope with and/or recover from the experience of stressful events. According to Little & McPeak (2014), resilience applies to pastoralists in three ways; their ability to recover during drought cycles, coping effectively with climate and ecological variabilities and flexibility, and mobility, adopted as a way of reducing exposure to droughts and other adverse events. According to them, possible threats to the resilience of pastoralists include losing land to other competing users, persistence of conflict and violence, dominance of pastoral systems by a few wealthy owners, and the increased occurrence of extreme events mainly attributable to climate change (Little & McPeak, 2014).

The occurrence of stressful events thus can influence the resilience of livestock dependent populations. A mixed-method study conducted among 153 pastoralist households and six pastoral experts in Central Afghanistan demonstrated this relationship. The respondents in the study identified drought, conflicts, livestock disease outbreaks as the three major shocks and stressors affecting livestock farming. The experts interviewed intimated that pastoralists' ability to maintain herd size and family stability following adversity constitute resilience (Agonafir, 2018). Little & McPeak (2014), who stated that providing secure food sources and markets, mobility of pastoralists and effective local empowerment by the government are the factors required to enhance pastoralists' resilience, expressed similar convictions.

A study which the vulnerability of 302 pastoral households in Kenya to climate-induced stressful events, found 27% of households to be highly vulnerable, 44% moderately vulnerable and 29% less vulnerable. The less vulnerable group had high propensity to cope and adapt to stressors. The moderately vulnerable required temporary support to recover while the highly vulnerable had little or no resilience. The levels of vulnerability were significantly predicted by sex and age of the household head, household size, marital status, access to extension services, and experience of more than two adverse events over 5 years (Opiyo et al., 2014).

Research findings from a qualitative inquiry in Australia have shown that chronic experience of adverse weather events erodes farmers' emotional and psychological resilience. The capacity to bounce back following such events was deemed to be intractable, as a clinical psychologist in the study indicated that several positive experiences are required before recovery was possible (Ellis & Albrecht, 2017).

In a mixed-method survey conducted in semi-arid Amibara and the more arid Gewane districts in Ethiopia, among 240 pastoralists, researchers found differences in resilience in the study districts. Pastoralists in the arid Gewane district were found to be more resilient compared to those in the Amibara district. Pastoralists who also grow crops had higher levels of resilience than those who do not. Households with male heads reported higher resilience scores than female-headed households (Mekuyie, Jordaan, & Melka, 2018).

According to a wellbeing survey conducted in Australia, older farmers aged 65 years or more had higher resilience scores compared to the younger ones. Resilience scores were also higher in farmers with larger farms and/or herd sizes. Farmers resident in the arid Western Australia region were also found to be more resilient than those residing in the semi-arid zones. Resilience was however, similar in males and females (Schirmer & Hanigan, 2015).

To enable them cope, pastoralists often adopt certain adaptive and coping strategies. The study by Opiyo, Wasonga, Nyangito, Schilling, & Munang (2015), found that majority of pastoralists (82%) engage in other economic activities including making handicrafts, crop farming, and charcoal production during periods of drought. Nearly 50% of the pastoralists studied also move with their herds to access pasture and markets elsewhere during adverse events occurrences. Other measures employed to adapt to adversity include the raising of mixed livestock species including small ruminants, and education of children in anticipation of future employment to generate support for the household in the future (Opiyo et al., 2015).

Finally, a study involving Monduli and Longido districts in Tanzania also identified the sale of livestock and loans from friends or relatives as measures utilized to mitigate losses during droughts. To avert the negative consequences of droughts, some pastoralists split their herds or purchase cattle feeds, veterinary medications and exclusive rights to private pasturelands. Adopting these coping strategies and reducing the ratio of livestock loss, were significant in reducing vulnerability in pastoralists with larger herds (Goldman & Riosmena, 2013).

2.3.3 Quality of life implications of the loss of livestock

The WHO defines the quality of life (QOL) as “an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns” (WHO, 1998). The WHOQOL tools assess an individual's own perception of their wellbeing, including satisfaction with the level of functioning, which previously received very little attention (WHO, 1998).

Even though the circumstances in agricultural dependent populations especially pastoral communities predispose them to lower qualities of life, not many studies assessed QOL implications of asset loss among livestock dependent populations. Most studies on QOL often target persons with chronic debilitating conditions (Portugal et al., 2016; Quitmann et al., 2016; Schlack, Ravens-sieberer, & Petermann, 2013). In studies about farmers' satisfaction with QOL, the research focus mainly have been on crop farmers, though many pastoral livelihood improvement programmes target improving pastoralists' QOL.

A national survey was conducted in Finland among workers including farmers aged between 30 and 64 years. The study found that farmers had significantly lower QOL scores compared to the other working groups including entrepreneurs and salaried workers (Saarni, Saarni, & Saarni, 2008). Respondents who were married or co-habiting had large improvements in their QOL compared to those who do not have companions in the study (Saarni et al., 2008).

In their study among 201 rural farmers in selected agrarian Malaysian areas, Terano & Mohamed (2013) also found farmers who were exclusively engaged in only agriculture as a full-time work reported lower satisfaction with overall QOL compared to farmers involved in other secondary occupations. In addition, farmers with lower levels of education were more satisfied with their QOL compared to those with higher levels of education. The provision of services and government support to farmers and support from other farmers were the key significant predictors of higher QOL of respondents (Terano & Mohamed, 2013).

Similarly, another study conducted in Ireland among 344 farm and non-farm workers reported that farmers aged less than 35 years had significantly lower perceived quality of life compared to those aged above 55 years. Almost 60% of farmers in the study perceived their QOL to be good. Females were also found in this study to have a decreased perceived quality of life than their male counterparts (Bogue & Phelan, 2005).

In Kenya, a study among 205 pastoralists in the Marsabit District utilized the WHO quality of life questionnaire (WHOQOL) to assess differences in the QOL of pastoralists across different age groupings. The researchers found that QOL scores declined with increasing age in both settled and nomadic herdsman. Nomadic pastoralists had a significantly higher decline in their QOL scores over their life span compared to pastoralists who had settled. The general linear model that robustly predicted pastoralists quality of life included the pastoralist's residence, age and support availability (Campbell, Gray, & Radak, 2011).

A retrospective cohort study utilized data collected over three decades between 1982 and 2010 among farmers resident in Iowa, to assess the determinants of farmers' quality of life. Results showed a positive change in the quality of life of participants over time. Increases in household incomes positively predicted the perception of QOL. However, farmers whose farm incomes constitute a substantial proportion of household income had less positive perceptions of QOL. Farmers with higher average stress levels, recorded lower QOL (Arbuckle Jr. & Kast, 2012).

A study by Windon, Jepsen, & Scheer (2014) among 400 farmers sampled from Ohio district in the United States of America had contrary findings. Almost 80% of the farmers surveyed reported satisfaction with their QOL. Other key areas of life the respondents were satisfied with include satisfaction with emotional support (70%), satisfaction with social activities (68%) and satisfaction with overall health (57%). The authors identified factors such as the experience of stress, gender (being female) and unavailability of social support, to have significantly reduced farmers' satisfaction with their quality of life (Windon, Jepsen, & Scheer, 2014).

Similar contrary findings were made in a comparative study among farmers and other workers in Zhejiang Province, China. In all 6,511 participants were recruited into the study (3,675 farmers and 2,836 workers). The mean age of the farmers was 46.7 years, the majority had less than secondary education and were married. These were significantly different from those of other workers. Comparatively, the farmers reported relatively lower problems with their health and their health-related quality of life scores were better. Among the farmers, those with more than secondary education and the married farmers had higher QOL scores (Liu et al., 2017).

2.3.4 Level of food insecurity in pastoral communities

Food security encompasses the availability of enough good quality food at the appropriate times that is able to meet the nutritional requirements of individuals. Depending on food availability and adequacy, a person could be classified into one of three different food security states; food secure when there is adequate intake of food with decreased risk of food insecurity. A person is vulnerable when intake of food is enough but the risk of food insecurity is high, and, food insecure when the person is not eating enough food and also have increased risk of food insecurity (FAO, 2000). Different tools have been developed to measure food insecurity, mainly on a continuum of varying levels of severity, of individuals including the United States Household Food Security Survey Module, the Household Food Insecurity Access Scale and the Food Insecurity Experience Scale (FIES) (Ballard, Kepple, & Cafiero, 2013).

In a global survey conducted by the Voices of the Hungry project of the FAO in 2014, researchers identified regions with high levels of food insecurity using the FIES. The global prevalence of severe food insecurity was 7%. Overall, sub-Saharan Africa recorded the highest level of food severe insecurity (25%) way above the developing nation's average of (12%). Ghana also recorded a high prevalence of 23% of severe food insecurity in 2014 (FAO, 2016).

Speranza, Kiteme & Wiesmann (2008) found in a longitudinal study of 127 agro-pastoral households in Makueni district of Kenya that, more pastoral households experienced food shortages during periods of drought than non-drought periods. More than 90% of the households recorded varying levels of food insecurity that was significantly associated with the occurrence of drought. Nearly 25% of the agro-pastoral households were chronically food insecure (Speranza et al., 2008). Smith et al. (2013), explained this observation, suggesting that livestock dependent populations “tend to sell rather than consume the animal source foods produced” (Smith, Sones, Grace, Macmillan, & Tarawali, 2013).

Other studies also had similar food insecurity findings among subsistence crop farmers. In a cross-sectional study of 346 households in some farming communities in northern Ghana, the majority (66%) of subsistent farm households were found to be food insecure. About 30% of respondents had low subjective wellbeing scores. Experience of food insecurity significantly reduced perceived wellbeing of farmers while belongingness to support groupings predicted higher perceived wellbeing (Yakubu & Aidoo, 2015).

Additionally, a survey of 576 households in Punjab province, Pakistan revealed almost a quarter of smallholder crop farmers to be food insecure. Major livelihood risks identified by respondents in this study were high food prices, increased incidence of crop diseases and water shortages among others. The mean age of the household head was 47 ± 9.8 years. On average, a smallholder household size was 7 persons (Ahmed, Ying, Bashir, Abid, & Zulfiqar, 2017).

Generally, the literature shows improved food security when livestock and crop farming are combined. In a study in two Ugandan districts, Nakasongola and Nakaseke, the researchers found that pastoral households were more food insecure than their agro-pastoral counterparts. Seasonal variations were significantly associated with study participants' level of food security. Nearly 50% of pastoral households were extremely food insecure with only 5% being food secure (Mayanja, Rubaire-Akiiki, Greiner, & Morton, 2015).

2.4 Social support availability for livestock farmers

Several studies in the field of psychology and social anthropology advance the argument that the higher the availability of social support networks to persons exposed to different levels of stressful events, the better the improvement in their psychosocial wellbeing (Mayanja et al., 2015; Mort et al., 2005; Peck et al., 2002). Given the magnitude of adverse events livestock dependent populations often face, inferences could be made to the possibility that relevant support provision would improve their resilience in dealing with the challenges faced. For instance in a study by Mayanja et al. (2015), pastoralists were found to have a higher affinity for joining social network support groups more than their agro-pastoral counterparts did.

In a study conducted among 99 male farmers in two regions in the north and south of Australia, availability of higher levels of social support and sense of belongingness was significantly associated with lower levels of depression and suicidal thoughts by farmers. In the absence of these protective factors, the farmers were highly depressed and had suicidal tendencies. Friends and family were key sources of support to the farmers. Suicidal thoughts were found to be associated with depression only when some social support exists. The suicidal tendencies further weakens with increases in the number of protective factors (McLaren & Challis, 2009).

Similarly, two studies were conducted in North Cumbria, Britain, following the foot and mouth disease outbreak in 2001 to assess the psychosocial effect of the outbreak on farmers. The studies each adopted a quantitative or qualitative approach in the inquiry. The quantitative

study was done by Peck et al. (2002) among 198 farmers. The researchers compared the psychological wellbeing of farmers in Highland that did not experience the FMD outbreak and the most affected Cumbria County. The response rate to the survey was low (29%). They found that livestock farmers in Cumbria (73%) had clinically significant mental health problems than those in Highland (33%). Farmers in Cumbria, whose livestock were culled, had even worse psychological health. The total number of support sources available to farmers significantly predicted reduced levels of psychological problems. The main sources of support sought by the affected livestock farmers included support from close family (78%), close friends (60%), other farmers (74%) and veterinary officers (40%). Majority of the respondents (50%) believed the availability of farmer's self-help group would be helpful to them. Nearly 75% of the farmers sought support from either family, close friends or other farmers. Farmers with psychological problems were more likely to seek for support than others (Peck et al., 2002).

In the qualitative inquiry among 54 farmers purposively selected from the same North Cumbria area between October and November 2001, Mort et al. (2005) found that the epidemic was distressing to the lives of the farmers. Places of usual residence to affected farmers were no longer sources of refuge but haunted farmers with many sad memories. Many of the farmers felt powerless to deal with the situation. However, the health problems of affected farmers were alleviated by the availability of both formal and informal support networks (Mort et al., 2005).

Owing to the above findings, the availability of support can be key to the wellbeing of livestock farmers. Few studies assess this potential in Africa. A study conducted in Boranaland, Southern Ethiopia, found that the pastoral community had an indigenous social support scheme, which ensures restocking of herds for poor households that lose livestock to natural stressful events like diseases, conflict, and drought. However, these indigenous sources of support diminished following sustained periods of recurrent shocks. The dwindling indigenous social support significantly increased impoverishment and experience of food insecurity (Berhanu, 2011).

Dzingirai et al. (2017), in a study found government support to pastoralists in the form of veterinary and extension services to livestock as well as health services to humans in North-eastern Kenya to be limited and short in supply leading to difficulties with disease control and treatment (Dzingirai et al., 2017). Opiyo et al. (2014) had similar findings. They found in a study among 302 pastoral households in the Turkana County of Kenya that more than 54% of pastoral households did not receive any form of extension services following adverse event occurrences (Opiyo et al., 2014). Admassie & Abebaw (2014) however emphasized that pastoralists often receive less support from government sources because of their tendency to live in geographically isolated areas from infrastructure and facilities. A study conducted in Cameroon and Western Burkina Faso provided perspective to the findings in the work of (Admassie & Abebaw, 2014). The researchers found in this particular study that, the preference of pastoralists for settlements that are isolated from farmer's villages was often determined by their quest to avoid disturbance to their herds (Dongmo et al., 2012).

2.5 Summary of the reviewed literature

From the ensuing reviewed literature, pastoralists are exposed to diverse stressful events including drought, animal diseases and conflicts in their work. These adverse events often affects them psychologically, physically, economically and socially given their strong attachment to their livestock. The availability and utilization of requisite support mechanisms in pastoral areas appear to be crucial to reducing the impact of adverse conditions they grapple with, thereby improving their general wellbeing and productivity.

CHAPTER THREE

METHODS

3.1 Study design

The study was an analytic cross-sectional survey with a concurrent mixed method approach where both qualitative and quantitative methods of data collection were used to obtain information relevant to answering the study questions at one point in time (1st July 2018 to 29th September 2018). According to Creswell (2009), the mixed-method design allows for qualitative findings to provide depth in meaning to quantitative results thereby neutralizing the inherent limitations in the use of a single research method. The study was designed within the concept of One Health, which promotes the integration of polices on human, animal and the environment, in a transdisciplinary manner, to maximize the health benefits. A mixed method approach is thus, highly recommended for studies conducted within the One Health framework (Zinsstag, Mahamat, & Schelling, 2015).

3.2 Study area

This study was carried out in the Northern and Southern Belts of Ghana. Two of the highest livestock production districts, one from each stratum, were selected based on data from the 2010 population and housing survey. According to the census report, livestock rearing of cattle, sheep, and goats dominate the economic activity in the northern savannah belt and the Afram plains basin in the south (Ghana Statistical Service, 2012). From a sampling frame fourteen (14) districts in the Northern Belt and seven (7) in the South, the Bunkpurugu-Yunyoo (BY) district in the Northern Region of Ghana and the Kwahu Afram Plains South (KAPS) District in the Eastern Region were sampled randomly as the representative Districts in the Northern and Southern Belts respectively (Figure 2).

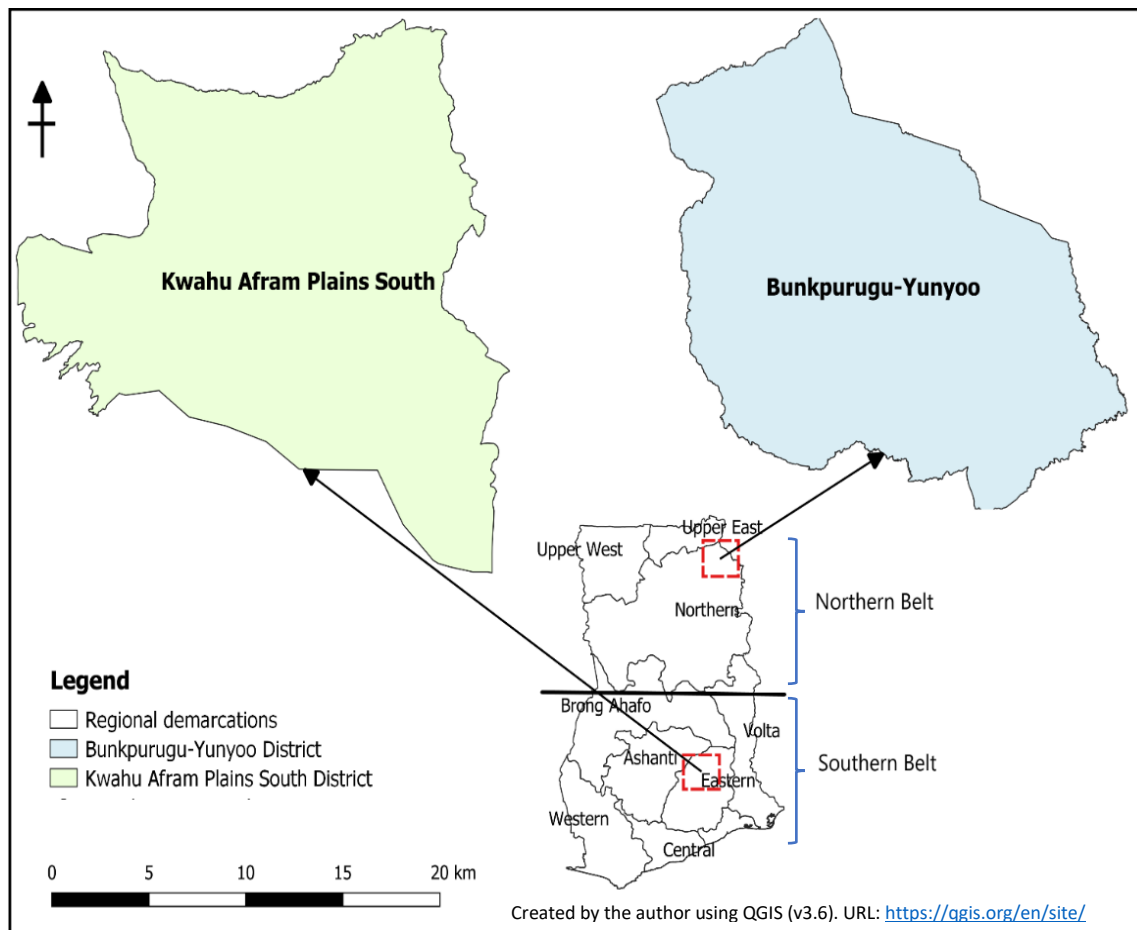


Figure 2: Map of Ghana showing the study area

Bunkpurugu-Yunyoo (BY) District

The Bunkpurugu-Yunyoo (BY) District is an agrarian settlement with a population of more than 120,000 persons. Geographically, it is located in the North-eastern corner of the Northern Region of Ghana (Figure 2). The Garu-Tempane District in the North, East Mamprusi in the West and the Gushiegu and Chereponi Districts in the South, bound it. It also shares a boundary with Togo to the East. The White Volta enters the District from the Northeast direction serving as a boundary with Garu Tempane in the North (Ghana Statistical Service, 2014a). However, following a successful referendum in December 2018, the District has now been separated into Bunkpurugu and Yunyoo Districts and now is located in the North East Region of Ghana (Daily Graphic, 2019).

The District lies within the Northern Savannah Agro-ecological zone and has common grass vegetation. The landscape and climatic conditions make the district conducive for the cultivation of food and cash crops and rearing of livestock. There is only a single rainfall season annually in the district usually between April and October. More than 94% of households within the district are engaged in agricultural activities (GSS, 2014a).

The BY District Assembly is the highest political and administrative body in the district headed by the District Chief Executive. The custodian of the land is the traditional outfit who allocate land portions to persons who wish to engage in agriculture. The main festivals of the people in the District are the yam and fire festivals celebrated by the Konkombas and Mamprusis respectively. The District is characterized with occasional episodes of ethnic, land and chieftaincy disputes (GSS, 2014a). Farmers in the district are into subsistence and cash crop agriculture, with extensive dependence on traditional labour intensive method of farming. Food crops including maize, rice, millet, sorghum, groundnuts and soya beans are cultivated. Livestock and poultry production is mostly done under a free-range system, and BY District had the highest number of households engaged in livestock rearing in 2010 (GSS, 2012). The main animals reared in the district include chicken, goats, sheep, cattle, and pigs.

Kwahu Afram Plains South (KAPS) District

The Kwahu Afram Plains South (KAPS) District is located at the North-western part of the Eastern Region of Ghana and covers a total land surface area of approximately 3,095 square kilometres. It is bordered on the North by the Kwahu Afram Plains North District, on the South by Kwahu South District, on the East by the Volta River and the West by two Districts in the Ashanti region namely Sekyere and Asante-Akim Districts. The District has a youthful population with a majority of the residents being males and migrants. Rural settlements constitute more than 70% of the District's

population. Even though the majority of residents are Ghanaian by birth, there are a significant number of migrant Fulani herdsmen in the District for livestock farming (GSS, 2014b). The District Chief Executive with support from the District Assembly heads the District. The Kwahu Traditional Council, headed by the Omanhene, is the highest traditional authority in the District, supported by divisional chiefs operating within various traditional areas in the District.

The KAPS District is generally an agricultural settlement with over 80% of the population engaged in agricultural activities including crop production, livestock rearing, and fish farming. The landscape of the District is generally undulating with vast stretches of arable agricultural land that lies within the Savannah vegetation zone. The soils in the district are suitable for the cultivating food crops such as cassava, plantain, yam, cocoyam, maize, and other cash crops (GSS, 2014b). According to the GSS (2012), livestock rearing is the second most important agricultural activity in the district after crop farming. The main animals reared in the district are cattle, goats, and sheep.

3.3 Study Variables

Table 1 provides the list of the variables assessed during this study. These include fifteen (15) independent variables. The dependent variable in this study is psychosocial wellbeing of livestock farmers. There are four other dependent variables: mental health, resilience, quality of life and food security which form the dimensions from which the psychosocial wellbeing outcome was generated.

Table 1: List of variables in the quantitative study

No.	Variable name	Operational definition	Type of variable	Scale of measurement
1	Sex	Sex of livestock farmer	Independent	Nominal
2	Age	Age of livestock farmer in years	Independent	Interval
3	District	Farming district of livestock farmer	Independent	Binary
4	Education	Educational status of livestock farmer	Independent	Ordinal
5	Marital status	Marital status of livestock farmer	Independent	Nominal
6	Household size	Size of the household of livestock farmer	Independent	Ratio
7	Herd size	Number of cattle per livestock farmer	Independent	Ratio
8	Support source	Number of support sources available to the farmer	Independent	Ratio
9	Crop cultivator	Livestock farmer engaged in cropping	Independent	Binary
10	Illness status	Self-reported illness status of the farmer	Independent	Binary
11	Number of adverse events	Number of adverse events, in 1 year, experienced by a livestock farmer	Independent	Ratio
12	Source of loss	Factors leading to livestock loss	Independent	Nominal
13	Proportion of livestock lost	The proportion of livestock lost in 1 year	Independent	Ratio
14	Attachment to livestock	Level of the emotional attachment of livestock farmer to livestock	Independent	Binary
15	Childhood history with livestock	A farmer's reported history of involvement in livestock rearing since childhood	Independent	Binary
16	Psychosocial wellbeing	The psychosocial wellbeing of livestock farmer	Dependent	Ratio
17	Mental health	The mental health of livestock farmer	Dependent dimension	Ratio
18	Resilience	The resilience level of livestock farmer	Dependent dimension	Ratio
19	Quality of life	The quality of life of livestock farmer	Dependent dimension	Ratio
20	Food security	The food security level of livestock farmer	Dependent dimension	Ratio

3.4 Study population

The study population includes:

- All livestock farmers in the KAPS and BY Districts of Ghana.
- Veterinary officers including Doctors of Veterinary Medicine (DVM) and Veterinary Field Officers in the BY and KAPS Districts of Ghana.

3.4.1 Inclusion criteria

Quantitative study

- Livestock farmers who rear at least ten (10) cattle in their herds within the study districts.

Qualitative study

- Livestock farming community leaders in areas from which the cattle farmers are recruited.
- Veterinary officers officially assigned within the study districts.

3.4.2 Exclusion criteria

- Livestock farmers who have been into cattle farming for less than 2 years.
- District Veterinary officers not directly involved in managing cattle for at least 2 years.

3.5 Sample size

The sample size for this study was derived with Epi Info™ 7.2 using the following assumptions:

Expected frequency = 20%.

In a nationally representative survey conducted in Ghana between 2009–2010, nearly 20% of study participants had psychological distress (Sipsma et al., 2013).

Acceptable margin of error = 6%; As indicated in Dillman, Smyth, & Christian (2014).

Design effect = 1.5, to clear variations between strata during sampling

Confidence level = 95%

Number of strata = 2

From the above, the minimum sample generated was 258 pastoralists. With the inclusion of 10% (26) for non-response, a sample size of 284 was obtained. A 10% non-response was included as done in (Ambelu et al., 2017) due to the previously recorded low response rates in studies of livestock farmers (Haaften, Oiff, & Kersten, 2004; McLaren & Challis, 2009). Based on the total sample (284), a minimum of 142 respondents were to be recruited per strata (study district).

3.6 Sampling technique

The respondents were recruited through the veterinary offices in the study districts. The veterinary officers introduced the research team to the leaders of the livestock farmers in communities who have a good number of cattle farmers for inclusion in the study. This list of cattle farming communities served as the sampling frame from which the study communities were drawn. See Appendix 6 for the list of cattle farming communities provided per district. The number 12 and 10 were randomly selected (from among the numbers 10 to 20) as the number of communities for the KAPS and BY Districts respectively, from which respondents would be recruited. Then, the 12 communities were randomly drawn from a list of 54 communities for the BY District. Ten (10) communities were also sampled from a total list of 40 communities from the KAPS District.

In the communities, the leaders of the cattle farmers provided the names and locations of the cattle farmers within their jurisdictions. From this list, the research team consecutively recruited the farmers from both study districts. The farmers were interviewed in their homes during the period when they are available upon introduction. Data was collected on average for 28 days per district. In all, 287 livestock farmers were recruited: 142 from KAPS and 145 from BY Districts.

For the qualitative approach, the research team purposively selected the leaders of cattle farmers in all communities where quantitative data were collected until saturation was reached. Overall,

nineteen (19) community leaders were selected. All the veterinary officers including a veterinary doctor (1) and veterinary field officers (4) in both districts were selected for interview.

3.7 Data collection instruments

Two data collection tools were used to obtain information relevant to answering research questions: a structured questionnaire and semi-structured interview guide for quantitative and qualitative data respectively (Appendix 2).

The structured questionnaire utilized five standardized instruments: WHOQOL-BREF quality of life assessment scale, 14-Item Resilience Scale (RS-14), Food Insecurity Experience Scale (FIES), Depression Anxiety and Stress Scale (DASS 21), and Emotional Attachment to livestock Scale. The DASS-21 measures self-reported negative emotions of depression, stress, and anxiety for the purposes of mental health assessment by researchers or health professionals. Higher scores on this Likert scale are indicative of poorer mental health (Szabo, 2010). The WHOQOL-BREF assesses an individuals' perception about certain key areas of their lives in relation to their goals, expectations and living standards. Higher scores on this Likert scale imply the better quality of life (Feder et al., 2015). The RS-14 directly measures five resilience characteristics; self-reliance, purpose, equanimity, perseverance, and authenticity of individuals, with higher scores signifying strong resilience (Wagnild, 2009). The FIES is an experience-based tool for measuring insecure access to food of individuals or households, through inquiry into behavioural and psychological indicators of food insecurity. Each question in the FIES assesses a unique food insecurity situation with affirmative responses to each subsequent question depicting a more severe level of food insecurity (Ballard et al., 2013). The Emotional Attachment to Livestock Scale is a 5-point Likert scale comprising five statements which inquire about a farmer's perceptions, attitudes, and

relationships with their livestock. Higher scores were indicative of strong emotional attachment (Vittersø et al., 1998). A detailed description of these scales is annexed in Appendix 5.

Based on the literature, the other sections of the questionnaire were designed by the Principal Investigator (PI) to assess the sources of livestock losses, sources of support to respondents, a number of livestock lost over a period and other socio-demographic factors. The PI, based on the study objectives also designed two semi-structured interview guides tailored to the study population of livestock farming community leaders and veterinary officers respectively.

Both the structured and semi-structured instruments were translated using back translation, into three (3) spoken local languages in the study areas: Bimoba for the BY District, and Ewe and Akan for the KAPS District. Two experts each in the languages carried out the translation exercise.

3.7.1 Structured questionnaire

The questionnaire was structured into seven (7) sections. These include socio-demographic information and farm characteristics (Section A), adverse events occurrences in livestock farming (Section B), emotional attachment to livestock (Section C), measures of mental health, quality of life, resilience, and food security in Sections D, E, F, and G. The psychosocial wellbeing outcome was generated as a numerical estimate from a standardization of the four dimension scales. Details of the standardization process are described in Section 3.9 of this Chapter. The Resilience Center™ holds the copyright to distribute the RS-14 Scale. The RS-14 tool was delivered together with its supporting files after all requisite terms of use were met. Apart from the resilience measure, all other tools used in this study were freely available.

3.7.2 Interview guide for leaders of livestock farmers

This interview guide comprising of nineteen (19) open-ended questions, designed by the PI, was employed for interviews with leaders of the livestock farming communities. The question list was not exhaustive but flexible to accommodate emerging concepts and ideas during interview sessions. It also obtained some socio-demographic details from the community leaders including age, sex, community name and number of years involved in livestock rearing.

3.7.3 Interview guide for veterinary officers

The second interview guide was used for collecting information relevant to answering research questions, from the veterinary officers within the study districts. It comprises of 11 core questions relating to livestock farming practices and the provision of veterinary services to farmers. It also obtained some socio-demographic details of the veterinary officers to enable the PI to situate the research findings within the context of subjects in the study.

3.8 Data collection procedure

The data was collected in July and August of 2018 in the BY and KAPS Districts respectively. The researcher with the help of three assistants visited the cattle farmers and veterinary officers in their homes and workplaces to administer the questionnaires. Two technicians each, with at least diploma qualification, who were resident in the study districts were recruited and trained on the administration of data collection tools. One research assistant with a Bachelor of Science qualification was permanently involved in data collection for both districts. To enhance supervision of the data collection process in the field, the research team was divided into two: the PI worked with one resident technician, while the research assistant supervised the other technician in each district. The PI maintained oversight over the activities of both groups during the period.

The questionnaires were administered to the livestock farmers in one of the four (4) languages, English, Ewe, Akan or Bimoba, depending on their language preference. Each cattle farmer was visited in his/her respective home or ranch once, and the questionnaire completed. Similarly, the in-depth interviews with livestock farming community leaders and veterinary officers were done in the preferred languages of the respondents.

3.9 Data management and analysis

During the data collection in the field, the PI and permanent research assistant cross checked questionnaires after each day, to ensure completeness. Completed questionnaires and consent forms were stored in sealed boxes, and access limited to the PI. Recordings from interviews were stored on a secured project computer. Only the research team members had access to tape recordings of interviews conducted.

Following the questionnaire administration and interviews, a period of two weeks was used to develop a codebook from the responses received for questionnaires administered. The completed questionnaires were entered in Microsoft Excel in preparation for statistical analysis. The interview recordings were transcribed in Microsoft Word. Copies of the quantitative dataset, transcribed text, and audio recordings were uploaded on the cloud database of Afrique One African Science Partnership for Intervention Research Excellence and the project external hard drive as backup.

For quantitative analysis, the data from the questionnaires were processed and cleaned. The resulting Comma Separated Value (CSV) file was uploaded into various statistical software including SPSS v20, R v3.5 and Stata v15 (IBM Corp, 2011; R Core Team, 2013; StataCorp, 2017) for analysis. Descriptive and inferential analyses were conducted. The descriptive analysis of categorical data was expressed as frequencies and relative frequencies. The means and standard

deviations for continuous variables were also calculated. For inferential analysis, Pearson's chi-square, logistic and linear regression models were used to explain the variations in the dependent variables accounted for by independent predictors. Details of the specific analyses approach for each of the standard tools are provided in the sections 3.9.1 to 3.9.6. The results were presented in the form of frequency distribution tables and charts. All associations were adjusted for potentially confounding variables. Values of $p < 0.05$ were considered statistically significant.

To analyse the qualitative information, transcripts of responses obtained during the in-depth interviews of livestock farming community leaders and veterinary officers were uploaded into NVivo v12 (QSR International, 2018). With the assistance of NVivo software, deductive coding of the interview narratives was done after an iterative process of reading all transcripts to generate themes and sub-themes from the emerging patterns in the data relevant to the research questions. The process also assessed for similarities and contradictions in the coded interview narratives. Key findings from the analysis were presented in narratives supported by verbatim quotations.

3.9.1 Analysis of the Attachment to a livestock scale

This is a 5-item Likert-scale with responses ranging from 1 to 5; higher scores indicate stronger emotional attachment of the livestock farmer to cattle. The analysis involved computing the sum of the Likert scores for each farmer and estimation of the mean attachment score (Vittersø et al., 1998). Respondent scores less than the mean attachment score were categorized as not attached while scores above the mean score were classified as emotionally attached to their cattle.

3.9.2 Analysis of the Depression Anxiety and Stress Scale – 21 (DASS-21)

The Likert-scale scores of the DASS-21 range from 0 to 3, 0 meaning non-experience of the negative emotion and 3 as frequent negative emotion experience. The scores of the respondents were reversed so that higher scores denote better mental health; 0=3, 1=2, 2=1 and 3=0. The

reversed Likert scores were summed under each of the three subscales (depression, stress, and anxiety), and multiplied by 2 to generate depression, stress and anxiety scores. The mean of these three scores was computed to obtain a mental health score (Lovibond & Lovibond, 1995). The mental health scores were categorized into two; scores above and below the mean mental health score depicting better and worse mental health respectively. Inferential analysis was done to identify the factors that explained variations in the mental health categories using Chi-square tests. Logistic regression analysis was done to determine the strength of association using odds ratios.

3.9.3 Analysis of the 14-Item Resilience Scale (RS-14)

The RS-14 Likert-scale scores range between 1 and 7. Higher scores implied higher resilience. Individual resilience scores and categories were computed from the Likert-scale scores of the respondents using the User's guide recommendations (Wagnild, 2009) into two groups. Livestock farmers who scored less than 65 were classified as low resilience and scores of 65 and greater had high resilience. The factors that explained variations in the resilience categories were assessed using Chi-square tests, and simple and multiple logistic regression analysis.

3.9.4 Analysis of the WHOQOL – BREF

The WHOQOL – BREF has 26 items, two of which assess a study subject's own perception of their quality of life and overall health status. These two general measures were excluded in the analysis for QOL. Three of the items; item 3, 4 and 26, are negatively framed. Except for these, higher scores on the Likert-scale, ranging between 1 and 5 denote the better quality of life. The three negatively framed scores were thus reversed, 1=5, 2=4, 3=3, 4=2 and 5=1. The livestock farmers' responses to the WHOQOL-BREF questionnaire was loaded into SPSS to obtain scores for the four domains of quality of life namely; physical, psychological, social relationships and environment using an IBM SPSS syntax file provided by WHOQOL Group. The domain scores

were derived by computing the mean score of the items within each domain, multiplied by 4. The mean of the four domain scores was computed to derive an overall quality of life score (WHOQOL Group, 1996). The approach by (Feder et al., 2015) was adopted to obtain QOL categories. The quality of life score was categorized: scores less than the mean depict poor quality of life while scores more than the mean had good quality of life. Inferential analysis was done to identify factors that influenced the quality of life categories using Chi-square and logistic regression analysis.

3.9.5 Analysis of the Food Insecurity Experience Scale (FIES)

The FIES is an 8-item scale with YES and NO responses. Each subsequent item on the scale is a more severe measure of food insecurity. The dichotomous scale was transformed into a continuous one: study subjects who responded NO to any question received a score of zero (0). Each question in the FIES assesses a unique food insecurity situation with affirmative responses to each subsequent question depicting a more severe level of food insecurity (Ballard et al., 2013). Thus, answering YES to Question 1 yielded a score of 1, YES to Question 2 yielded a score of 2 and etcetera. The scores were reversed as follows: 0=9, 1=8, 2=7, 3=6, 4=5, 5=4, 6=3, 7=2 and 8=1, to achieve a similar direction as the other dimension scales. This transformation yielded a continuous scale scores ranging between 8 and 72, which were then categorized. Those who had maximum scores were classified as food secure. Scores less than the maximum score of 72 were categorized into two classes; moderately food insecure (55 – 71) and severe food insecure (≤ 54) (Ballard et al., 2013). To perform bivariate analysis, the food security scores were categorized into two levels; food secure for respondents with maximum score (72) and food insecure for scores less than the maximum score (≤ 71). Chi-square tests and logistic regression models were used to assess for the predictors of food security.

3.9.6 Analysis of psychosocial wellbeing

To generate a score for psychosocial wellbeing, a mean percentage standardization of the four individual dimension scale scores was performed. This approach according to Fischer (2010), allows for comparison of outcomes from different studies which are sample specific and otherwise difficult to interpret using the standard normal approach. Firstly, the mean scores of each farmer from different domains within the mental health, quality of life and resilience scale, were computed. The mean scores from the food insecurity measure were also computed to ensure the four individual dimension scales are comparable. These mean scores were then transformed into a percentage scale by dividing each individual livestock farmers' mean score over the maximum mean score possible and multiplying by 100 (Fischer, 2010), as follows:

$$y_i = \frac{\bar{x}_i}{\max \bar{x}_i} * 100$$

Where: $\bar{x}_i$ is the mean score of a study subject across the domains of each of the indicator/dimension scales (DASS-21, WHOQOL-BREF, RS-14 and FIES).

$\max \bar{x}_i$ is the maximum mean score of respondents in the sample on the dimension scales.

y_i is the percentage of the mean score of a study subject on the dimension scales.

The psychosocial wellbeing score was then computed for each livestock farmer by calculating a mean score using the four dimension percentage scores as illustrated in the formula below:

$$y_{wellbeing} = \frac{\sum y_i}{4}$$

Where: $\sum y_i$ is the sum of the percentage mean scores of the dimension scales.

$$= \sum (y_{MENTAL\ HEALTH} + y_{RESILIENCE} + y_{QUALITY\ OF\ LIFE} + y_{FOOD\ SECURITY})$$

$y_{wellbeing}$ is the psychosocial wellbeing score for each study subject.

The psychosocial wellbeing scores ($y_{wellbeing}$) were used in further analyses. Descriptively, the scores were categorized into two levels of psychosocial wellbeing: poor and good. Inferential analysis was done to determine the most efficient linear model of psychosocial wellbeing and predictors, using the backward elimination approach (Heinze, Wallisch, & Dunkler, 2018). Model selection was done using likelihood ratio tests, starting with the most plausibly complex model.

3.10 Validity and reliability

Validity is defined as the degree to which the researcher has measured what he or she was supposed to measure (Polit & Beck, 2006). The validity of this study was ensured by using standardized instruments. The study also used a random sampling in selecting communities from which farmers were recruited, to minimize errors with sampling. To ensure uniformity in questioning in the local languages spoken, two language experts each in the local languages translated the tools, by back-translation. Additionally, the technicians were recruited based on their ability to speak in the local language of the communities studied. All the research assistants were also trained prior to data collection to improve the consistency and accuracy of administering the questionnaires.

Reliability of an instrument is the degree of consistency or accuracy with which the instrument measures the attribute it is designed to measure (Creswell, 2008). A study is said to be reliable when it produces the same results when tested in similar situations using the same method. Reliability of this study was ensured by allowing participants to answer the questionnaires independently. The data collection tools were pretested to validate the questions and questionnaire. Cronbach alphas were computed for the all the standard scales; all scales showed strong psychometric properties ($\alpha \geq 0.70$; WHOQOL-BREF = 0.84, RS-14 = 0.87, FIES = 0.82, DASS-21 = 0.87, Attachment to livestock scale = 0.70).

3.11 Pre-testing of Structured Questionnaire

A pilot study was conducted in six (6) cattle farming communities in the Greater Accra Region (Amrahia, Ashale Botwe, Madina, Malejor, Ogbojo, and Turaku) in June 2018. In this pilot study, 40 livestock farmers were recruited by consecutive sampling through their community heads. The structured questionnaire was administered to the farmers to assess for clarity of the questions, and perform reliability testing of the instruments. Descriptive and inferential analysis of the responses was performed. All the standard tools were found to have solid psychometric validity and internal consistency with Cronbach alphas ≥ 0.70 (Appendix 7). All ambiguous and uncomfortable questions to respondents were identified and rephrased.

3.12 Ethical Considerations

The ethical approval for this study (054/17-18) was obtained from the Institutional Review Board of Noguchi Memorial Institute of Medical Research (Appendix 3) on 10th January 2018. Administrative authorization was obtained from the Departments of Agriculture in the study districts. The livestock farmers and veterinary officers recruited in this study provided informed consent prior to questionnaire and interview administration, by signing or thumb printing the consent form. The voluntariness of participating in the study was emphasized to the study participants. A compensation (a bar of soap) was given to each participant after data was collected. This did not involve coercion or inducement. All information generated from the study were treated as confidential records. Information collected on study questionnaires and audio recordings had code numbers and participants' names omitted from reports on this study.

This study was carried out with full sponsorship by Afrique One – African Science Partnership for Intervention Research Excellence (ASPIRE) within the framework of the DELTAS Africa Initiative. The funders had no role in the design and implementation of the study.

CHAPTER FOUR

The summary of the findings from the research are presented in this chapter. The Bunkpurugu-Yunyoo (BY) and Kwahu Afram Plains South (KAPS) Districts were selected as representative districts in the Northern and Southern Belts of Ghana respectively. Data were collected in July in the BY District and August in the KAPS District. Overall, 287 livestock farmers were recruited for the quantitative study including 145 and 142 livestock farmers in the BY and KAPS Districts respectively. While 24 key informants comprising nineteen (19) livestock farming community leaders and five (5) veterinary officers were selected for the qualitative study. The findings from the quantitative and qualitative study are presented in sections 4.1 and 4.2 respectively.

4.1 QUANTITATIVE RESULTS

4.11 Socio-demographic characteristics of livestock farmers

As shown in Table 2, the mean age (SD) of the farmers is 46.9 ± 11.7 years. Thirty-two percent of the respondents were aged between 40 and 49 years. The ages were statistically different in the study districts ($p = 0.008$), with farmers' in the KAPS District being significantly older. Almost all the respondents are male (93%) and have some basic education (46%). The educational level of the livestock farmers was statistically different in both study districts. The farmers in the BY District had significantly higher education levels compared to those in the KAPS District ($p < 0.001$). The average pastoral household has 10 persons. Ninety-two percent of the respondents were married. The main Ghanaian tribe involved in cattle keeping in the BY District are Bimoba (86%) whereas, in the KAPS District, it is the Ewes (48%). However, there is greater diversity in the ethnic distribution in the KAPS District (13 tribes) compared to five in the BY District. Overall, 43% (124/287) of livestock farmers were Bimoba (Figure 3).

The livestock farmers also assessed their own health status at the time of the study. They reported symptoms including myalgia, asthma, skin lesions, eye problems and high blood pressure. The researcher classified the reported symptoms under musculoskeletal, gastrointestinal, cardiovascular, neurological, respiratory and skin illnesses. About one-third (90/287) of the respondents reported experiencing some illness. Of these 90, the 46% (41/90) reported musculoskeletal symptoms. Other key symptoms identified were gastrointestinal (21%) and cardiovascular (17%) related. The least of symptoms reported were skin lesions by 3% (3/90) of the farmers (Figure 4). In difficult times, the people the livestock farmers mainly turn to are their families (240/287) (Table 3).

The majority of the livestock farmers (70%) in the study were raised up in their childhood days, in households where farm animals were kept. Only 87 of the respondents did not have their parents or guardians keeping livestock during childhood. A typical farmer had about 31 cattle holdings, (range: 11 to 400). The herd sizes were significantly different in the BY and KAPS Districts. The livestock farmers in the KAPS District had relatively larger cattle holdings compared to those in the BY District ($p = 0.006$). Aside from raising cattle, a little over 90% (261/287) of the livestock farmers also cultivate crops including cereals (230/261), legumes (114/261), vegetables (49/261) and root tubers (39/261). All the livestock farmers in the BY District cultivate at least one crop with the major crops being cereals and legumes grown by 100% (145/145) and 63% (91/145) livestock farmers respectively in the BY District. Few of the livestock farmers in the BY District cultivate tubers and vegetables. The growing of crops is however widely diverse in the KAPS a good number of the livestock farmers cultivate all crop types. The major crops cultivated were cereals and vegetables (Figure 5).

Table 2: Socio-demographic characteristics of livestock farmers by district (N = 287)

Variables	BY(n _i =145)	KAPS(n _j =142)	Total (n _{ij})	Percent (%)	Chi-sq.
Age (<i>Mean ± SD</i>)years			(46.9 ± 11.7)		15.4**
Less than 30	12	3	15	5.2	
30 – 39	41	22	63	22.0	
40 – 49	45	48	93	32.4	
50 – 59	31	46	77	26.8	
60 – 69	9	13	22	7.7	
70 or more	7	10	17	5.9	
Sex					2.9
Female	6	13	19	6.6	
Male	139	129	268	93.4	
Education					24.1***
No formal education	43	53	96	33.5	
Basic	56	76	132	46.0	
Secondary	33	12	45	15.7	
Tertiary	13	1	14	4.8	
Marital status					0.2
Not married	12	10	22	3.8	
Married	133	132	265	92.3	
Household size (<i>Mean ± SD</i>)			(46.9 ± 11.7)		0.3
10 or less	86	80	166	57.8	
More than 10	59	62	121	42.2	
Herd size (Median: Range)			31 (11 to 400)		7.4**
50 or less	114	91	205	71.4	
More than 50	31	51	82	28.6	
Experience with raising livestock					0.6
No livestock raised in childhood	41	46	87	30.3	
Raised livestock since childhood	104	96	200	69.7	
Cultivation of crops					-
No	0	26	26	9.1	
Yes	145	116	261	90.9	
Self-reported illness status					1.9
Not ill	105	92	197	68.6	
Ill	40	50	90	31.4	

SD=standard deviation, n_i=BY subtotal, n_j=KAPS subtotal, n_{ij}=total, **=p<0.01, ***=p<0.001

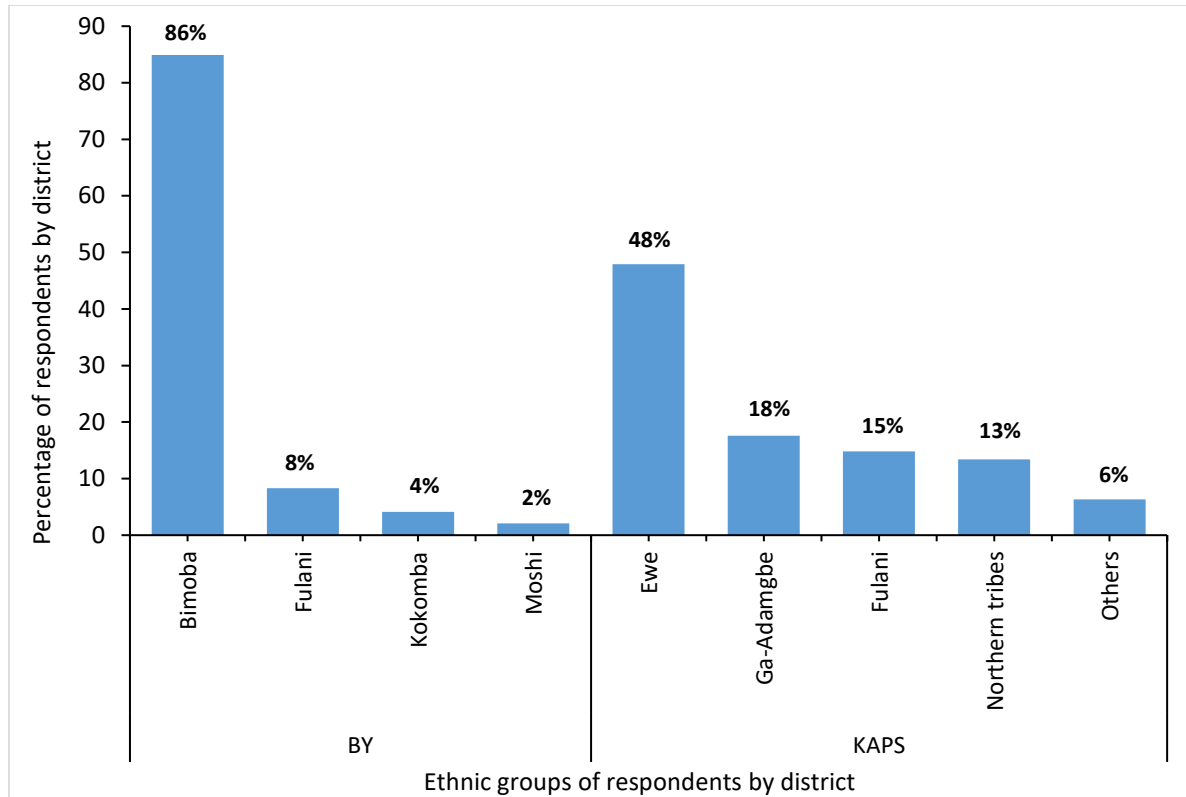


Figure 3: Ethnic groupings of livestock farmers in the BY and KAPS Districts

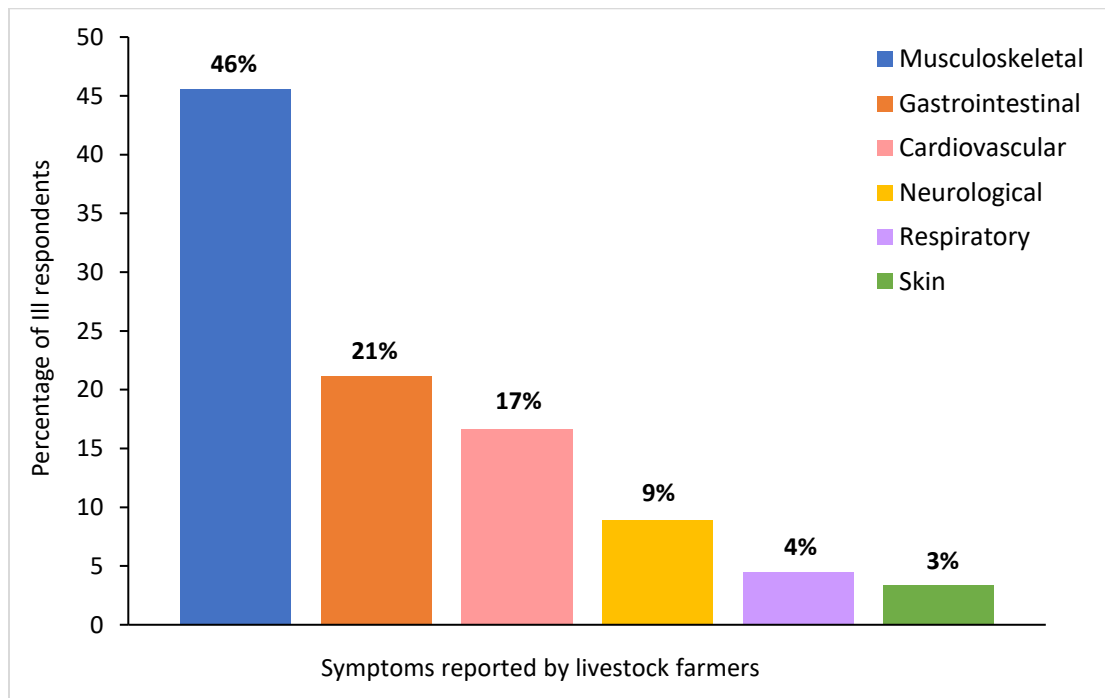
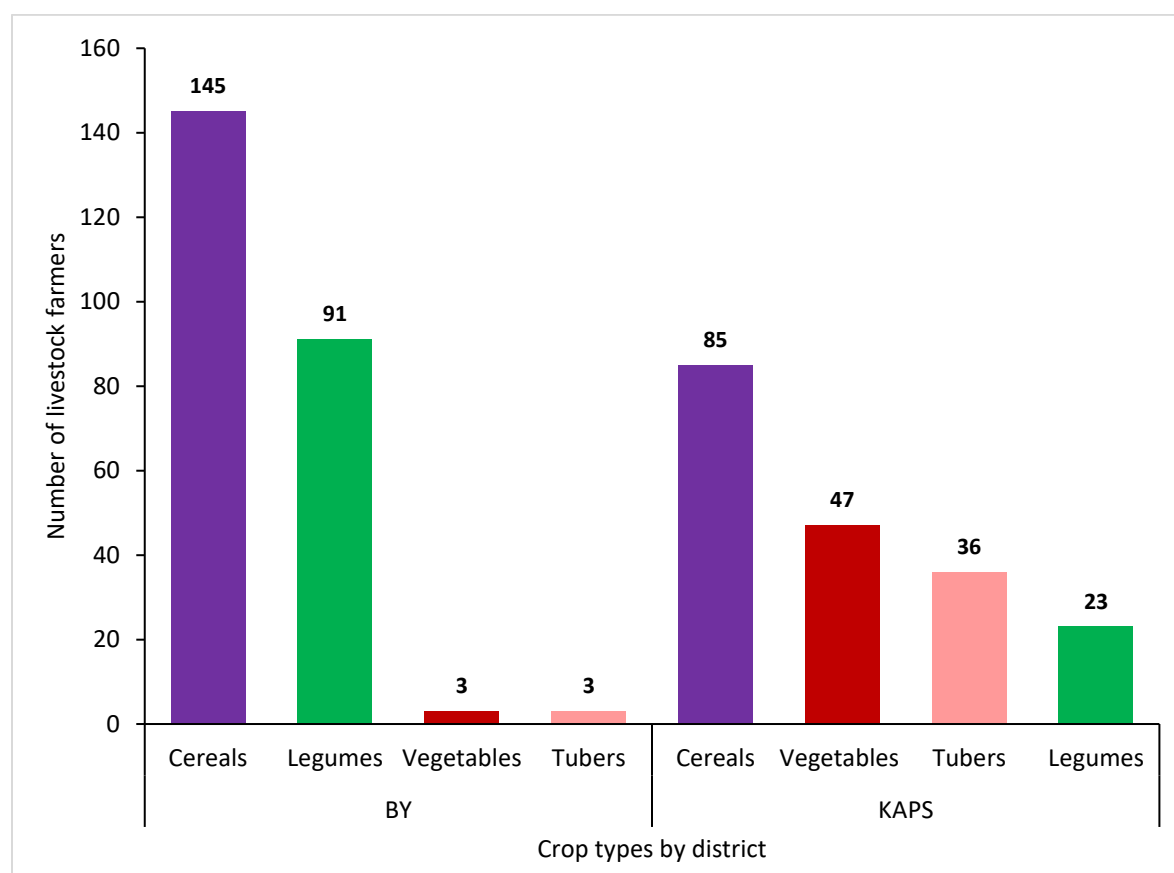


Figure 4: Symptoms reported by livestock farmers in the BY and KAPS Districts

Table 3: The persons livestock farmers turn to help deal with adversity (N=287)

Person	Frequency (n)*
Family	240
Friends	180
Community leaders	115
Religious leaders	106
Self	17
Others	13

*multiple responses


Figure 5: Distribution of crops cultivated by livestock farmers by district

4.12 Factors that lead to livestock losses to pastoralists

The occurrence of adverse events in pastoral communities may or may not lead to livestock losses. In this study, it was found that only 16% of the respondents did not lose any cattle over the past year period until the date of data collection. Table 4 shows the adverse events that stress livestock farmers' significantly in their work over a period of five years. The main adverse events stressing cattle farmers include animal diseases, pasture shortages mainly from drought, cattle theft, poor market prices for cattle and unavailability of grazing lands.

Table 4: Adverse events that affected livestock farmers between 2012 and 2017 (N=287)

Source of stress	Frequency (n)*
Illness of cattle	286
Pasture shortage	267
Drought	261
Theft of cattle	226
Poor cattle prices	222
Lack of grazing land	217
Land degradation	188
Lack of water points	173
Fire outbreak	138
Conflict	94
Flood	24
Others	3

*multiple responses

Sometimes, the occurrence of adverse events leads to livestock losses. Overall, 84% (240/287) of the farmers lost cattle in the past 1 year. The major factors leading to cattle losses were animal diseases among 91% (218/240) of the farmers. Other key sources of loss were from cattle theft (50%), pasture shortages (27%) and conflicts (22%). From Figure 6, the proportion of livestock losses by farmers to the main loss factors was similar in both BY and KAPS Districts.

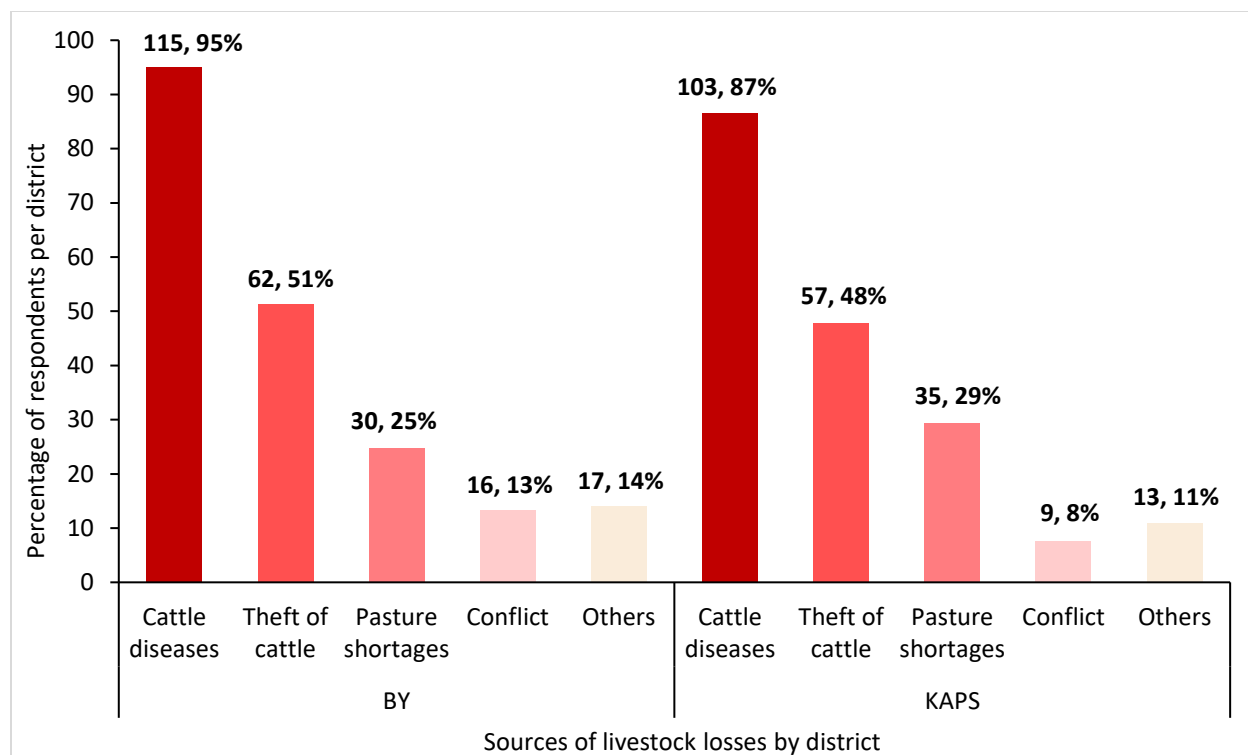


Figure 6: The leading sources of livestock losses to pastoralists in the BY and KAPS Districts

Overall, the median number of cattle lost over the past 1 year to each livestock farmer was seven (97) cattle (IQR = 7). Specifically, the livestock farmers lost on average five (5) cattle to livestock diseases, two (2) cattle to theft, one (1) cattle to conflicts, and one (1) cattle to pasture shortages in the past year. Proportionately, the farmers lost on average, 15% of their cattle herds in the past year. The proportionate losses were significantly different in the BY and KAPS Districts ($p < 0.001$). The farmers in the BY District lost an average of 11% (SD = 12%) of their cattle herds while an average of 18% (SD = 15%) of cattle herds were lost in the KAPS District.

Information was collected from all the 218 livestock farmers who lost cattle to diseases (Figure 6) on the clinical signs and symptoms seen in the cattle before they are lost. The livestock farmers reported signs including foot and mouth sores (207/218) and difficulty breathing (200/218). The other symptoms reported by the farmers include skin patches, cough, and diarrhoea (Table 5).

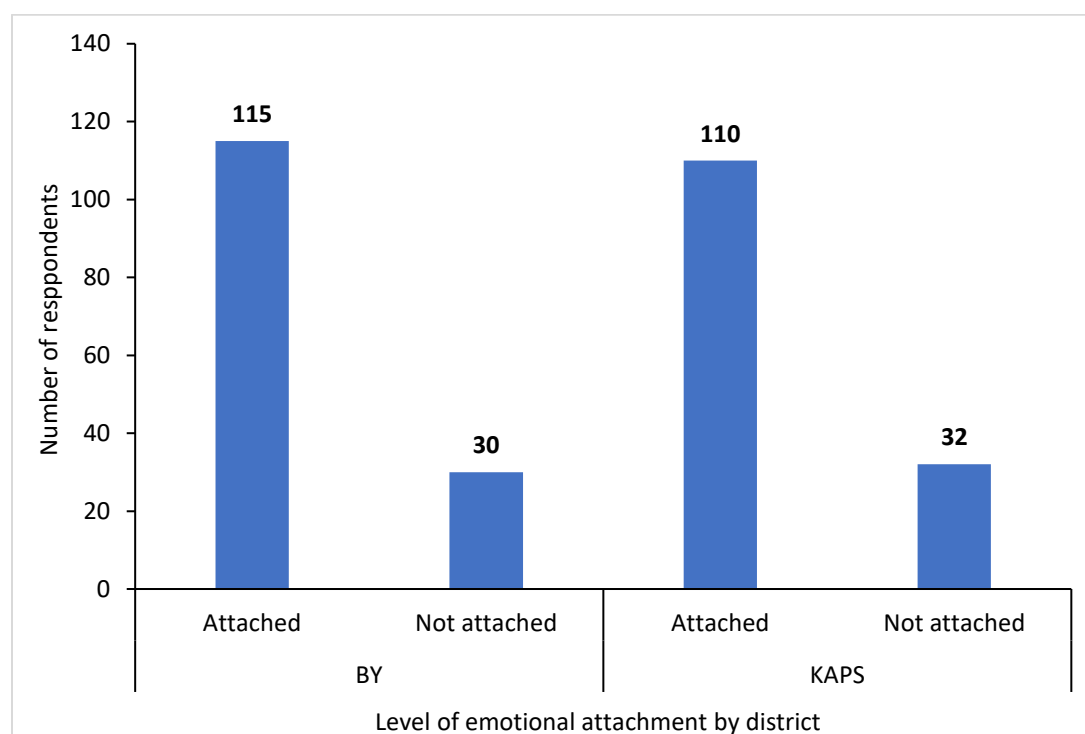
Table 5: Clinical signs and symptoms presented by cattle before losses (N=218)

Clinical signs and symptoms	Frequency (n)*
Foot and mouth sores	207
Difficulty with breathing	200
Chronic thinness	176
Chronic thinness with eye secretions	158
Abortions of cattle	149
Bleeding from orifices	24
Others	22

*multiple responses

4.13 Level of attachment of pastoralists with their livestock

Assessment by the Attachment to Livestock Scale shows that almost 80% of the respondents (225/287) were emotionally attached to their cattle. There was no significant difference between the attachment of the livestock farmers to cattle in the BY and KAPS Districts (Figure 7).

**Figure 7:** Level of the emotional attachment of livestock farmers with their cattle by district

4.14 Availability of social support services to livestock farmers

The average number of support sources, for dealing with adverse events in the past year, reported by the livestock farmers was from two (2) sources (IQR = 4). The number of support sources was significantly different in the BY and KAPS Districts ($p < 0.001$): average number of support sources available in the BY District was 3 (SD = 2) and the average number of support sources available in the KAPS District was 1 (SD = 2). The support available tends to decrease with increasing herd size ($p = 0.001$). There was a significant inverse relationship between the herd size of a farmer and the number of support sources available. The majority of livestock farmers (170/287) received support from veterinary services to deal with adverse events' occurrences. Other key sources of support to the pastoralists are from family and friends (Table 6).

Additionally, the livestock farmers were asked to indicate a single intervention or support that if provided, can help them reduce the experience of losses of their livestock. The majority of the farmers believed that supplying veterinary drugs (119/287) would help them. Another key support requested was the provision of veterinary services (Figure 8).

Table 6: Sources of support available to livestock farmers to deal with adverse events (N=287)

Source of support available	Small herd (<50 cattle)	Large herd (≥50 cattle)	Total frequency (n)
Veterinary services	119	51	170
Family	104	47	151
Friends	76	37	113
Pastoralist association	61	36	97
Insurance	4	4	8
Government compensation	1	1	2

*multiple responses

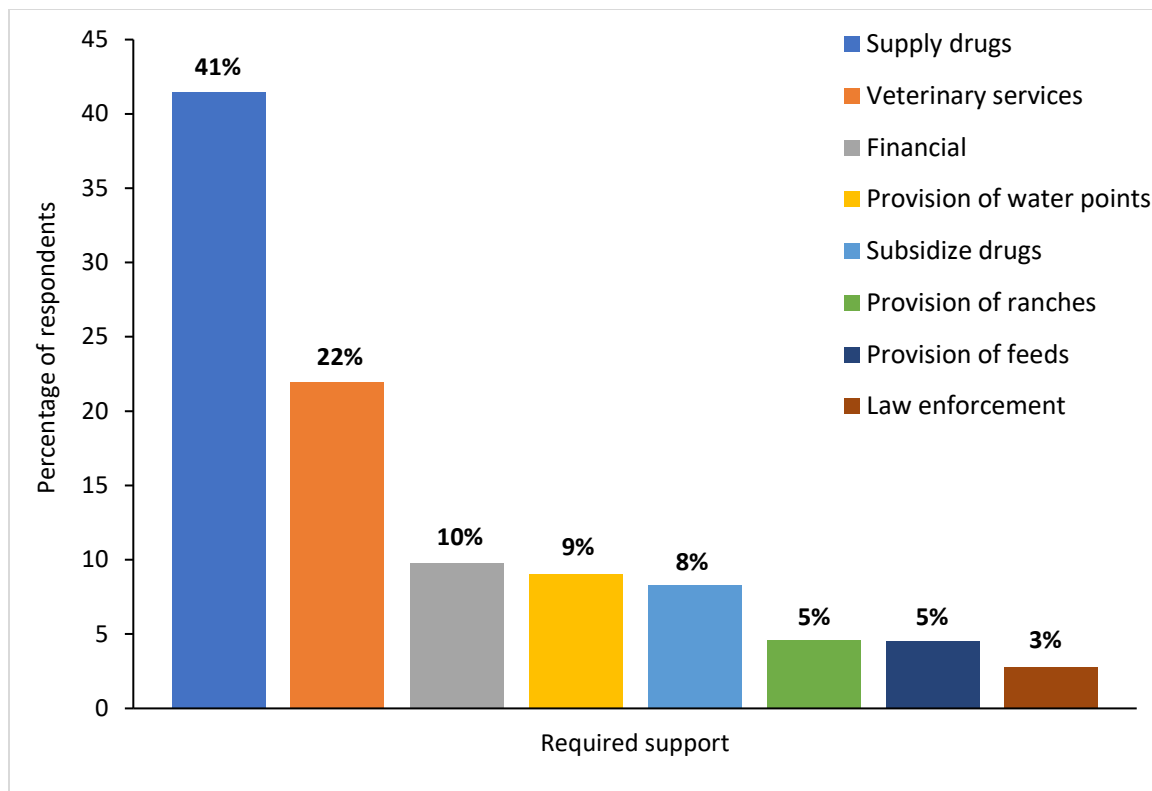


Figure 8: Support services required by livestock farmers to reduce losses

4.15 Proportion of pastoralists with psychosocial problems

Table 7 presents the descriptive summary of the scores of livestock farmers on psychosocial wellbeing and its dimensions. The farmers scored on average 76.1% (SD = 7.2%) on the psychosocial wellbeing measure. The performance of livestock farmers on the four (4) dimension scales was mainly poor except for the resilience scale, where farmers scored highly. The mean mental health score was 45.7 (SD = 5.7). The livestock farmers performed better on the anxiety sub-scale of the mental health assessment. The resilience of the livestock farmers was high with a mean resilience score of 71 ± 8 . The livestock farmers performed highly on the self-reliance sub-scale. The average quality of life score of respondents was 14 ± 2 , with scores generally similar across all quality of life domains (sub-scales). The livestock farmers scored an average of 57 ± 13 on the food security measure.

Table 7: Summary of psychosocial wellbeing and wellbeing dimension scores

Variable	Number of items	Mean	Standard deviation
Mental health	21	45.7	5.7
Stress	7	42.8	7.4
Anxiety	7	47.6	6.4
Depression	7	46.9	6.6
Resilience	14	71.1	8.1
Self-reliance	5	25.6	3.3
Purpose	3	15.1	1.9
Equanimity	2	9.6	1.6
Perseverance	2	10.6	1.5
Authenticity	2	10.2	1.6
Quality of life	24	14.4	1.6
Physical	7	14.7	2.2
Psychological	6	14.8	1.8
Social	3	14.8	2.4
Environment	8	13.3	1.9
Food security	8	57.2	12.7
Psychosocial wellbeing	4	76.1	7.2

Figure 9 presents a comparison of the psychosocial wellbeing dimension scores in the two study districts. The livestock farmers had significantly different quality of life and food security dimension scores ($p < 0.001$). The livestock farmers in the KAPS District had significantly higher quality of life and food security compared to those in the BY District. Even though the average mental health and resilience levels were not statistically different in the study districts, the livestock farmers in the KAPS District similarly performed better on both mental health and resilience dimensions than the livestock farmers in the BY District, having relatively higher resilience and mental health scores.

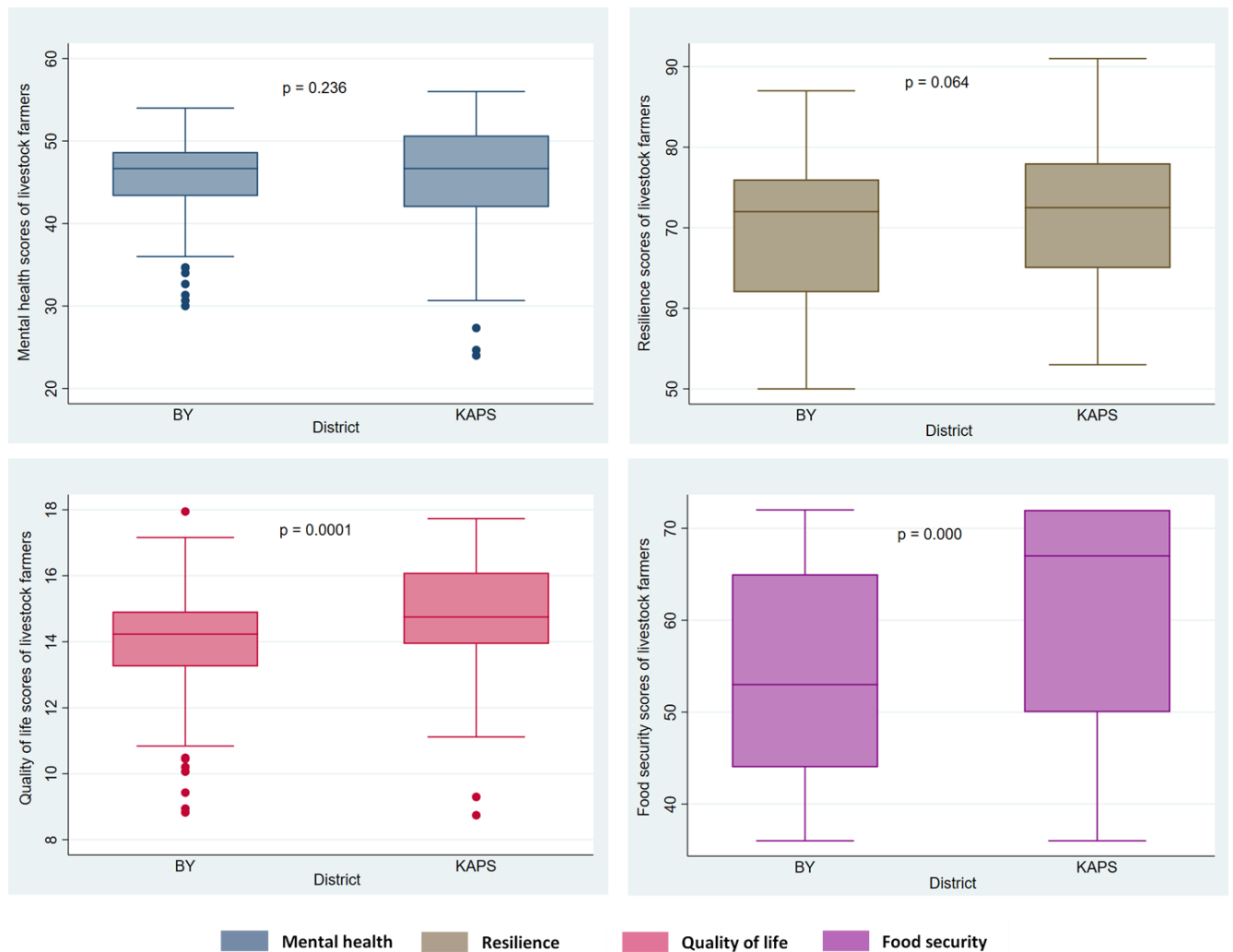


Figure 9: Psychosocial wellbeing dimensions of livestock farmers by study site

In Figure 10, it can be seen that the psychosocial wellbeing was poor in 53% (151/287) of the livestock farmers. Aside from performing well on the resilience measure, where close to 70% (198/287) of the livestock farmers were highly resilient, the livestock farmers performed poorly on all other wellbeing dimensions. While about 60% (171/287) of the livestock farmers, had poor mental health, 55% (154/287) also reported the poor quality of life. Additionally, only 20% (55/287) of the livestock farmers were food secure. The remaining 80% of the farmer had food insecurity; 40% each were either moderately food insecure or severely food insecure.

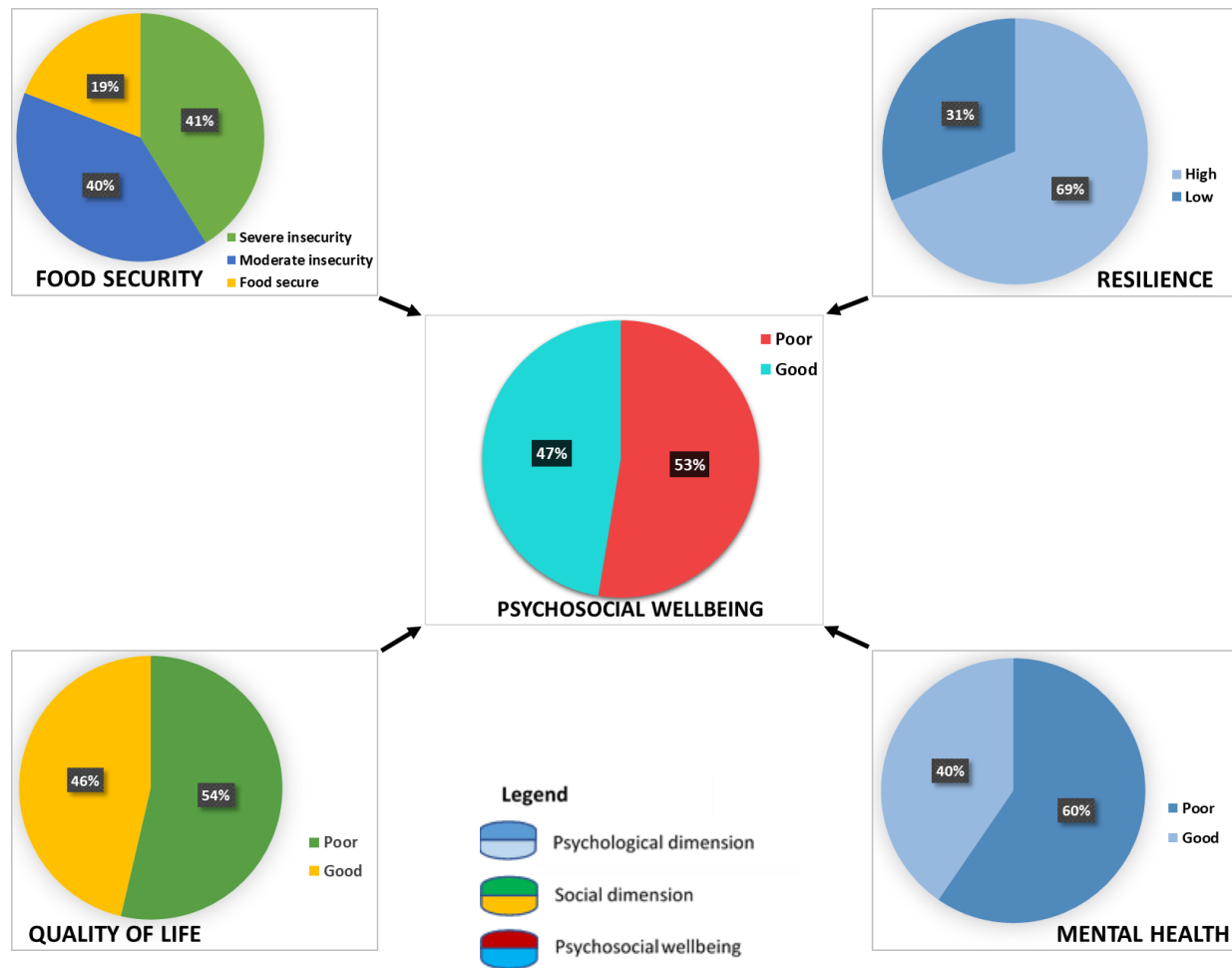


Figure 10: Psychosocial wellbeing and wellbeing dimensions of livestock farmers

4.16 Bivariate and multivariate analysis of independent and dependent variables

The bivariate analysis shows that the mental health of livestock farmers is influenced significantly by the age of the livestock farmer, farmers' emotional attachment to their livestock, farmers' illness status, number of stressful events experienced and proportion of livestock lost (Table 8).

Table 9 shows that the farmers had poorer mental health with increasing age: farmers who are 50 years or older had 2 times the odds of having poor mental health compared to those less than 50 years old [cOR = 2.08 (95% CI = 1.27 – 3.42), $p = 0.003$].

Table 8: Factors influencing the mental health of livestock farmers

Variables	Category	Poor (n=171)	Good (n=116)	Percent (%)	Statistical significance	
					Chi-square	P-value
Age of farmer	Less than 50 years	90	81	59.6	8.487	0.004
	50 years and above	81	35	40.4		
Sex	Female	15	4	6.6	3.169	0.092 [¥]
	Male	156	112	93.4		
Highest level of education	No formal education	56	40	33.4	1.782	0.642 [¥]
	Basic	81	51	46.0		
	Secondary	24	21	15.7		
	Tertiary	10	4	4.9		
District	Afram plains	80	62	49.5	1.228	0.268
	Bunkpurugu	91	54	50.5		
Marital status	Not married	12	10	7.7	0.251	0.616
	Married	159	106	92.3		
Number in household	10 or fewer persons	93	73	57.8	2.070	0.150
	More than 10 persons	78	43	42.2		
Number of cattle in herd	50 or fewer cattle	117	88	71.4	1.875	0.171
	More than 50 cattle	54	28	28.6		
Cultivation of crops	No	15	11	9.1	0.042	0.837
	Yes	156	105	90.9		
Raised with farm animals	No	45	42	30.3	3.201	0.074
	Yes	126	74	69.7		
Support availability	No support (≤ 2 sources)	109	70	62.4	0.340	0.560
	Support (> 2 sources)	62	46	37.6		
Level of attachment	Not attached	24	38	21.6	14.307	<0.001
	Attached	147	78	78.4		
Self-reported illness status	Not ill	103	94	68.6	13.892	<0.001
	Ill	68	22	31.4		
Level of livestock loss	No loss (0%)	16	31	16.4	19.556	<0.001
	Low loss ($< 10\%$)	49	32	28.2		
	Moderate loss (10-25%)	68	42	38.3		
	Severe loss ($> 25\%$)	38	11	17.1		

Numbers (n) and percentage (%) of farmers falling into each category of ‘poor’ and ‘good’ mental health and their Chi-square and p-value. [¥] denotes Fisher’s exact test probabilities for observations less than 5 persons in each mental health category.

From Table 9, the livestock farmers that were emotionally attached to their cattle were 3 times more likely to have poor mental health compared to those who are not emotionally attached with their cattle [cOR = 2.98 (95% CI = 1.67 – 5.33), $p < 0.001$]. The proportion of livestock lost was also highly significant in predicting mental health levels of the farmers. The mental health of the farmers worsened with increasing levels of loss. Farmers who lost less than 10% of their herds (low loss) were 3 times more likely to have poor mental health compared to those with no losses in the year [cOR = 2.97 (95% CI = 1.40 – 6.28), $p = 0.004$]. The farmers who lost more than 25% of their cattle in a year had 6.7 times the odds of having poor mental health compared to those with no losses [cOR = 6.69 (95% CI = 2.71 – 16.5), $p < 0.001$]. Similarly, the findings show that experience of each additional adverse event increased the odds of having poor mental health by 30% [cOR = 1.31 (95% CI = 1.13 – 1.52), $p < 0.001$] (Table 9).

After adjusting for the livestock farmers' age and childhood history with livestock rearing, a farmers' sex, health status, level of attachment to cattle, the number of adverse events experienced and proportion of livestock lost, significantly predicted the mental health of the farmers ($p < 0.001$). The adjusted odds ratio for having poor mental health associated with one increase in the number of adverse events experienced is 1.31 (95% CI, 1.10 to 1.57) (Table 9). Also, losing more than 25% of livestock heads increased the odds of having poor mental health by four-folds when adjusted for other significant predictors [aOR = 4.02 (95%CI = 1.51 – 10.7), $p = 0.005$]. The adjusted odds ratio for having poor mental health associated when a farmer is emotionally attached to livestock is 1.98 (95% CI = 1.02 – 3.84, $p = 0.044$). Also, after adjusting for other univariate predictors, the odds of having poor mental health is 2 times as great when a livestock farmer reported an ill-health condition as if they did not report ill health [aOR = 2.13 (95% CI = 1.15 – 3.95), $p = 0.016$] (Table 9).

Table 9: Predictors of the mental health of livestock farmers in Ghana

Variables	Unadjusted model		Adjusted model	
	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Number of adverse events	1.31 (1.13, 1.52)	0.0002	1.29 (1.08, 1.54)	0.006
Age of farmer		0.0033		0.066
Less than 50 years	ref		ref	
50 years and above	2.08 (1.27, 3.42)		1.70 (0.97, 3.01)	
Sex		0.0639		0.044
Female	ref		ref	
Male	0.37 (0.12, 1.15)		0.26 (0.07, 0.96)	
Raised with farm animals		0.0748		0.723
No	ref		ref	
Yes	1.59 (0.96, 2.64)		1.11 (0.62, 1.97)	
Level of attachment		0.0002		0.044
Not attached	ref		ref	
Attached	2.98 (1.67, 5.33)		1.98 (1.02, 3.84)	
Self-reported illness status		0.0001		0.016
Not ill	ref		ref	
Ill	2.82 (1.62, 4.92)		2.13 (1.15, 3.95)	
Level of livestock loss		0.0002		0.024
No loss (0%)	ref		ref	
Low loss (<10%)	2.97 (1.40, 6.28)	0.0040	2.25 (0.99, 5.10)	0.052
Moderate loss (10-25%)	3.14 (1.53, 6.42)	0.0020	1.79 (0.81, 3.97)	0.150
Severe loss (>25%)	6.69 (2.71, 16.5)	0.0000	4.02 (1.51, 10.7)	0.005

Variables included as predictors of the mental health of livestock farmers in Ghana. Crude odds ratio (cOR) with 95% CI and the associated p-value for unadjusted model and adjusted odds ratio (aOR) with 95% CI and the associated p-value for the adjusted model. ref denotes the reference category.

Table 10 shows, the livestock farmers' resilience levels were influenced positively by the farmer's age, herd size, childhood history of livestock rearing, emotional attachment to livestock and the proportion of livestock lost to adverse events. The level of education, farming in the Bunkpurugu-Yunyoo (BY) District and support availability to farmers negatively predicted the resilience levels.

Table 10: Factors influencing the resilience levels of livestock farmers

Variables	Category	Low (n=89)	High (n=198)	Percent (%)	Statistical significance	
					Chi-square	P-value
Age of farmer	Less than 50 years	70	101	59.6	19.481	<0.001
	50 years and above	19	97	40.4		
Sex	Female	4	15	6.6	0.943	0.445 [¥]
	Male	85	183	93.4		
Highest level of education	No formal education	30	66	33.4	13.476	0.004 [¥]
	Basic	35	97	46.0		
	Secondary	23	22	15.7		
	Tertiary	1	13	4.9		
District	Afram plains	36	106	49.5	4.206	0.040
	Bunkpurugu	53	92	50.5		
Marital status	Not married	7	15	7.7	0.007	0.932
	Married	52	183	92.3		
Number in household	10 or fewer persons	59	107	57.8	3.780	0.052
	More than 10 persons	30	91	42.2		
Number of cattle in herd	50 or fewer cattle	75	130	71.4	10.423	0.001
	More than 50 cattle	14	68	28.6		
Cultivation of crops	No	5	21	9.1	1.854	0.173
	Yes	84	177	90.9		
Raised with farm animals	No	40	47	30.3	13.071	<0.001
	Yes	49	151	69.7		
Support availability	No support (≤ 2 sources)	26	153	62.4	60.425	<0.001
	Support (> 2 sources)	63	45	37.6		
Level of attachment	Not attached	32	30	21.6	15.691	<0.001
	Attached	57	168	78.4		
Self-reported illness status	Not ill	64	133	68.6	0.641	0.424
	Ill	25	65	31.4		
Level of livestock loss	No loss (0%)	31	16	16.4	43.469	<0.001
	Low loss ($< 10\%$)	31	50	28.2		
	Moderate loss (10-25%)	19	91	38.3		
	Severe loss ($> 25\%$)	8	41	17.1		

Numbers (n) and percentage (%) of farmers falling into each category of 'low' and 'high' resilience and their Chi-square and p-value. [¥] denotes Fisher's exact test probabilities for observations less than 5 persons in each resilience category.

Table 11 shows that farmers in the BY District had 70% increased odds of low resilience compared to those in KAPS District [cOR = 1.70 (95% CI = 1.02 – 2.82), $p= 0.040$]. The odds of having low resilience is 8.2 times as great if the livestock farmers had support as if they did not [cOR = 8.24 (95% CI = 4.68 – 14.5), $p<0.001$]. Secondary school leavers were 2 times more likely to be less resilient compared to those with no formal education [cOR = 2.30 (95% CI = 1.11 – 4.76), $p=0.03$].

However, livestock farmers aged 50 years and older had a 72% reduction in the odds of being less resilient compared to those less than 50 years [cOR = 0.28 (95% CI = 0.16 – 0.50), $p<0.001$]. Having more than 50 cattle heads was also associated with a 64% reduction in odds [cOR = 0.36 (95% CI = 0.19 – 0.68), $p<0.001$]. As the proportion of livestock lost increased, the odds of having low resilience decreased. Compared to farmers who lost no cattle, those with less than 10% loss had 68% reduced odds of being less resilient [cOR = 0.32 (95% CI = 0.15 – 0.68), $p= 0.003$], losing between 10 – 25% of cattle further reduces the odds of by 21% [cOR = 0.11 (95% CI = 0.05 – 0.24), $p<0.001$]. The farmers who lost more than 25% of their cattle in a year were highly resilient and 90% less likely to have lower resilience scores [cOR = 0.10 (95% CI= 0.04 – 0.27), $p<0.001$].

After adjusting for the predictors, the farmers' resilience level was significantly influenced by the level of attachment to cattle, childhood history with livestock, support availability and the proportion of cattle head lost in a year ($p<0.001$) (Table 11). For the proportion of livestock lost, adjusted odds ratios associated with low resilience decreased with an increasing proportion of cattle lost. Farmers who lost between 10 and 25% of cattle head were 79% less likely to have low resilience [aOR = 0.21, 95% CI = 0.08 – 0.52] while those with severe loss were 83% less likely, compared to those with no loss [aOR = 0.17, 95% CI = 0.06 – 0.52]. However, the odds of being less resilient when support is available to livestock farmers is 7 times more likely, when other predictors are adjusted for (aOR = 7.17, 95% CI = 3.78 – 22.21, $p<0.001$).

Table 11: Predictors of the resilience of livestock farmers in Ghana

Variables	Unadjusted model		Adjusted model	
	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Age of farmer		0.0000		0.058
Less than 50 years	ref		ref	
50 years and above	0.28 (0.16, 0.50)		0.49 (0.24, 1.02)	
Highest level of education		0.0030		0.237
No formal education	ref		ref	
Basic	0.79 (0.44, 1.41)	0.4350	0.70 (0.32, 1.43)	0.329
Secondary	2.30 (1.11, 4.76)	0.0250	1.08 (0.41, 2.83)	0.872
Tertiary	0.17 (0.02, 1.35)	0.0940	0.06 (0.00, 0.82)	0.035
District		0.0398		0.121
Afram plains	ref		ref	
Bunkpurugu	1.70 (1.02, 2.82)		0.53 (0.24, 1.18)	
Number in household		0.0502		0.961
10 or fewer persons	ref		ref	
More than 10 persons	0.60 (0.36, 1.01)		0.98 (0.50, 1.94)	
Number of cattle in the herd		0.0008		0.169
50 or fewer cattle	ref		ref	
More than 50 cattle	0.36 (0.19, 0.68)		0.57 (0.26, 1.27)	
Raised with farm animals		0.0004		0.012
No	ref		ref	
Yes	0.38 (0.22, 0.65)		0.43 (0.22, 0.83)	
Support availability		0.0000		0.000
No support (≤ 2 sources)	ref		ref	
Support (> 2 sources)	8.24 (4.68, 14.5)		7.17 (3.24, 15.85)	
Level of attachment		0.0001		0.013
Not attached	ref		ref	
Attached	0.32 (0.18, 0.57)		0.39 (0.19, 0.82)	
Level of livestock loss		0.0000		0.000
No loss (0%)	ref		ref	
Low loss ($<10\%$)	0.32 (0.15, 0.68)	0.0030	0.48 (0.19, 1.23)	0.126
Moderate loss (10-25%)	0.11 (0.05, 0.24)	0.0000	0.21 (0.08, 0.52)	0.001
Severe loss ($>25\%$)	0.10 (0.04, 0.27)	0.0000	0.17 (0.06, 0.52)	0.002

Variables included as predictors of the resilience of livestock farmers in Ghana. Crude odds ratio (cOR) with 95% CI and the associated p-value for unadjusted model and adjusted odds ratio (aOR) with 95% CI and the associated p-value for the adjusted model. ref denotes the reference category.

As shown in Table 12, the quality of life of the livestock farmers in this study is only influenced significantly by support available to them and the district the livestock is raised. The proportion of cattle lost however did not significantly influence the quality of life level of the livestock farmers ($p= 0.17$).

Table 13 illustrates that the farmers raising livestock in the BY District are 2 times more likely to have poor quality of life compared to farming in the KAPS District [cOR = 1.99 (95% CI= 1.25 – 3.19), $p= 0.004$]. Surprisingly however, farmers who have some support available to them to deal with adverse events, have a 70% increased odds of reporting poor quality of life when compared with the farmers with no support available [cOR= 1.73 (95% CI= 1.06 – 2.81), $p= 0.027$].

After adjusting for the support availability to a livestock farmer and the proportion of livestock lost to adverse events, the farming District (BY or KAPS), is a significant predictor of poor quality of life. The adjusted odds ratio of having a poor quality of life associated with rearing livestock in the BY District is 1.61 (95% CI, 1.05 to 2.94, $p= 0.033$).

However, after controlling for the District a farmer rears cattle and the level of loss in relation to herd size, the support available to livestock farmers to deal with adversity, was no longer significant in predicting the quality of life of the livestock farmers ($p= 0.205$). These tests of associations are shown in Table 13.

Table 12: Factors influencing the quality of life of livestock farmers

Variables	Category	Poor (n=154)	Good (n=133)	Percent (%)	Statistical significance	
					Chi-square	P-value
Age of farmer	Less than 50 years	96	75	59.6	1.048	0.306
	50 years and above	58	58	40.4		
Sex	Female	10	9	6.6	0.009	0.926
	Male	144	124	93.4		
Highest level of education	No formal education	53	43	33.4	1.240	0.743
	Basic	67	65	46.0		
	Secondary	25	20	15.7		
	Tertiary	9	5	4.9		
District	Afram plains	64	78	49.5	8.337	0.004
	Bunkpurugu	90	55	50.5		
Marital status	Not married	11	11	7.7	0.128	0.720
	Married	143	122	92.3		
Number in household	10 or fewer persons	88	78	57.8	0.066	0.797
	More than 10 persons	66	55	42.2		
Number of cattle in herd	50 or fewer cattle	108	97	71.4	0.275	0.600
	More than 50 cattle	46	36	28.6		
Cultivation of crops	No	11	15	9.1	1.481	0.224
	Yes	143	118	90.9		
Raised with farm animals	No	50	37	30.3	0.730	0.393
	Yes	104	96	69.7		
Support availability	No support (≤ 2 sources)	87	92	62.4	4.889	0.027
	Support (> 2 sources)	67	41	37.6		
Level of attachment	Not attached	30	32	21.6	0.884	0.347
	Attached	124	101	78.4		
Self-reported illness status	Not ill	107	90	68.6	0.109	0.742
	Ill	47	43	31.4		
Level of livestock loss	No loss (0%)	24	23	16.4	5.042	0.169
	Low loss ($< 10\%$)	49	32	28.2		
	Moderate loss (10-25%)	61	49	38.3		
	Severe loss ($> 25\%$)	20	29	17.1		

Numbers (n) and percentage (%) of farmers falling into each category of ‘poor’ and ‘good’ quality of life and their Chi-square and p-value.

Table 13: Predictors of the quality of life of livestock farmers in Ghana

Variables	Unadjusted model		Adjusted model	
	cOR (95% CI)	P-value	aOR (95% CI)	P-value
District		0.0038		0.033
Afram plains	ref		ref	
Bunkpurugu	1.99 (1.25, 3.19)		1.61 (1.05, 2.94)	
Support availability		0.0265		0.205
No support (≤ 2 sources)	ref		ref	
Support (> 2 sources)	1.73 (1.06, 2.81)		1.43 (0.82, 2.50)	
Level of livestock loss		0.1680		0.800
No loss (0%)	ref		ref	
Low loss ($<10\%$)	1.47 (0.71, 3.03)	0.300	1.45 (0.69, 3.06)	0.328
Moderate loss (10-25%)	1.19 (0.60, 2.37)	0.613	1.43 (0.69, 2.94)	0.335
Severe loss ($>25\%$)	0.66 (0.29, 1.48)	0.315	0.88 (0.38, 2.04)	0.761

Variables included as predictors of the quality of life of livestock farmers in Ghana. Crude odds ratio (cOR) with 95% CI and the associated p-value for unadjusted model and adjusted odds ratio (aOR) with 95% CI and the associated p-value for the adjusted model. ref denotes the reference category.

As shown in Table 14, the level of food (in)security of farmers is significantly predicted by their age, farming district, marital status, cattle herd size, support availability, the health status of the farmer and the number of stressful events the farmer experienced overtime. For a livestock farmer who is aged 50 years and above, the odds of being food insecure when compared with those who are food secure is reduced by 59% [cOR = 0.41 (95% CI= 0.22 – 0.74), $p= 0.003$]. However, the odds of being food insecure is 7.2 times as great if farmers raise livestock in BY District as if they raised livestock in KAPS District [cOR = 7.24 (95% CI= 3.38 – 15.5), $p<0.001$]. Additionally, the livestock farmers who had support were 10 times more likely to be food insecure than if they did not have support [cOR = 10.4 (95% CI= 3.62 – 29.6)] (Table 15).

Table 15 shows that after adjusting for a farmers' age, ill-health status and cattle herd size, the number of adverse events experienced, farming in the BY District, being married and availability of support to farmers negatively affected the farmers' food security ($p<0.001$).

Table 14: Factors influencing the food security level of livestock farmers

Variables	Category	Food insecure (n=232)	Food secure (n=55)	Percent (%)	Statistical significance	
					Chi-square	P-value
Age of farmer	Less than 50 years	148	23	59.6	8.915	0.003
	50 years and above	84	32	40.4		
Sex	Female	13	6	6.6	2.025	0.155
	Male	219	49	93.4		
Highest level of education	No formal education	78	18	33.4	1.402	0.705 [¥]
	Basic	104	28	46.0		
	Secondary	39	6	15.7		
	Tertiary	11	3	4.9		
District	Afram plains	96	46	49.5	31.760	<0.001
	Bunkpurugu	136	9	50.5		
Marital status	Not married	13	9	7.7	7.273	0.007
	Married	219	55	92.3		
Number in household	10 or fewer persons	134	32	57.8	0.003	0.954
	More than 10 persons	98	23	42.2		
Number of cattle in herd	50 or fewer cattle	174	31	71.4	7.566	0.006
	More than 50 cattle	58	24	28.6		
Cultivation of crops	No	19	7	9.1	1.111	0.292
	Yes	213	48	90.9		
Raised with farm animals	No	75	12	30.3	2.325	0.127
	Yes	157	43	69.7		
Support availability	No support (≤ 2 sources)	128	51	62.4	26.717	<0.001
	Support (> 2 sources)	104	4	37.6		
Level of attachment	Not attached	47	15	21.6	1.292	0.256
	Attached	185	40	78.4		
Self-reported illness status	Not ill	165	32	68.6	3.458	0.063
	Ill	67	23	31.4		
Level of livestock loss	No loss (0%)	37	10	16.4	2.315	0.510
	Low loss ($< 10\%$)	70	11	28.2		
	Moderate loss (10-25%)	86	24	38.3		
	Severe loss ($> 25\%$)	39	10	17.1		

Numbers (n) and percentage (%) of farmers falling into each category of 'food insecure' and 'food secure' and their Chi-square and p-value. [¥] denotes Fisher's exact test probabilities for observations less than 5 persons in each food security category.

The adjusted odds ratio for being food insecure associated with an increase by one in the number of adverse events experienced is 1.43 (95% CI, 1.21 to 1.69, $p=0.022$). Also, support availability remained significant in predicting food insecurity ($p=0.017$). The odds of being food insecure are 4 times more likely, when support is available to farmers (aOR = 3.96, 95% CI = 1.27 – 12.31). Livestock farmers in the BY District were 3.6 times more likely to be food insecure compared to those farmers in the KAPS District [aOR = 3.64 (95% CI = 1.51 – 8.78), $p=0.004$] (Table 15).

Table 15: Predictors of the food security of livestock farmers in Ghana

Variables	Unadjusted model		Adjusted model	
	cOR (95% CI)	P-value	aOR (95% CI)	P-value
Number of adverse events	1.43 (1.21, 1.69)	0.0000	1.24 (1.03, 1.49)	0.022
Age of farmer		0.0031		0.269
Less than 50 years	ref		ref	
50 years and above	0.41 (0.22, 0.74)		0.67 (0.33, 1.36)	
District		0.0000		0.004
Afram Plains	ref		ref	
Bunkpurugu	7.24 (3.38, 15.5)		3.64 (1.51, 8.78)	
Marital status		0.0137		0.012
Not married	ref		ref	
Married	3.30 (1.33, 8.17)		3.97 (1.36, 11.59)	
Number of cattle in the herd		0.0076		0.143
50 or fewer cattle	ref		ref	
More than 50 cattle	0.43 (0.23, 0.79)		0.60 (0.30, 1.19)	
Support availability		0.0000		0.017
No support (≤ 2 sources)	ref		ref	
Support (> 2 sources)	10.4 (3.62, 29.6)		3.96 (1.27, 12.31)	
Self-reported illness status		0.0148		0.357
Not ill	ref		ref	
Ill	0.56 (0.31, 1.04)	0.0679	0.72 (0.35, 1.46)	

Variables included as predictors of the food security level of livestock farmers in Ghana. Crude odds ratio (cOR) with 95% CI and the associated p-value for unadjusted model and adjusted odds ratio (aOR) with 95% CI and the associated p-value for the adjusted model. ref denotes the reference category.

Table 16 illustrates five simple linear regressions performed to assess the influence of the major sources of livestock losses and the total proportion of herd size lost to all causes on wellbeing. The loss of livestock to pasture shortages and diseases were surprisingly significantly associated with a 1.66 and 0.22 increase in wellbeing scores with each additional cattle lost.

Table 16: Simple regression analyses of loss sources predicting farmers' psychosocial wellbeing

Source of loss	Slope	Wellbeing	
		95% (CI)	p-values
Animal disease	0.22	(0.06 – 0.38)	0.006
Theft	-0.02	(-0.33 – 0.29)	0.888
Pasture shortage	1.66	(1.01 – 2.31)	<0.001
Conflict	-0.11	(-0.44 – 0.22)	0.516
Total proportion of cattle lost	-0.01	(-0.07 – 0.05)	0.791

“Slope” denotes coefficients that are unstandardized regression slopes with 95% confidence intervals (95% CI) in parentheses. “Source of loss”= included major sources of loss to livestock farmers in Ghana.

A four-step backward elimination regression analysis using likelihood ratio tests to determine the most efficient model of livestock loss factors that predict the wellbeing of the farmers was done. The modelling was started with the most plausibly complex model in step 1 (Model 1) and then one variable each is removed in subsequent steps using likelihood ratio tests until the final model (Model 4) was obtained. The psychosocial wellbeing of livestock farmers was negatively affected by the proportion of cattle loss to adverse events and positively by loss of livestock to pasture shortages and animal diseases [$F(3, 283) = 12.45, p < 0.001, R^2 = 0.12$]. After controlling for losses to conflict and theft, each percentage increase in the proportion of herd lost predicts a 0.08 reduction in wellbeing scores ($p = 0.020$). Losing livestock to pasture shortages and animal diseases were significantly associated with 1.62 units ($p < 0.001$) and 0.29 units ($p = 0.001$) improvements in the psychosocial wellbeing of livestock farmers respectively. Even though the loss to theft and conflicts reduced psychosocial wellbeing scores, these associations were not significant.

Table 17: Backward elimination regression analysis for loss sources predicting farmers' psychosocial wellbeing

Source of loss	Model 1		Model 2		Model 3		Model 4	
	<i>B</i>	95%CI	<i>B</i>	95% CI	<i>B</i>	95% CI	<i>B</i>	95%CI
Pasture shortage	1.63	(0.97, 2.28)***	1.62	(0.97, 2.28) ***	1.60	(0.96, 2.24)***	1.62	(0.98, 2.26)***
Animal diseases	0.26	(-0.04, 0.56) *	0.25	(-0.05, 0.56) *	0.30	(0.13, 0.48)***	0.29	(0.11, 0.46)**
Proportion of herd lost	-0.08	(-0.17, 0.00) *	-0.08	(-0.17, -0.01)*	-0.08	(-0.14, -0.01)*	-0.08	(-0.15, -0.01)*
Conflict	-0.17	(-0.51, 0.16)	-0.18	(-0.51, 0.15)	-0.17	(-0.50, 0.16)		
Proportion X disease	0.01	(-0.01, 0.01)	0.01	(-0.01, 0.01)				
Theft	-0.02	(-0.34, 0.31)						
<i>N</i>		287		287		287		287
<i>R</i> ²		0.12		0.12		0.12		0.12
<i>F</i>		6.38***		7.68***		7.68***		12.45***

“*B*” denotes coefficients that are unstandardized regression slopes with confidence intervals (95% CI) in parentheses. *, **, ***, denote 10%, 5%, 1% and 0.1% significance level respectively. “*N*” denotes the total sample. “*F*” denotes the F statistic from multiple linear regression analysis. “*R*²” denotes the coefficient of determination for each of the multivariate linear regression models. Sources of loss are continuous variables included as predictors of the psychosocial wellbeing of livestock farmers in Ghana. The variable “Proportion X disease “ is an interaction term between loss of livestock to diseases and total proportion of herd lost.

In Table 18, the factors that predicted the psychosocial wellbeing of livestock farmers were assessed. Six (6) stepwise regression models using the backward elimination approach starting with the most plausibly complex model comprising 13 independent variables was performed. Likelihood ratio tests were used to eliminate variables to obtain the most efficient predictor model with eight independent variables.

The findings showed that livestock farmers' psychosocial wellbeing was negatively influenced by the proportion of cattle head lost, a number of adverse events experienced, report of ill health, rearing livestock in the BY District and number of support sources available. Whereas a farmers' age, experience with raising livestock and increased education level, positively predicted wellbeing [$F(10, 276) = 13.42, p < 0.001, R^2 = 0.33$] (Table 18).

After adjusting for the livestock farming District of the livestock farmers, their psychosocial wellbeing decreases by 0.06 units with each percentage increase in the proportion of cattle head lost ($p = 0.031$), when other predictor variables are held constant. Similarly, the number of adverse events experienced was associated with a 0.6 units reduction in a farmers' psychosocial wellbeing ($p = 0.017$). The farmers who reported ill health at the time of the study had wellbeing scores reduced by about 4 units ($p < 0.001$). Finally, with every increase in the number of support sources available to a farmer, their wellbeing decreases by 1.6 units, after adjusting for other predictor variables ($p < 0.001$). Even though farming the BY District was associated with a reduction in farmers' psychosocial wellbeing, this association was not significant ($p = 0.097$).

Conversely, having a childhood experience in livestock rearing improves wellbeing by 2 units when the other predictor variables are adjusted for ($p = 0.021$). In addition, as the livestock farmers attain at least a basic education, their psychosocial wellbeing improves by 2 units ($p = 0.015$).

Table 18: Backward elimination regression analysis for factors predicting farmers' psychosocial wellbeing

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variable	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)	Coef. (95% CI)
Number of support sources	-1.59 (-2.1,-1.1)	-1.60 (-2.1,-1.1)	-1.61 (-2.1,-1.1)	-1.61 (-2.1,-1.1)	-1.63 (-2.1,-1.1)	-1.62 (-2.1,-1.1)
Ill health status (Ill)	-4.02 (-5.6,-2.4)	-3.98 (-5.6,-2.4)	-3.92 (-5.5,-2.3)	-3.99 (-5.6,-2.4)	-3.96 (-5.6,-2.3)	-3.80 (-5.4,-2.2)
Proportion of herd lost	-0.06 (-0.1,-0.0)	-0.06 (-0.1,-0.0)	-0.06 (-0.1,-0.0)	-0.06 (-0.1,-0.0)	-0.06 (-0.1,-0.0)	-0.06 (-0.1,-0.0)
Number of adverse events	-0.55 (-1.1,-0.1)	-0.55 (-1.0,-0.1)	-0.53 (-1.0,-0.1)	-0.61 (-1.1,-0.1)	-0.63 (-1.1,-0.2)	-0.58 (-1.1,-0.1)
District (Bunkpurugu)	-1.26 (-3.1,0.6)	-1.38 (-3.1,0.4)	-1.41 (-3.2,0.4)	-1.36 (-3.1,0.4)	-1.40 (-3.2,0.4)	-1.50 (-3.3,0.3)
Experience with livestock	1.76 (0.2,3.3)	1.76 (0.2,3.3)	1.76 (0.2,3.3)	1.75 (0.2,3.3)	1.83 (0.3,3.4)	1.85 (0.3,3.4)
Age	0.07 (0.0,0.1)	0.07 (0.0,0.1)	0.07 (-0.0,0.1)	0.07 (-0.0,0.1)	0.07 (-0.0,0.1)	0.08 (0.1,0.2)
Level of education (basic)	2.11 (0.5,3.8)	2.11 (0.5,3.7)	2.04 (0.4,3.6)	2.02 (0.4,3.6)	2.03 (0.4,3.6)	2.01 (0.4,3.6)
Household size	0.15 (-0.0,0.3)	0.15 (-0.1,0.3)	0.14 (-0.1,0.3)	0.13 (-0.1,0.3)	0.12 (-0.1,0.3)	
Gender (male)	-1.69 (-4.6,1.2)	-1.72 (-4.6,1.2)	-1.86 (-4.8,1.0)	-1.71 (-4.6,1.2)		
Attachment to cattle	-1.03 (-2.8,0.8)	-1.07 (-2.9,0.7)	-1.11 (-2.9,0.7)			
Marital status (married)	-1.10 (-3.9,1.7)	-1.06 (-3.8,1.7)				
Grows crops (yes)	-0.71 (-3.3,1.9)					
<i>N</i>	287	287	287	287	287	287
<i>Constant</i>	82.87	82.30	81.61	81.34	80.01	80.22
<i>R</i> ²	0.34	0.34	0.34	0.34	0.33	0.33
<i>F</i>	9.37	10.05***	10.80***	11.55***	12.47***	13.42***

“*Coef*” denotes coefficients that are unstandardized regression slopes with confidence intervals (95% CI) in parentheses. ***, denote 0.1% significance level. “*N*” denotes the total sample. “*Constant*” denote the intercept of the model. “*F*” denotes the F statistic from multiple linear regression analysis. “*R*²” denotes the coefficient of determination for each of the multivariate linear regression models. “Variable”=Variables included as predictors of the psychosocial wellbeing of livestock farmers in Ghana. Categorical variables and their levels, added in the regression are self-reported ill health status (0 = Not ill/1 = Ill), District (0 = Kwahu Afram Plains South/1 = Bunkpurugu-Yunyoo), Level of education (0= none/1 = Basic/2 = Secondary/3 = Tertiary), Marital status (0=Not married/1 = Married), Gender (0 = Female/1 = Male), Attachment to cattle (0 = Not attached/1 = Attached), experience raising livestock (0 = No/1 = Yes), Grows of crops (0 = No/ 1 = Yes). All ‘0’ denote reference category.

4.2 QUALITATIVE RESULTS

In this section, the qualitative findings that provide depth in meaning to the quantitative results obtained are presented. The interview transcripts used for this analysis were coded deductively based on the study objectives and quantitative results. See Appendix 8 for details of the main themes generated and a word cloud map showing the major issues of concern to the participants.

4.21 Study participants

Almost all the leaders of livestock farmers in both study districts were male. The mean age of the leaders in livestock farming communities is 53.6 (SD = 3.9) years. A typical community leader had about 200 cattle and is involved in livestock farming for 25 years. There was only one doctor of veterinary medicine available to participate in the study. The veterinary field officers each have operation areas generally equivalent to half the size of each district. Averagely, the veterinary personnel has been involved in providing veterinary services to farmers for 13 years. Table 19 provides a summary of participants in the in-depth interviews of the study.

Table 19: Summary of in-depth interview participants (N = 24)

Participants/groups	In-depth interview participants		
	Male	Female	District
Livestock farming community head	10	-	Bunkpurugu-Yunyoo
Livestock farming community head	8	1	Kwahu Afram Plains South
Veterinary field officers	2	-	Bunkpurugu-Yunyoo
Veterinary field officers	2	-	Kwahu Afram Plains South
Veterinary Doctors	1	-	Kwahu Afram Plains South
Total	23	1	

4.22 Emotional attachment between cattle farmers and livestock

Cattle farming according to the farmers, require careful planning. The farming practices are similar in both the Bunkpurugu-Yunyoo (BY) and Kwahu Afram Plains South Districts (KAPS). Cattle are kept mostly in remote areas away from human residence to minimize confrontations. Most of the livestock farmers employ herdsmen to feed the cattle. The feeding practices mainly involve free-range mobility to find pasture and water. The livestock farmers see to the basic needs of the herdsmen and their families:

“For cattle rearing, you need to make sure, certain things are put in place before you start. First, you need to get a place away from the human settlement where you keep the cattle. It should be a place where the cattle can get food and water. There are different breeds of cattle that you choose. If your interest is to make a profit from farming, you buy the breeds that are less affected by diseases and the dry season” (Female livestock farmer, 48 years, KAPS).

“...I monitor and supervise them to make sure that their sleeping place is good and that the young ones (calves) are given better attention. Also, I will check for diseases to see if they are sick. If they are far away, then I visit them monthly. If they are close, it’s almost every week I go to the kraal... the Fulani man who is with them reports to me through the phone about some of the challenges that he has with them” (Male livestock farmer, 72 years, BY).

Livestock rearing means different things to different farmers. Some farmers raise animals as their main livelihood source. Others also keep cattle to maintain their status and relevance in society:

“Cattle rearing is lucrative work. I will say on my part that cattle rearing helped me to provide for my children when they were in school. The same work enabled me to cater for my household. And based on what I have seen so far, I hope to acquire some valuable property through it” (Male livestock farmer, 39 years KAPS).

“...we need to respect the cattle because they are our food. Because if you do not sell it, you cannot eat. I don’t have any other work I do except for this. It is through them we get our clothing, pay for healthcare and food” (Male, livestock farmer, 38 years, BY).

“... I think most of them (farmers), think of multiplying the herds as a source of prestige and that is what they boast of most. So instead of selling some to uplift themselves, they will rather prefer seeing the animals increase in number rather than selling to support themselves”
(Doctor of Veterinary Medicine, 51 years, KAPS).

Even though most of the livestock farmers in both study districts depend on their livestock to meet the basic needs of their households, many of them show strong emotional connections with their cattle. The majority of the livestock farmers see the cattle as part of their lives:

“They (cattle) are lovely, caring and are breadwinners. Their milk is a product we can take. Their droppings are a fertilizer for you to use. When you are in need, you can sell it for survival... they mean a lot to a farmer. They are our life. And we are also their life. When they are in pain, we are able to talk to them to be calm. You can see some tearing up when you are trying to pamper them. It is a reciprocal relationship” **(Male livestock farmer, 46 years, BY).**

“I usually go to see them at times when I am sad. I especially interact with the very young ones (calves). Just looking at them gives me joy. I do feed them leaves sometimes and they become happy. They love it when I do that, so always when I visit the kraal, they come closer to me” **(Female livestock farmer, 48 years, KAPS).**

“Most of them (cattle farmers) have a good relationship with their cattle... They attend to them very well. You see them most often going close to the cattle to remove the ticks on the animals and at times even spraying them” **(Veterinary Field Officer, 52 years, KAPS).**

“They (cattle farmers) are very close to the animals. Sometimes they even go and sleep inside the animals’ kraal and sleep there until day breaks. And the animals will sleep around them”
(Veterinary Field Officer, 27 years, BY).

Given this emotional attachment to the cattle, many of the farmers adopt different ways of identifying their animals. The cattle are given names based on colour, lineage, and markings:

“...we give them names too, like humans. Sometimes we use the cattle’s colour or marks they have on their body to identify them. There are some Fulani who are able to identify a calve, that is an offspring from their bull” (Male livestock farmer, 78 years, KAPS).

“We identify them by their families: usually the cattle sleep in groups of different families, so you will know them by that. Some people mark their cattle on the ear. Sometimes, the herdsmen give them names based on the colour of the fur” (Male livestock farmer, 38 years, BY).

“They (livestock farmers) do name the cattle. They do notching or tattooing. Some have Attah, Moses, tattooed on the cattle so that if they get lost or somebody steals them, they can easily identify it” (Veterinary Field Officer, 39 years, KAPS).

4.23 Factors leading to livestock losses and management of losses

As illustrated in Figure 11 (Appendix 8), the main adverse events affecting the livestock farmers are animal diseases, pasture and water shortages, cattle theft and conflicts. These events are similar to farmers in both the BY and KAPS Districts. There is, however, a variation in the severity of these adverse events: farmers in the BY District report more problems associated with dry weather and poor access to water compared to the farmers in the KAPS District. Livestock diseases lead in both districts, as the main source of livestock losses. The main diseases of reported by the farmers are Contagious Bovine Pleuropneumonia (CBPP), and Foot and Mouth Disease (FMD):

“Two years ago, thieves came and took all the cattle in a kraal and sent them away. They did this to two cattle farmers, where all their cattle were stolen and until now, we have not seen any of them. Last year, one illness (CBPP) attacked the animals and killed most of them. It affects their breathing and heart function and you only see the cattle falling to the ground and dying. The commonest disease we usually experience is the foot and mouth rot (FMD) but when you treat it; that is all. However, over the past one year, the CBPP has really led to many cattle losses and worried us a lot” (Male livestock farmer, 47 years, KAPS).

“Our main problems are with cattle dying through a sickness like foot rot (FMD) and one that causes them to suffer from breathing (CBPP). The diseases are common in the wet season. When they get these diseases, eating and movement become a problem and they die through

that. In the dry season, lack of water and grass also make the cattle suffer a lot from thirst and hunger, they become weak and die” (Male livestock farmer, 33 years, BY).

“Naturally, during drought periods, there is grass shortage and the cattle are unable to get food, they sometimes die. Diseases also make some of the cattle to die. Some of the diseases when they happen, no matter what you do, the cattle will die. Some of the cattle experienced abortions...Sometimes when the cattle enter people’s farms, the farmers butcher or even poison them. They add the poison to cattle feed and spray around. So that when the cattle eat it, they die. Some people also set big traps for the cattle, and they die when they fall into such traps” (Female livestock farmer, 48 years, KAPS).

“For that heart disease (CBPP), I do not know. If it just enters your kraal, it takes time before it goes. It is not easy, not one year or two years. If you don’t take care, you will lose a lot. I know a farmer who had about 300 cattle, when this disease affected him. Before he realised, only 100 remained. Sometimes they go out to graze, and before you know it, five of them have died. For that sickness; too much!” (Male livestock farmer, 38 years, BY).

“...CBPP kills them a lot. Foot and mouth disease is not much of a problem because only the young ones die from it. Because they are unable to suck with the sore in the mouth. For the CBPP, it is serious. Then theft cases as well. So that’s another problem; stealing and the disease outbreak” (Veterinary Field officer, 39 years, KAPS).

“...you see especially Bunkpurugu here, the farmers don’t want to vaccinate their animals. Because of that, we are facing many problems like PPR, CBPP, and anthrax...we see CBPP and PPR always. That one is not going at all” (Veterinary Field officer, 27 years, BY).

Given the evidence that the farmers in both the BY and KAPS Districts suffer losses mainly from cattle diseases, these farmers have adopted an approach of trying to recover some of their investment by selling diseased animals for meat on the market:

“We do not eat the cattle if it dies of diseases. So we have to sell at very low prices, sometimes 700 Ghanaian cedis. You lose a lot due to this” (Male livestock farmer, 38 years, BY).

“These diseases that affect our animals, where people are giving all sorts of injections to their cattle on their own, pose a health threat to those in the cities: if the meat is unwholesome and the farmer doesn’t discard it, it will be sent there” (Male livestock farmer, 47 years, KAPS).

“...now a days, it is like the farmers don’t own up, even if the disease is present in the community. They rather kill and sell them” (Veterinary Field Officer, 28 years, BY).

“For most of the farmers, they will sell the dead ones; they will not throw it away. If the animal dies, some of them will smoke it nicely and send it to Akate market as bushmeat. That is what they do...It will affect them because the price they sell the live animals will be more compared to what they get for the dead animal” (Veterinary Field Officer, 39 years, KAPS).

4.24 Psychosocial wellbeing implications of livestock losses

The findings show that the occurrence of these adverse events affects the farmers psychologically, socially, economically and physically. Farmers who have an emotional attachment to their cattle tend to be more affected irrespective of their cattle holdings:

“Angry, sad, everything. Even you lose appetite, you will not want to eat when one of your animals die. You will be very worried and sad. Like one day, I was called that one of my cattle did not return after going out to graze; I could not eat the whole day” (Male livestock farmer, 38 years, KAPS).

“It really affects your heart. It creates a situation where you are unhappy about everything. In addition, you have no other job apart from this work and no money too. So if they just die, you are finished. You enter a difficult situation. That is why if a cattle farmer sees his animal die, he can be both very furious and depressed. Some people even threaten to commit suicide” (Male livestock farmer, 72 years, KAPS).

“When they lose it, you yourself will just see that, Yes, truly they feel losing something very important; they feel it deeply...They feel the pain even more than we the veterinary officers” (Veterinary Field Officer, 28 years, BY).

4.25 Support availability to livestock farmers

The main support sought by farmers to deal with adverse events in both the BY and KAPS Districts is from veterinary services. However, the operation areas of the veterinary officers are evidently vast. Thus, they are unable to reach many of the farmers. In addition, the unavailability of logistics including drugs and vaccines at veterinary posts was a challenge to the delivery of veterinary services. Some of the farmers resort to buying veterinary drugs from unregulated sources:

“Our animals die because of lack of attention from the veterinary officers. Veterinary services are very, very poor. You go to them and they say there is no medicine. So the veterinary services itself is not well responsive to the livestock farmer. I cannot tell you the number of times that they even come to check on our animals. It is virtually nil. In fact, we have resorted to taking veterinary services from Togo. I have two of them. When I call them, they are here. When you call this our people (veterinary officers), they say I’m here or there; I’m in Tamale to look for drugs. And they will never come” (Male livestock farmer, 72 years, BY).

“...during my childhood, I know the veterinary officers always visit the livestock farmers to inject the animals. However, none of those things is happening in Afram plains nowadays. These practices need to be brought back...Because anytime a disease occurs in the district; it affects all of us leading to many cattle losses” (Male livestock farmer, 47 years, KAPS).

“Transportation is tough. Sometimes if you do not have the means to travel to the farm, it becomes difficult. Because we don’t have a clinic here. We, therefore, have to move from farm to farm to attend to these animals. So in a day even if you are using a motorbike, you cannot go to all the places to render service” (Veterinary Field Officer, 28 years, BY).

“The challenge has to do with personnel. The area is so vast and we are seriously understaffed. The zone I am taking care of alone could be a whole district somewhere...It is a challenge we are facing. The farmers live in areas that are so far apart so at times hmmm, it is difficult to get to all of them...We know there are some quarks going round, injecting the animals, but because we are under-staffed, I don’t fight with them” (Veterinary Field Officer, 39 years, KAPS).

The farmers express disquiet about the neglect by the state and veterinary services to provide them with the needed support even though they are always required to pay taxes. They believe there is fewer benefits coming to them compared to the support crop farmers receive from the government:

“...government need to help us, they do not mind us. But, when you catch your cattle to go and sell, they will request for you to pay tax. When you need an effort from them, they would not mind you. Then in about a year’s time, they come back for tax...They give cocoa farmers chemicals to spray on their farms. But cattle farmers you do not give them anything. We also have problems. So even if the government could have subsidized some of the drugs too for cattle farmers, our animals would even look better” (Male livestock farmer, 46 years, BY).

“Almost every week, there are about two or three reported cases of theft in this area. The punishment for such acts is lacking. Even if you catch the thief red-handed and send to the police station, they will make you walk and walk until you become fed up and leave them. Before you know, the thief is walking freely around...there is no justice” (Female livestock farmer, 48 years, KAPS).

There are, however, some instances when the impediment to service provision is purely financial. Some of the farmers complain of inadequate funds to pay for the services. Often times, leading to delays in the request for veterinary services. The veterinary officers pre-finance the purchase of supplies used in providing the services therefore, it becomes difficult for them to continue providing the services if the farmers do not pay for them:

“When the veterinary officers inform us and you call all the cattle farmers to a meeting to inform them about an upcoming vaccination exercise, some people give the excuse that they do not have money. Some of the cattle farmers have no other source of income, so they complain they do not have money” (Male livestock farmer, 47 years, KAPS).

“Sometimes when you call doctor, he will say his fuel, car, etc., then charges you a higher amount that I cannot afford. That’s how they are. Sometimes it’s just a problem with one animal. For this, you will waste all that money?” (Male livestock farmer, 49 years, BY).

“...somebody (farmer) will call you to come and treat the animals. Then you go to these places to vaccinate or treat and he will not give you the money. Another day, he will not call you. He will call another veterinary man, even though he owes you, he will just change the veterinary man...So the next time you call me, I will not go” (Veterinary Field Officer, 27 years, BY).

“Sometimes they (farmers) agree with you to administer the drugs on credit. Thereafter, the payment becomes a problem. You go to administer the drug and some will say we do not have money. Meanwhile, you have already reconstituted the drug and started with treatment. If it happens like that and you could not cover the entire drug, the rest become a waste...So, next time if you call me, I won't bother to go and do the work for him. Because it will affect me. The small money that I have taken to buy the drugs to work for you and you do not want to pay me the money” (Veterinary Field Officer, 39 years, KAPS).

Owing to the poor access to veterinary services, several of the farmers resort to self-treatment of diseases that affect their animals. The unregulated access to veterinary drugs exacerbates the problem. This practice is widespread among farmers in both the BY and KAPS Districts. They sometimes resort to persons from neighbouring countries to render veterinary services to them:

“Well, the vets are not readily available so we try to manage it. Sometimes some people bring medicine from across the border, which we buy to treat them. Sometimes it works but many times we lose them to the sicknesses” (Male livestock farmer, 54 years, BY).

“Sometimes the farmers do not even know how to administer the drugs properly. Everyone just does what they think is right. Some farmers buy medicine in a red and yellow bottle and mix with “Akpeteshie” before injecting the animals. So sometimes, I think we the farmers ourselves kill the animals because the injections are not given properly and we do not even know the right quantity to give. If the drugs are given in excess, the animal may die and people just smoke them and send to the market” (Male livestock farmer, 47 years, KAPS).

“We do not really have access to veterinary services to treat our cattle. The officers are few and it takes so long if you call them before they can attend to you and by then, if you do not treat them yourself, you will lose them” (Male livestock farmer, 33 years, BY).

“The drugs are all over in the market now; Nkawkaw, Akate, they are all over. Even we have people who roam, they go from house to house selling veterinary drugs. They have identified people with cattle so they move to them” (Veterinary Field Officer, 52 years, KAPS).

In spite of this food safety threat, some aspects of the veterinary system are able to deal with animals that die from diseases. The veterinary officers, however, report some challenges with adequate oversight over the slaughtering of animals:

“We issue slaughter permit to those who slaughter animals. Our challenge is that we do not have a slaughterhouse in this place. So, most of the slaughtering is done in the house especially by the chop bar operators. Thus, it makes our work difficult...If they do not call you before you realize there is meat at the roadside. Usually, when you ask them, they say they called an environmental officer to inspect. So, you cannot do anything. Because we work together with them (environmental officers)” (Veterinary Field Officer, 39 years, KAPS).

“They (veterinary) inspect the meat before it is sold. There are also “Tangas” (environmental officers) who check the meat to see if it is wholesome. The veterinary check for the health of the cattle to see whether it is good for people to eat. Sometimes they make us bury the carcass, when they see the sickness can infect humans” (Male livestock farmer, 38 years, BY).

“You know this area they don’t like foregoing carcass. When you explain to them that this carcass has anthrax; no they will never forego unless you yourself burn it. So we burn and bury such carcasses ourselves” (Veterinary Field Officer, 27 years, BY).

It is therefore not surprising that the major support the farmers feel is crucial to enable them to deal with adverse events occurrences, is the provision of veterinary services and supply of veterinary drugs for the treatment of the diseases affecting their livestock and other solutions to drought:

“What I will like mainly is water for the cattle to drink. In this community, access to water for the animals is difficult. They (cattle) have to go very far away before they are able to find a place to drink” (Male livestock farmer, 33 years, BY).

“We need readily available medicines because sometimes when you go to the veterinary officers to treat or vaccinate your cattle, they may go two or three times and tell you the vaccines or drugs were not ready. If the government can make readily available the drugs that prevent these diseases and we even have to pay for them, it will really be good” (Female livestock farmer, 48 years, KAPS).

“I would love to have the drugs for treatment available to treat our cattle. Letting veterinary officers come to inspect and assess the farm, and help us to take good care of the animals. This will reduce our losses and help every family to make progress. We also need a dam here to provide water for the cattle, because water and feeds are problems here during the dry seasons (Male livestock farmer, 48 years, BY).

Similarly, the veterinary personnel mainly believe the provision of the needed logistics and additional personnel will facilitate the delivery of services and improve the productivity of the farmers:

“We would prefer if the government can provide us with the facilities to enable us to store and supply our medications and vaccines here, so we can easily have access to them when needed” (Veterinary Field Officer, 28 years, BY).

“If the government can assist with additional personnel and then provide us with the means to easily mobilise to the communities, we can step up our service delivery in the district” (Veterinary Field Officer, 52 years, KAPS).

CHAPTER FIVE

DISCUSSION

In spite of global and local efforts aimed at improving food security and healthy living, agricultural production levels remain inadequate to meet the demand of a growing population. Livestock production serves to supply a key source of protein in the human diet while providing a livelihood source for the farmers. To achieve the maximum benefits from livestock farming, it is essential that the sources of livestock losses and psychosocial wellbeing consequences for the livestock farmers in Ghana be determined. This study, the first of its kind in Ghana, sought to identify the sources of livestock losses and their influence on the psychosocial wellbeing of livestock farmers.

5.1 Factors that lead to livestock losses to farmers

Owing to negative climatic variability, there has been a reported general rise in the occurrence of adverse events including droughts, floods, conflicts with other land users, and animal diseases. These events negatively affect the livestock holdings of livestock owners. Findings from this study show that the major constraints confronting farmers are animal disease outbreaks, pasture and water shortages, cattle theft and conflicts over grasslands. This finding is similar to those observed in other studies conducted across Africa (Bett et al., 2009; Grace et al., 2017; Kimaro et al., 2018; Leff, 2009; Manu et al., 2014; Opiyo et al., 2014) and Australia (Peel & Schirmer, 2016). However, contrary to our findings of livestock diseases as the major source of stress and losses to farmers, most of the losses observed in these earlier studies were attributed to droughts and conflicts. A possible explanation why livestock diseases lead as the main source of loss to farmers is the poor farmer access to veterinary services and the practice of self-treatments, which delays the solicitation of expert veterinary services by the farmers. The lack of responsibility on the part of some livestock farmers to vaccinate their cattle against diseases, as the qualitative findings reveal, further worsens the situation.

Despite the availability of vaccination against contagious bovine pleuropneumonia (CBPP), it was widely prevalent in both study areas accounting for many losses to the farmers. As qualitative findings revealed, the livestock farmers do not patronize vaccination services when organized, but prefer treating the diseases instead. Some farmers also complained of a lack of vaccines at veterinary offices when required. This non-utilization of the available vaccines would explain the high prevalence of CBPP on farms. Another disease commonly reported by the farmers was the Foot and Mouth Disease. This finding is consistent with the findings from earlier studies done in Tanzania and Kenya among cattle farmers (Bett et al., 2009; Chengula et al., 2013; Kimaro et al., 2018) including other viral diseases like East Coast fever.

There were little differences in the occurrence of adverse events in the Bunkpurugu-Yunyoo (BY) and Kwahu Afram Plains South (KAPS) Districts. The occurrence of disease outbreaks was widespread in both study districts. However, the farmers in the BY District, in addition also predominantly report the occurrence of water shortages. This could be explained by the relative differences in the weather in the districts. The experience of drought also was typically more severe in the BY District than observed in the KAPS District, as commonly found in the Savannah and vegetation zones in Ghana. On the other hand, more cases of conflicts with crop farmers were reported in KAPS than in the BY District. This is possible, where crop farming is also highly practiced within the KAPS District, due to favourable weather.

Worrying, however, is the finding that some livestock farmers prepare diseased cattle for sale on the markets, in order to minimize the losses they incur. The arbitrary use of veterinary drugs by the farmers can potentially lead to antimicrobial resistance and exacerbates the food safety concerns. These findings are in agreement with the work done earlier in Northern Ghana which also found that farmers struggled to obtain veterinary services and often resort to the purchase of veterinary drugs (Alicic, Ennali, & Toric, 2014). This is potentially harmful to the health of unsuspecting patrons of meat and requires further studies to mitigate the health hazards posed.

5.2 Emotional attachment of livestock farmers to livestock

Many of the livestock farmers in this study were found to have a strong emotional attachment to their livestock. Livestock rearing, therefore, was more than just a source of livelihood. These findings are consistent with qualitative inquiries conducted in Maasai communities in Eastern Africa, in Australia and the Alps of Switzerland which found deep emotional bonds between livestock farmers and their cattle (Ellis & Albrecht, 2017; Hoffet, 2015; Macgregor & Waldman, 2017). The emotional attachment could emanate from the close contact the livestock farmers have with the cattle during milking, feeding, and cleaning of pens among others, which are practices similar to the earlier studies and this present one. The livestock farmers manifest their bond to cattle by talking to the cattle, giving names to cattle and caring for their furs. This emotional attachment to livestock tended to amplify the negative effect of loss on the farmers as the findings revealed. As the farmers often perceived the livestock as more than just animals.

The level of attachment was observed to be similar in both study districts. However, the livestock farmers were more often less involved in the daily upkeep of the cattle. Many employ the services of Fulani herdsmen, who are seen by both the farmers and veterinary officers' as being more closely attached to the cattle. This is understandable given the practice of the Fulani herdsmen isolating themselves from human settlements and staying together with just the cattle in places where grasslands are accessible. As findings showed, this emotional bond affects the health-seeking behaviour for animals by the farmers. Similar observations were made in an earlier study among Swedish livestock farmers (Hansson & Lagerkvist, 2012).

5.3 Psychosocial wellbeing of livestock farmers

Previous research had shown that smallholder farmers tend to have poorer psychological and social wellbeing (Peel & Schirmer, 2016). The effect of stressful events on livestock farmers is especially exacerbated by the loss of their livestock holdings in the absence of needed support (Mort et al., 2005; Taylor et al., 2008). The findings from this study are in agreement with the

work done previously. The majority of the livestock farmers in this study were found to be food insecure, have a poor quality of life and poor mental health. The number of adverse events they experienced and the proportion of livestock lost negatively affected the psychosocial wellbeing and mental health of the farmers. This is consistent with previous studies, which have shown negative psychological and social consequences when livestock farmers face adverse events (Mort et al., 2005; Peck et al., 2002; Taylor et al., 2008). This is possible when the farmers consider the time and resources expended in operating their farms prior to the loss.

In the current study, we found that farmers in the BY District in the more arid Northern Ghana comparatively had poorer psychosocial wellbeing, to the farmers in the KAPS District. This finding is not far from the general observation of relatively poorer wellbeing of residents in Northern Ghana, as the study on psychological distress in Ghana revealed (Canavan et al., 2013). Other agencies have similarly expressed this disparity, informing the development initiatives including the Savannah Accelerated Development Authority (SADA) and the Northern Development Authority, to facilitate the bridging of gap in development. Several factors have been identified to contribute to this disparity including lack of access to social services, unemployment and sustained conflicts (Shepherd et al., 2005).

Nevertheless, livestock farmers in Ghana are highly resilient and this presents an opportunity that can be harnessed by the government in its quest to achieve increased productivity towards attaining food security and, general growth and development. Typically, persons recurrently exposed to adversity often tend to be robust in the face of difficulty, as several studies have shown among pastoralists in Africa (Agonafir, 2018; Little & McPeak, 2014; Mekuyie et al., 2018). Thus, the high resilience of the farmers was not surprising; given the challenges confronting them. It is in agreement with a similar study in Turkana, Kenya, where two-thirds of pastoralists were found to be highly resilient (Opiyo et al., 2014). This similarity may be due to the regularity of adverse events including droughts and conflicts seen in the Turkana area.

More so, having larger head sizes and increasing proportion of livestock losses, in the present study, was significantly associated with higher resilience scores. This finding is similar to a study conducted in Australia by Schirmer & Hanigan (2015). However, farmers in the more arid BY District were relatively less resilient compared to the farmers in the KAPS District, unlike the findings in Australia (Schirmer & Hanigan, 2015) and Ethiopia (Mekuyie et al., 2018), where more arid zone farmers had better resilience compared to the less arid zones. This difference could probably be due to the relative homogeneity in the experience of adverse events, particularly diseases, in both study areas. The main adaptive measures of the farmers include the self-treatment of cattle diseases and selling of diseased meat to recover their losses.

The finding of high levels of severe food insecurity in about half of the respondents in this study is quite high when compared to the national average of 23% severe food insecurity and that of Africa at large (25%) (FAO, 2016). This finding could be explained by the practice of livestock farmers to live in isolation away from other human activities that might limit the availability of food except for what is cultivated. It is thus not surprising that more than 90% of the pastoralists in this study also grew crops. The growing of crops in addition to livestock rearing was identified as one of the coping strategies of pastoralists by Mekuyie et al. (2018).

The majority of livestock farmers in this study had a poor quality of life. This is consistent with similar studies in Finland (Saarni et al., 2008) and in Kenya (Campbell et al., 2011). However, contrary to the Kenyan study, support provision in this study was associated with worsening quality of life. This may be because the farmers who are less satisfied with their quality of life, may most likely seek for support than those already satisfied. The other significant predictor of the quality of life in this study was the difference in farming District where farmers in the BY District had a significantly lower quality of life. This is comparable to a similar study conducted among subsistence farmers the Northern Region of Ghana (Yakubu & Aidoo, 2015). Provision of support to these farmers, thus, remains crucial to improving their wellbeing.

Ultimately, from the model selection conducted, the psychosocial wellbeing of the farmers in this study was negatively influenced by an increase in the number of stressful events experienced, increasing proportions of total cattle holdings lost, self-reported ill health of the farmer and increasing number of support sources at their disposal. The wellbeing significantly improves with farmers' increasing age and experience with livestock keeping as well as higher education levels. Generally, these relationships were expected based on the literature reviewed.

Quite surprisingly though, was the finding that availability or increased number of support negatively affected psychosocial wellbeing and all the other wellbeing dimensions. It is highly possible that the farmers with psychosocial problems were the ones most likely to seek for support from significant others and other available support sources to help them cope with adversity, while farmers with better psychosocial wellbeing are less likely to seek for support. The inability of cross-sectional studies to ascertain the temporal order of the relationship between exposure and outcome variables, in this case, support and wellbeing outcomes can explain this finding. More so, the revelation that veterinary services was the support sought by the majority of farmers who had some support in this study, suggests these are probably a cry for help by farmers to get the required veterinary services to deal with the cattle diseases, and may not indicate an actual availability of these support services to the farmers.

5.4 Sources of support and support available to pastoralists

The support available to livestock farmers in this study, to deal with adverse events is limited in supply. This is possible because of the free-range type of livestock farming practiced where livestock farmers migrate to distant locations in search of pasture to avoid confrontations with other land users. This often limits their access to social services including veterinary services (Admassie & Abebaw, 2014). The inadequate number of veterinary personnel and other logistical constraints in this study undermine the efforts of the Ministry of Food and Agriculture to improve livestock production. This is consistent with a study among Turkana pastoralists

where almost 60% of the farmers received no extension and veterinary services (Opiyo et al., 2014). Similar observations were made in North Eastern Kenya (Dzingirai et al., 2017). The veterinary personnel in this study were often required to self-finance the purchase of materials they use for their work, with the hope of recuperating the cost from farmers that patronize their services. Unfortunately, some farmers either refuse to pay or are genuinely incapable of payment, thereby setting such farmers up for veterinary blacklisting and its attendant problems.

Consequently, the farmers resort to treating the animals themselves or seeking for veterinary services from foreigners and other farmers whose competence in dealing with such events is questionable. A similar finding was made in the study among pastoral households in the Turkana County of Kenya (Opiyo et al., 2014). The practice of farmers treating their animals themselves was identified as an adaptive strategy in Tanzania (Goldman & Riosmena, 2013). The additional financial burden on veterinary personnel, to pre-finance the purchase of needed logistics including drugs and personal protective equipment, exacerbates the practice of self-treatment, when personal finances of veterinary officials are short in supply. This area requires close attention to forestall negative outcomes when farmers feel powerless to deal with losses.

Similar to the findings by Peck et al., (2002), another major source of support to the livestock farmers' in this study is their self-help associations. Many of the farmers do receive support from family and friends in times of difficulty. However, some of the farmers in this study believe the support provided by these self-help groups and friends are limited to dispute resolution with crop farmers and other persons with whom disagreements occur as well as the establishment of checkpoints to retrieve stolen cattle of farmers. The associations, for instance, have been largely incapable of securing easy access to veterinary drugs and services as required by the members. Nevertheless, their operation provides a key avenue to address minor local disagreements without having to resort to other violent or aggressive means. It is the expectation of farmers that these associations can be empowered to deliver on their mandates.

5.5 Study limitations

The quality of the research data obtained influences the results and inferences made therein. Even though all efforts were made to improve the quality of the research data, there are bound to be some limitations. Firstly, this was a cross-sectional study thus could not assess the temporal relationship between the dependent and explanatory variables. This makes it difficult to infer causal relationships in the associations observed between the variables in the study.

Secondly, even though randomization was used in selecting the study districts and communities from which participants were recruited, the frequent mobility of the farmers only permitted the use of a consecutive recruitment instead of a random approach. The lack of data about the actual population of livestock farmers in the study districts also hindered the use of a proportional to size approach in recruiting participants from the districts. This may potentially bias the results obtained. However, collecting of a large number of farmers in this study (N = 287) improved the power of the study to identify differences in the study population.

Thirdly, the data relied on participants self-reported information on questions posed. Thus, the respondents may be influenced to selectively report issues that work in their favour. For instance, the claim by farmers that they do not get vaccination services was disputed by the veterinary officers who report that farmers do not patronize vaccination exercises. In spite of this, the use of in-depth interviews allowed for further probing, which provided the opportunity to verify some of the claims made. Also, even though the recall period for adverse events and numbers of livestock lost were short, there is potential of some respondents misreporting figures of the livestock losses and the adverse events suffered due to poor record keeping.

Finally, the study did not collect data on the disease management practices and the drugs used by farmers in the absence of professional veterinary care. Such information would be valuable in determining if the quality of meat produced is compromised, but was not assessed. In spite of these limitations, the study provides useful information that could inform policy.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The major adverse events affecting livestock farmers in the Northern and Southern Belts of Ghana include the occurrence of disease outbreaks in livestock, pasture and water shortages, conflicts with other land users and theft. These events occurrences were generally similar in both study districts, leading to livestock losses to more than two-thirds of the farmers in a year.

Livestock farming mainly serves as a source of livelihood for farmers. Proceeds from the sale of livestock and livestock products are useful in meeting the basic needs of the farmers and their dependents. However, a majority of cattle farmers especially nomadic herdsman have a strong emotional attachment with their cattle. The livestock keeping practices involve free-range mobility in search of pasture and water and health-seeking for the livestock. However, the responsibility of farmers in keeping livestock appears to be less clearly defined as farmers sometimes neglect the vaccination of their livestock leading to the poor control of diseases.

In spite of these challenges, the availability of support in the form of veterinary extension services is limited in supply. The veterinary personnel do not have readily available logistics including drugs and means of transportation but have vast working areas. The farmers requiring veterinary services, therefore, treat animals on their own or seek for veterinary services from unlicensed operators. The drugs used are freely available in the cattle markets. When treatments fail, the farmers resort to selling the diseased animals for meat on the market. Self-treatment of livestock by the farmers and sale of diseased meat appears to be an adaptive strategy to deal with reduced access to veterinary services. These occurrences pose significant health threats to both the farmers and the consumers of meat and meat products.

Overall, the majority of livestock farmers in Ghana experience severe psychological and social problems. Many of them have high levels of depression, stress and anxiety, poor quality of life and are food insecure. However, resilience levels of livestock farmers are very high. The psychosocial wellbeing of the farmers is negatively affected by the increased occurrence of adverse events, proportion of livestock lost, farming in the more arid Bunkpurugu-Yunyoo District in the Northern Belt of Ghana, self-reported illness by farmers and support available to the farmers. The psychosocial wellbeing however improved if farmers had experience with raising livestock during childhood. In addition, the attainment of basic education, as well as increasing age, significantly improved psychosocial wellbeing.

6.2 Recommendations

Based on the study findings, the following recommendations are made to the listed agencies:

Veterinary Service Department

It is recommended that the Veterinary Services Department (VSD) should intensify their surveillance activities especially at livestock markets and slaughter areas. This can help detect persons dealing in the illegal sale of veterinary drugs and identify diseased animals that are unwholesome for food, for the recommended corrective measures to be executed. The VSD should also organize education programs on the roles and responsibilities of livestock farmers to forestall farmers taking up responsibilities that are not meant for them.

Ministry of Food and Agriculture

The Ministry of Food and Agriculture (MoFA) should create the policy framework within which the veterinary services and livestock farmers can clearly identify with their responsibilities and rights. MoFA should ensure that the veterinary services department is provided with the necessary human and physical resources, including employment of veterinary staff, provision of veterinary drugs and vaccines, refrigerators for drugs storage and motorcycles, and education of farmers, in order to enhance access to the services rendered.

The MoFA should also consider the facilitation of financial facilities (loan schemes) which the livestock farmers can access to improve their productivity while paying back within the stipulated time.

Mental Health Authority

The mental health authority should collaborate with the VSD to reach out to the livestock farmers, especially those with psychological health problems, using the One Health approach, to provide the needed services.

Recommendations for future research

It is recommended that a comprehensive evaluation of the performance of veterinary services in Ghana is done, to identify the gaps and potential solutions for addressing them. This exercise is essential to the government of Ghana's agenda of improving livestock production to meet local and international demand.

Also, the implementation of field experiments to determine which intervention works best in addressing the root causes of livestock losses is highly recommended. This would help to reduce losses, improve productivity and ultimately improve the psychosocial wellbeing of livestock farmers and food security of the Ghanaian populace.

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APPENDICES

Appendix 1: Informed Consent

Consent Form

Title: Factors associated with livestock losses and their influence on the psychosocial wellbeing of pastoralists in Ghana

Principal Investigator: Nuvey Francis Sena Kwaku

Address: University of Ghana School of Public Health, Epidemiology and Disease Control Department, C/O School of Public Health, P.O. Box LG 13 Legon-Accra.

Tel: 0240091462.

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General Information about Research: This is a research that assesses the psychosocial effect of livestock losses on pastoralists in the northern and southern belts of Ghana. This form provides all the detail you need to decide whether or not to partake in the study. You are welcome to ask any questions that you may have if you are not clear on any of the points discussed. Then, if you decide to participate, please sign and date this form in front of the person who explained the study to you.

General objective: The main aim of this study is to assess the factors associated with livestock losses and their influence on psychosocial wellbeing of pastoralists in Ghana.

Purpose(s) of research: The purpose of this research is to determine how the stressful situations pastoralists are exposed to affect their psychological and social wellbeing and how to identify possible means of addressing these challenges through appropriate support measures that will in the long term increase the productivity levels of pastoral households.

Procedure of the research: The completion of this questionnaire should not exceed 30 minutes of your time. To find answers to the issues raised above, you are asked a few questions to obtain information.

The researcher has engaged some trained persons to assist with administering the tools to you. Feel free to mention if a question or statement is not clear to you. Please submit the completed questionnaire as soon as possible to the researcher.

Possible Risks and Discomforts: By participating in this research, you are likely to have some uneasiness of questioning. The study team will try and decrease the chances of any risks/dangers happening, but if an untoward event happens, you will be immediately managed by a health care personnel and will be provided with free medical care in a hospital.

Possible Benefits: The data collected will help to identify ways of minimizing the effect of losing livestock on your mental health, quality of life, food security and resilience. Also, we will understand better the nature of bond between you and your livestock and determine the social support services provided to you in the community when you lose some of your animals.

Confidentiality: All of your records from this study will be treated as confidential records. Information collected on study questionnaires and audio recordings will be given code numbers. Your name will not be recorded on the research forms or in the electronic database. The findings of this study may be reported in publications or reports but your name will not be mentioned. However, as part of my responsibility to conduct this research properly, I may allow my academic supervisors and sponsors to have access to your records.

Compensation: By estimation, each questionnaire will be completed within 30 minutes, you would be provided with a bar of soap to cater for the time you would have utilized for other productive work.

Voluntary Participation and Right to Leave the Research: You do not have to take part in this research if you do not wish to do so, and this will not affect your access to resources for agricultural purposes in the district. Taking part in this study should be out of your own free will. You are not under obligation to do so. Research is entirely voluntary. You may choose to withdraw from the research at any time that you wish to, without having to explain yourself.

There will be no consequence or loss of benefit to you if you choose to withdraw from the study. Please note however, that some of the information that may have been obtained from you before you choose to withdraw may be modified or used in analysis reports and publications without your name being mentioned. These cannot be removed anymore. I do promise to make effort to comply with your wishes as much as practicable.

Contacts for Additional Information

If you have any questions you may ask those now or later. If you wish to ask questions later, you may contact:

Francis Sena Kwaku Nuvey
School of Public Health, University of Ghana
Tel. 0240091462 / 0504991496

Your rights as a Participant

This research has been reviewed and approved by the Institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB). If you have any questions about your rights as a research participant you can contact the IRB Office between the hours of 8am-5pm through the landline 0302916438 or email addresses: nirb@noguchi.ug.edu.gh

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research title (*Psychosocial Effect of Livestock Losses to Pastoralists in the Northern and Southern Belts of Ghana*) has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

Date

Name and signature or mark of volunteer

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Date

Name and signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Date

Name Signature of Person Who Obtained Consent

Appendix 2: Data Collection Instruments

Quantitative Questionnaire

SECTION A: DEMOGRAPHIC INFORMATION AND FARMING PRACTICES

QUESTIONNAIRE ID: _____

HOUSEHOLD ID: _____

DATE: _____

1. Sex:

- ☐ Female
☐ Male

2. Age: _____

5. Community: _____

3. Highest level of education:

- ☐ Never been to school
☐ Basic School
☐ Secondary School
☐ Tertiary

6. Ethnic group: _____

7. Number of persons in your household: _____

4. Marital status:

- ☐ Single
☐ Married
☐ Co-habiting
☐ Divorced
☐ Widowed

8. Number of cattle in your herd: _____

9. Do you grow crops aside herding animals: _____

10. Do you own the animals you herd?

- ☐ Yes
☐ No

11. Do you live with your family together while working?

- ☐ Yes
☐ No

12. Whom do you usually turn to when you are faced with challenges?

- ☐ Family
☐ Friends
☐ Religious leaders
☐ Community leaders
☐ Others _____

13. Are you currently ill?

- ☐ Yes
☐ No

14. If something is wrong with your health what do you think it is?

_____ illness/ problem

SECTION B: PREVALENCE OF ADVERSE EVENTS IN PASTORAL COMMUNITIES

1. Which of the following events would you say caused you significant stress in the past five years:

- ☐ Illness of cattle
- ☐ Drought
- ☐ Flood
- ☐ Conflict
- ☐ Fire outbreak
- ☐ Lack of land for grazing
- ☐ Drying up of dams/water sources
- ☐ Land degradation
- ☐ Shortage of cattle feed (grass)
- ☐ Reduced cattle or beef sales
- ☐ Theft of cattle
- ☐ None
- ☐ Other, please state: _____

2. Which of the following factors usually accounted for cattle losses on your farm in the past year?

- ☐ Illness of cattle
- ☐ Poisoning of cattle
- ☐ Theft of cattle
- ☐ Shooting/Butchering of cattle (conflict killings)
- ☐ Flooding from excess rainfall
- ☐ Fire outbreak on farm
- ☐ Shortage of cattle feed (grass)
- ☐ Other, please state: _____

3. If illness led to cattle losses, which of the following signs did you see manifest in the herd?

- ☐ Sudden death and bleeding from orifices (body openings) of cattle
- ☐ Chronic emaciation (thinness) of cattle
- ☐ Breathing difficulty
- ☐ Secretions from eyes with chronic emaciation
- ☐ Abortions in pregnant cows
- ☐ Foot and mouth sores
- ☐ Other, please state: _____

The following question refers to **how often** you have experienced the stressful events above, if any, in **each year**. Please **TICK** as it applies to you.

Q. NO.	Adverse event	Never	Once	Twice	3 times	4 or more
4	Illness of cattle					
5	Drought					
6	Flood					
7	Conflict					
8	Fire outbreak					
9	Lack of land and water for grazing					
10	Land degradation					
11	Shortage of cattle feed (grass)					
12	Reduced cattle or beef sales					
13	Theft of cattle					
14	Other, please state					

The following question refers to the **severity** of each stressful event when it occurs i.e. which adverse event result in more loss to you with each episode. Please rank them from "1" (Less severe loss) on the left to "3" (Most severe loss) on the right. Please **TICK** as it applies to you.

Q. NO.	Adverse event	1	2	3
15	Cattle illness			
16	Drought			
17	Flood			
18	Unavailability of land for grazing			
19	Fire outbreaks			
20	Conflict			
21	Drying up of dams/water sources			
22	Land degradation			
23	Shortage of cattle feed (grass)			
24	Reduced cattle or beef sales			
25	Theft of cattle			
26	Other, please state			

In the following question please state on average, the **number of cattle lost in the last year** to each stressful event that you have experienced. Please indicate the total number of cattle you had during the period and how many was lost. Write “N/A” if you have not experienced a particular adverse event.

Q. NO.	Adverse event	Total cattle in herd	Number of cattle lost
27	Illness of cattle		
28	Drought		
29	Flood		
30	Conflict		
31	Fire outbreak		
32	Shortage of cattle feed		
33	Unavailability of water		
34	Unavailability of grazing land		
35	Theft of cattle		
36	Poisoning		
36	Other, please state		

Please indicate whether or not, by ticking **YES** or **NO**, the following are provided in your community in the event any of the adverse events occur.

Q. NO.	Support received	YES	NO
37	Payment of compensation by local government authority		
38	Veterinary and extension services		
39	Community network group (association) of pastoralist		
40	Insurance payments		
41	From close family relatives		
42	From close friends		
43	From other individual pastoralists		
44	Other, please state		

45. What is the **most important support** needed in your cattle rearing:

SECTION C: EMOTIONAL ATTACHMENT TO LIVESTOCK

1. Were you raised in a household where farm animals were also kept during your childhood?

☐ Yes

☐ No

Please read the following statements. To the right of each you will find five numbers, ranging from "1" (Strongly Disagree) on the left to "5" (Strongly Agree) on the right. Circle the number which best indicates your feelings about that statement. For example, if you strongly disagree with a statement, circle "1". If you are neutral, circle "3", and if you strongly agree, circle "5", etc.

Q. NO.	Support received	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
2	It is sad when one of our animals is killed by adverse event occurrences	1	2	3	4	5
3	I spend quite a lot of time caring, cuddling and talking with my cattle	1	2	3	4	5
4	Our farm animals are almost like family members	1	2	3	4	5
5	I am fond of my farm animals	1	2	3	4	5
6	It is very sad when our farm animals are sent to the slaughterhouse	1	2	3	4	5

SECTION D: DEPRESSION ANXIETY AND STRESS SCALES (DASS 21)

Please read each statement and **TICK** a number **0, 1, 2 or 3** which indicates how much the statement applied to you **over the past week**. There are no right or wrong answers.

0 = Did not apply to me at all - **NEVER**

1 = Applied to me to some degree, or some of the time – **SOMETIMES**

2 = Applied to me to a considerable degree, or a good part of time – **OFTEN**

3 = Applied to me very much, or most of the time - **ALMOST ALWAYS**

Q. NO.	Statements	0	1	2	3
1	I found it hard to gradually relax after doing something that make me tired or worried				
2	I was aware of dryness of my mouth				
3	I couldn't seem to experience any positive feeling at all				
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)				
5	I found it difficult to work up the initiative to do things				
6	I tended to over-react to situations				
7	I experienced trembling (eg, in the hands)				
8	I felt that I was using energy in excess than needed				
9	I was worried about situations in which I might be suddenly afraid and make a fool of myself				
10	I felt that I had nothing to look forward to				
11	I found myself getting agitated/upset				
12	I found it difficult to relax				
13	I felt discouraged and sad (down-hearted and blue)				
14	I was intolerant of anything that kept me from getting on with what I was doing				
15	I felt I was close to sudden fear (panic)				
16	I was unable to become interested about anything				
17	I felt I wasn't worth much as a person				
18	I felt that I was rather oversensitive (easily offended)				
19	I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)				
20	I felt scared without any good reason				
21	I felt that life was meaningless				

SECTION E: WHOQOL-BREF

Instructions

This assessment asks how you feel about your quality of life, health, or other areas of your life. **Please answer all the questions.** If you are unsure about which response to give to a question, **please choose the one** that appears most appropriate. This can often be your first response. Please keep in mind your standards, hopes, pleasures and concerns. We ask that you think about your life **in the last two weeks**. For example, thinking about the last two weeks, a question might ask:

	Question	Not at all	Not much	Moderately	A great deal	Completely
	Do you get the kind of support from others that you need?	1	2	3	4	5

You should **CIRCLE** the number that best fits how much support you got from others over the last two weeks. So you would circle the number 4 if you got a **great deal** of support from others.

	Question	Not at all	Not much	Moderately	A great deal	Completely
	Do you get the kind of support from others that you need?	1	2	3	4	5

You would circle number 1 if you **did not get any** of the support that you needed from others in the last two weeks

Please read each question, assess your feelings, and circle the number on the scale for each question that gives the best answer for you.

	Question	Very poor	Poor	Neither poor nor good	Good	Very good
1	How would you rate your quality of life?	1	2	3	4	5

	Question	Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
2	How satisfied are you with your health?	1	2	3	4	5

The following questions ask about **how much** you have experienced certain things in the **last two weeks**.

	Question	Not at all	A little	A moderate amount	Very much	Extreme amount
3	To what extent do you feel that physical pain prevents you from doing what you need to do?	1	2	3	4	5
4	How much do you need any medical treatment to function in your daily life?	1	2	3	4	5
5	How much do you enjoy life?	1	2	3	4	5

	Question	Not at all	A little	A moderate amount	Very much	Extreme amount
6	To what extent do you feel your life to be meaningful?	1	2	3	4	5
7	How well are you able to concentrate?	1	2	3	4	5
8	How safe do you feel in your daily life?	1	2	3	4	5
9	How healthy is your physical environment?	1	2	3	4	5

The following questions ask about **how completely** you experience or were able to do certain things in the **last two weeks**.

	Question	Not at all	A little	Moderately	Mostly	Completely
10	Do you have enough energy for everyday life?	1	2	3	4	5
11	Are you able to accept your bodily appearance?	1	2	3	4	5
12	Have you enough money to meet your needs?	1	2	3	4	5
13	How available to you is the information that you need in your day-to-day life?	1	2	3	4	5
14	To what extent do you have the opportunity for leisure activities?	1	2	3	4	5

	Question	Very poor	Poor	Neither poor nor good	Good	Very good
15	How well are you able to move around? (mobility)	1	2	3	4	5

The following questions ask you to say how **good or satisfied** you have felt about various aspects of your life **over the last two weeks**.

	Question	Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
16	How satisfied are you with your sleep?	1	2	3	4	5
17	How satisfied are you with your ability to perform your daily living activities?	1	2	3	4	5
18	How satisfied are you with your capacity for work?	1	2	3	4	5
19	How satisfied are you with yourself?	1	2	3	4	5
20	How satisfied are you with your personal relationships?	1	2	3	4	5
21	How satisfied are you with your sex life?	1	2	3	4	5

	Question	Very dissatisfied	Dissatisfied	Neither satisfied nor dissatisfied	Satisfied	Very satisfied
22	How satisfied are you with the support you get from your friends?	1	2	3	4	5
23	How satisfied are you with the conditions of your living place?	1	2	3	4	5
24	How satisfied are you with your access to health services?	1	2	3	4	5
25	How satisfied are you with your transport?	1	2	3	4	5

The following question refers to **how often** you have felt or experienced certain things in the **last two weeks**.

	Question	Never	Seldom	Quite often	Very often	Always
26	How often do you have feelings such as sadness, despair, anxiety, depression?	1	2	3	4	5

SECTION F: THE 14-ITEM RESILIENCE SCALE (RS-14)

Please read the following statements. To the right of each you will find seven numbers, ranging from "1" (Strongly Disagree) on the left to "7" (Strongly Agree) on the right. Circle the number which best indicates your feelings about that statement. For example, if you strongly disagree with a statement, circle "1". If you are neutral, circle "4", and if you strongly agree, circle "7", etc.

Circle the number in the appropriate column		Strongly disagree				Strongly agree		
1	I usually manage situations by some means (one way or another)	1	2	3	4	5	6	7
2	I feel proud that I have accomplished things in life.	1	2	3	4	5	6	7
3	I usually am not unsettled, delayed, or interrupted by something in my work	1	2	3	4	5	6	7
4	I am friends with myself.	1	2	3	4	5	6	7
5	I feel that I can handle many things at a time.	1	2	3	4	5	6	7
6	I am determined.	1	2	3	4	5	6	7
7	I can get through difficult times because I have experienced difficulty before.	1	2	3	4	5	6	7
8	I have self-discipline.	1	2	3	4	5	6	7
9	I keep interested in things.	1	2	3	4	5	6	7
10	I can usually find something to laugh about.	1	2	3	4	5	6	7
11	My belief in myself gets me through hard times.	1	2	3	4	5	6	7
12	In an emergency, I'm someone people can generally rely on.	1	2	3	4	5	6	7
13	My life has meaning.	1	2	3	4	5	6	7
14	When I'm in a difficult situation, I can usually find my way out of it.	1	2	3	4	5	6	7

SECTION G: FOOD INSECURITY EXPERIENCE SCALE (FIES)

Please read the following statements. Choose how they applied to your household in the past **12 months** by ticking "Yes" if it applied to you and "No" if it did not apply to you.

Now I would like to ask you some questions about your food consumption in the last 12 months. During the last 12 MONTHS, was there a time when:		Yes	No
1	You were worried you would run out of food because of a lack of money or other resources?		
2	You were unable to eat healthy and nutritious food because of a lack of money or other resources?		
3	You ate only a few kinds of foods because of a lack of money or other resources?		
4	You had to skip a meal because there was not enough money or other resources to get food?		
5	You ate less than you thought you should because of a lack of money or other resources?		
6	Your household ran out of food because of a lack of money or other resources?		
7	You were hungry but did not eat because there was not enough money or other resources for food?		
8	You went without eating for a whole day because of a lack of money or other resources?		

You have completed the questionnaire. Thank you for your time!

INTERVIEW GUIDE 1 – Pastoral Community Head’s Interview

Date of Interview:

Time:

1. Thank you for agreeing to participate in this study. Please tell me about the kind of work you do?
2. Tell me about what keeping livestock mean to you?
3. How much time do you spend with your animals in each day?
4. How often do you have veterinarians conduct check-ups on your cattle?
5. Do you think your animals should enjoy similar privileges like other people in the community?
6. Do you confide in your livestock?
7. Do people’s reaction towards your cattle influence the way you feel about them?
8. Do you sometimes consider your cattle as more than animals? Tell me about it.
9. Do your cattle know it when you are feeling bad? How do they react?
10. How much of respect do you feel must be accorded to your cattle?
11. How close are you with your cattle?
12. What do you like about owning cattle? What do you not like about owning livestock?
13. What are the occurrences that lead you to lose your cattle?
14. Which of those adverse events occur more frequently in a year? Which of them lead to more loss of cattle?
15. Do you get any negative feeling when any of your cattle dies? Tell me how you feel.
16. How would you say losing your cattle affects your life? E.g. food for your household, emotional and social wellbeing
17. What would you say, you need in your community to help you deal with losing your cattle?
18. Do you have any support group here to help deal with animal losses?
19. Is there any place in the community where you go and discuss losing your animals? If so, tell me what exactly they do. If you don’t have any such place, would you care to talk to a professional about how you feel anytime your animal dies?

Age:

Sex:

Community:

Number of years raising cattle:

Total number of cattle:

INTERVIEW GUIDE 2 – District officers in charge of Animal production

Date of interview

Time

1. Thank you for agreeing to participate in this study. Please tell me about the kind of work you do?
2. Tell me about the kind of events in this area that affect raising of livestock?
3. Which of those adverse events occur more frequently in a year? Which of them lead to more loss of cattle?
4. Which illnesses do you usually treat in cattle in this district?
5. What services do you provide for the pastoralists in this area? How is the uptake of services provided like? How often do you render these services?
6. What are some challenges the effective delivery of your work?
7. Is there any token available to farmers who may have lost animals?
8. What is your view on the relationship between pastoralists and their livestock? Tell me about it.
9. What is the usual living situation in a typical pastoral household?
10. In your experience, how does loss of livestock affect the pastoral households?
11. Is there any place in the community where pastoralists in this area are able to go in the vent of losing animals to get some form of compensation? If so, tell me what exactly they do.

Age:

Sex:

Designation/cadre of staff:

Community:

Number of years worked:

Appendix 3: Ethical Clearance Letter

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

Established 1979A Constituent of the College of Health Sciences

University of Ghana

Phone: +233-302-916438 (Direct)
+233-289-522574
Fax: +233-302-502182/513202
E-mail: nirb@noguchi.ug.edu.gh
Telex No: 2556 UGL GH

INSTITUTIONAL REVIEW BOARD



Post Office Box LG 581
Legon, Accra
Ghana

My Ref. No: DF.22
Your Ref. No:

10th January, 2018

ETHICAL CLEARANCE

FEDERALWIDE ASSURANCE FWA 00001824

IRB 00001276

NMIMR-IRB CPN 054/17-18

IORG 0000908

On 10th January, 2018, the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional Review Board (IRB) at a full board meeting reviewed and approved your protocol titled:

TITLE OF PROTOCOL : Psychosocial Effect of Livestock Losses to Pastoralist in the Northern and Southern Belts of Ghana

PRINCIPAL INVESTIGATOR : Nuvey Francis Sena Kwaku, Mphil Cand.

Please note that a final review report must be submitted to the Board at the completion of the study. Your research records may be audited at any time during or after the implementation.

Any modification of this research project must be submitted to the IRB for review and approval prior to implementation.

Please report all serious adverse events related to this study to NMIMR-IRB within seven days verbally and fourteen days in writing.

This certificate is valid till 9th January, 2019. You are to submit annual reports for continuing review.

Signature of Chair:

Mrs. Chris Dadzie
(NMIMR – IRB, Chair)

Appendix 4: Renewal of Ethical Clearance Letter

NOGUCHI MEMORIAL INSTITUTE FOR MEDICAL RESEARCH

Established 1979A Constituent of the College of Health Sciences

University of Ghana

Phone: +233-302-916438 (Direct)
+233-289-522574
Fax: +233-302-502182/513202
E-mail: nirb@noguchi.ug.edu.gh
Telex No: 2556 UGL GH

INSTITUTIONAL REVIEW BOARD



Post Office Box LG 581
Legon, Accra
Ghana

My Ref. No: DF.22
Your Ref. No:

9th January, 2019

ETHICAL CLEARANCE

FEDERALWIDE ASSURANCE FWA 00001824

IRB 00001276

NMIMR-IRB CPN 054/17-18 *amend. 2019*

IORG 0000908.

On 9th January, 2019, the Noguchi Memorial Institute for Medical Research (NMIMR) Institutional Review Board (IRB) conducted continuing review and amended your protocol titled:

TITLE OF PROTOCOL : Factors associated with livestock losses and their influence on psychosocial wellbeing of pastoralists in Ghana

PRINCIPAL INVESTIGATOR : Francisca Sena K. Nuvey

Please note that a final review report must be submitted to the Board at the completion of the study. Your research records may be audited at any time during or after the implementation.

Any modification of this research project must be submitted to the IRB for review and approval prior to implementation.

Please report all serious adverse events related to this study to NMIMR-IRB within seven days verbally and fourteen days in writing.

This certificate is valid till 8th January, 2020. You are to submit annual reports for continuing review.

Signature of Chair:
Mrs. Chris Dadzie
(NMIMR – IRB, Chair)

Appendix 5: Description of Standard Tools

Depression Anxiety and Stress Scale – 21 (DASS-21)

The livestock farmers' mental health was assessed using the DASS-21. The DASS is an instrument designed to measure self-reported negative emotions of depression, stress and anxiety for the purposes of mental health assessment by researchers or health professionals (Lovibond & Lovibond, 1995). There are two versions, a full one with 42 items (14 items per subscale) assessing the three negative emotions and an abridged version made up of 21 items also measuring the same negative emotions. The items in both questionnaires are assessed on a four-point Likert scale ranging from 0 to 3; 0 depicting never experiencing the negative emotion and 3 being almost always experiencing the negative emotion. In the abridged version (DASS-21), there are 7 items, each in a subscale that assess the three negative emotions.

The depression subscale measures the presence of anhedonia, life devaluation, hopelessness, self-deprecation, dysphoria, and inertia. Additionally, the anxiety subscale assesses the situational and subjective experience of anxiety, autonomic arousal, and skeletal muscular effects. The stress scale also measures restlessness, nervousness, irritability, and impulsivity. Specifically, the items 3, 5, 10, 13, 16, 17 and 21 on the DASS-21 assess for depressive emotions of the subject. The anxiety subscale comprises items 2, 4, 7, 9, 15, 19 and 20 that measure the study subjects' anxious emotions. Finally, the items 1, 6, 8, 11, 12, 14 and 18 assess the levels of chronic non-specific arousals of the tension of the research subject (Szabo, 2010).

These assessments are referenced to the research participant's experiences within a one (1) week period counting from the day of the interview. To obtain the cumulative scores for each of the subscales, the individual subscale scores are summed up. Higher scores imply poor mental health. Usually, scores obtained from the DASS-21 are transformed to the DASS scale by multiplying each subscale score by 2, to enhance comparability. The scores are then categorized into different

levels of severity on a continuum ranging from normal to extremely severe levels of depression, stress, and anxiety (Lovibond & Lovibond, 1995).

The WHOQOL-BREF

The WHOQOL is a quality of life assessment tool developed by the WHOQOL Group, which assesses an individuals' perception about certain key areas of their lives in relation to their goals, expectations and living standards (WHOQOL Group, 1998). There are two versions of the WHOQOL, the WHOQOL-100 and the WHOQOL-BREF, used for research or clinical purposes.

The WHOQOL-100 comprises a set of 100 questions that generate a profile of scores for an individual across six domains of quality of life namely; physical, psychological, level of independence, social relations, environment, and personal beliefs. All the 100 items fall under one of 24 facets that relate to the quality of life as well as two items assessing the overall quality of life and health. The development of the scale adopted a cross-cultural approach whereby 19 countries drawn from within all the WHO regions, contributed to its field trials, after rigorous reviews by a team of international experts, and subsequent adoption. Following field trials, extensive analysis of the data showed the scale had good internal consistency, reliability and was valid in discriminating between groups with varying levels of wellness. All six domains measured by the scale were also found to have significantly contributed to explaining variations in a subject's overall health and quality of life (p -values <0.001 except for personal beliefs domain, $p=0.02$ (WHOQOL Group, 1998).

The WHOQOL-BREF is an abridged version of the WHOQOL-100 designed to ensure brevity, convenience, and accuracy when conducting epidemiological studies among large samples. It consists of 26 items, carefully selected from the WHOQOL-100 to reflect all the items within each quality of life-related facet. At least one question was drawn from each of the 24 facets and the other two questions assess the overall quality of life and health. The 24 questions fall within four

domains of quality of life namely; physical (7), psychological (6), social relations (3) and environment (8). The questions are generally asked to a reference period of two weeks of the study subject's subjective experiences (WHOQOL Group, 1998).

After successful field trials, the WHOQOL-BREF was found to be comparable to the WHOQOL-100, and an adequate alternative assessment tool for the quality of life domains, as it had good internal consistency ($\alpha = 0.66-0.84$) and discriminant validity ($p < 0.001$) (WHOQOL Group, 1998).

To analyse the responses of study subjects to obtain scores for each quality of life domains, we take the mean of all items included within each domain and multiply it by a factor of four. This transforms it to a similar scale as the WHOQOL-100, to enhance comparability. Then the domain scores are transformed to a percentage scale (0-100). The domain scores are positively scaled; higher scores imply a higher quality of life (WHOQOL Group, 1996).

The 14-Item Resilience Scale (RS-14)

The resilience of the pastoralists to bounce back from stress and adversity was assessed using the RS-14. The Resilience Scale (RS) was designed by The Resilience Center in response to the demand by clinicians and researchers to directly measure an individual's resilience (Wagnild, 2009). It comprises 25 items that measure some five resilience characteristics namely; self-reliance, purpose, equanimity, perseverance, and authenticity. It mainly assesses two aspects of a person's life: self-acceptance and personal competence. The scale comprises a 7 point Likert scale with scores ranging from 1 to 7. Higher scores on the scale denote greater resilience. Several trials conducted after its development have shown that the RS has strong internal consistency and is highly valid for measuring resilience (Wagnild, 2009; Wagnild & Young, 1993).

The RS-14 is an abridged version of the Resilience Scale developed with the aim of reducing the study participant's burden while maintaining high levels of validity and reliability of the scale.

After field trials and analysis, 14 items within the RS were selected to reflect all the five resilience characteristics to constitute the RS-14. It is also on a 7-point Likert scale with higher scores indicative of higher resilience (range = 14 – 98). The resilience scores are then categorized on a continuum with varying levels of severity; very low to very high (Wagnild, 2009).

The Food Insecurity Experience Scale (FIES)

The FIES, developed by the FAO as part of Voices of the Hungry project, is an experience-based tool for measuring insecure access to food of individuals or households, through inquiry into behavioural and psychological indicators of food insecurity (Ballard et al., 2013). It was developed with a global utility perspective, and builds on other direct measures of food insecurity that were mainly region or country specific including the Latin American and Caribbean Food Security Scale, Household Food Insecurity Access Scale and the U.S. Household Food Security Survey Module (Ballard et al., 2013).

The FIES measures the access dimension of food insecurity over a defined period, generally 12 months starting from the day of the interview. The reference period, however, can be varied as 1, 3, 6 or 12 months depending on research priorities. The FIES consists of 8 items, with yes and no choice for responses, which ask study subjects directly about the potential compromise of the requisite quantity and quality of food consumed as a result of limited resources including money. Each question in the FIES assesses a unique food insecurity situation. Affirmative responses to each subsequent question in the scale represent a more severe level of food insecurity compared to that of the preceding question. After a study subject's responses are generated along this gradient, then their food insecurity can be classified on a continuum of food insecurity severity ranging from mild food insecurity to severe food insecurity. Study subjects whose responses are negative to all items in the scale are classified as food secure. After extensive field trials of the tools in over 150 countries, the FIES was found to be valid in measuring food insecurity and have

good internal consistency (median Rasch reliability = 0.73) (Ballard et al., 2013; Cafiero, Melgar-Quinonez, Ballard, & Kepple, 2014).

Emotional attachment to a livestock scale

The attachment to livestock scale was adapted from a similar study conducted among sheep farmers by Vittersø et al. (1998) to assess the relationship between livestock farmers' emotional attachment to livestock and their attitudes towards large predators. The attachment to livestock scale is a 5-point Likert scale, which comprises five items or statements. These items inquire about the farmer's perceptions, attitudes, and relationships with their livestock.

The study participants' scores on the five attachment items are then summed up, and descriptive analysis including mean, standard deviation, range, kurtosis, and skewness computed. The reliability of the sum of scores is also tested using Cronbach's alpha. The reliability testing done by the authors showed that the attachment to livestock scale has strong internal consistency ($\alpha = 0.74$) (Vittersø et al., 1998). The attachment to livestock scores can then be categorized using the mean or median, depending on the distribution of the responses.

Appendix 6: Sampling frame of livestock farming communities in BY and KAPS Districts

**SAMPLING FRAME OF LIVESTOCK FARMING COMMUNITIES IN KWAHU
AFRAM PLAINS SOUTH DISTRICT**

- | | |
|------------------|--------------------|
| 1. AGYATA | 21. HLIHADZI |
| 2. AMANHYIA | 22. KOMLA-KWAO |
| 3. AMEDZOFE | 23. KWAME DWAMENA |
| 4. AMEYAW | 24. KWASI-ADAE |
| 5. ATAKORA | 25. KWASIKUMAH |
| 6. ATONSU | 26. MAFIKOPE |
| 7. BATOR-KOFE | 27. MRANDAN |
| 8. BONKPATA | 28. NEKPOKOPE |
| 9. DEDESO | 29. NYAFRED |
| 10. DIM SAKABO | 30. ODOTOMU |
| 11. DOMEABRA | 31. ODUMASUA |
| 12. DOTORPONG | 32. OFFINSO |
| 13. EKYE | 33. OGBODOKOPE |
| 14. FASO-KRACHI | 34. SUMSE |
| 15. FORIFORI | 35. SEMENHYIA |
| 16. FOSU-TOMEFA | 36. TEASE |
| 17. GADORKOPE | 37. TRIBU |
| 18. GODODONUKOPE | 38. TWENFOUR FASO |
| 19. GODOPE | 39. WAWASE |
| 20. GODZIKOFE | 40. XEDZODZOE-KOPE |

**SAMPLING FRAME OF CATTLE FARMING COMMUNITIES IN BUNKPURUGU-
YUNYOO DISTRICT**

- | | |
|---------------------|------------------------|
| 1. BAMANGO | 28. KPENTAUNGKUNKWADAN |
| 2. BILFACO POIGA | 29. KUNPAK TAMBING |
| 3. BINDE | 30. MAJIA |
| 4. BOATERIGU | 31. MANGOR |
| 5. BUMBONG | 32. NAABAU |
| 6. BUNBUNA | 33. NABULIK |
| 7. BUNKPURUGU ZONGO | 34. NAJONG |
| 8. CHINTULUNG | 35. NAKPANDURI |
| 9. DAGBAN | 36. NAMANGAI |
| 10. DALOUR | 37. NAMGBAM |
| 11. GBANKONI | 38. NAMPOUTIBAU |
| 12. GBANKURUGU | 39. NANGOBK |
| 13. GBETMUNPAK | 40. NANYIAR |
| 14. GBINGBANI | 41. NASUAN |
| 15. GOMSUKA | 42. PAGNATIK |
| 16. GUAGBIANG | 43. PULI |
| 17. JAGOUK | 44. SAKBOUK |
| 18. JANDERI | 45. SANJAAK |
| 19. JILIK | 46. TABOKURUGU |
| 20. JIMBALE | 47. TATARA |
| 21. KAMBA KONKOOK | 48. TIENKINLU |
| 22. KAU | 49. TINKPANG |
| 23. KINKANGU | 50. TOJING |
| 24. KPAGYALA | 51. TUNA |
| 25. KPANLORI | 52. TUSUGU |
| 26. KPEKPALGBENI | 53. WAWA |
| 27. KPEMALE | 54. YUNYOO |

Appendix 7: Pilot study results

Nearly all the livestock farmers (39/40) lost cattle to illness. Other major sources of loss were cattle theft (32/40), conflict (19/40) and drought (12/40). The farmers lost on average about 7, 4 and 2 cattle to illness, theft, and conflict respectively per year. Proportionately, an average of 12% of cattle holdings is lost to illness, 7% to theft and 2% to conflict situations. Majority of the livestock farmers (60%) were emotionally attached to their cattle. The key sources of support to livestock farmers in dealing with adversity in the Greater Accra region come from veterinary services, family and pastoralists association. However, the majority report that they receive no support at all to help deal with losses.

There was a high prevalence of psychological problems in 78% (depression, stress, and anxiety) and quality of life is mainly poor, found in 75% of respondents. However, a little over half of the respondents (53%) were food secure and had high resilience (70%). Overall, psychosocial wellbeing was poor in the majority of respondents (53%). The psychosocial wellbeing of pastoralists was significantly predicted by the level of cattle loss when we adjust for other variables ($p < 0.05$).

All the tools were found to have solid psychometric validity and internal consistency with Cronbach α values ≥ 0.70 as shown in Table 1 below.

Table 20: Validity and reliability of data collection instruments

Tool	Number of items	Cronbach alpha
DASS-21	21	0.8193
RS-14	14	0.8314
WHOQOL-BREF	24	0.8334
FIES	8	0.9275
Attachment to livestock	5	0.6637

Appendix 9: List of communities and number of livestock farmers sampled

District	Community	Number of respondents
Bunkpurugu-Yunyoo	Bamango	12
	Bunkpurugu Zongo	11
	Gbankurugu	13
	Gbetmunpak	14
	Jagouk	12
	Kauk	13
	Kinkangu	12
	Naabauk	14
	Pagnatik	10
	Tatara	13
	Tojing	10
	Yunyoo	11
Kwahu Afram Plains South	Agyata	13
	Dim Sakabo	14
	Dotopong	13
	Ekye Amanfrom	17
	Forifori	17
	Fosu	16
	Gadorkorpe	15
	Kwame Dwamena	13
	Kwasi Addae	11
	Tease	13