EPIDEMIOLOGICAL STUDY ON COMMUNITY ACQUIRED PNEUMONIA AMONG HOSPITAL TREATED ADULTS IN TIGRAY, ETHIOPIA.

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SCHOOL OF PUBLIC HEALTH, ADDIS ABABA UNIVERSITY APPROVED BY THE EXAMINING BOARD

Chairman, Examining Board	**Signature and date**
Supervisor (Primary)	**Signature and date**
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External Examiner	**Signature and date**
Internal Examiner	**Signature and date**
Internal Examiner	**Signature and date**

Original Papers

This dissertation is based on the following three papers, which will be referred to in the text by their roman numbers:

I. Magnitude of Community Acquired Pneumonia among Hospital Treated Adults in Tigray, Ethiopia: A Hospital Based Retrospective Study.....published in Journal of Health, Medicine and Nursing; ISSN 2422-8419 : An InternationalPeer-reviewedJournal ,Vol.33, 2016

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III. Cost of illness among hospital treated adults for community acquired pneumonia in Tigray, Ethiopia, Annals ofAfrican Medicine. *in press*

Acronyms and Abbreviations

AAU	Addis Ababa University
AOR	Adjusted Odds Ratio
ATS	American Thoracic Society
BTS	British Thoracic Society
BMI	Body Mass Index
CAP	Community Acquired Pneumonia
CDC	Center for Disease Prevention and Control
CI	Confidence Interval
COR	Crude Odds Ratio
COI	Cost of Illness
COPD	Chronic Obstructive Pulmonary Disease
CSA	Central Statistical Agency
DHS	Demographic Heath Survey
EAT	Empiric broad-spectrum antibiotic treatment
EDHS	Ethiopia Demographic and Health Survey
EPI info	Epidemiological information
ETB	Ethiopian Birr
FMOH	Federal Ministry of Health
GDP	Gross Domestic Product
HAP	Hospital Aquired Pneumonia
HCAP	Health Care Associated Pneumonia
HDSS	Health and Demographic Surveillance System
HIV	Human Immunodeficiency Virus
ICU	Intensive Care Unit
IPD	Invasive Pneumococcal Disease
USA	United States of America
USD	United States' Dollar
LRTIs	Lower respiratory tract infections
NHAP	Nursing Home Associated Pneumonia

OR	Odds Ratio
PDT	Pathogen Directed Treatment
PI	Principal Investigator
PSI	Pneumonia Severity Index
SATS	South African Thoracic Society
SD	Standard Devation
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
T**B**	Tuberculosis
VAP	Ventilator Associated Pneumonia
WHO	World Health Organization

Glossary of operational definitions and concepts

Direct costs- medical costs like diagnostics, medications, laboratory and cost of hospitalization.

Indirect costs -earnings lost because of hospital stay related to community acquired pneumonia.

Productive age group-those who are between the age group of 18-64 Years

Table of Contents

List of Tables

List of Figures

Abstract

Background: - Lower respiratory tract infections are a leading cause of mortality worldwide, causing 1.6 million deaths annually in adults. Excluding tuberculosis they are the third most common cause of death worldwide and the most common cause of death in low-income countries. Community acquired pneumonia is responsible for a large proportion of these deaths. Globally, it is the leading cause of death from an infectious disease and the sixth leading cause of death overall. Studies in different settings of the world, attest to the fact that community acquired pneumonia has a substantial clinical and economic burden. Despite its high morbidity and mortality globally and specifically in Ethiopia, community acquired pneumonia is not adequately researched.

Objective:-The aim of this study was to assess the epidemiology of community acquired pneumonia among hospital treated adults in Tigray, Ethiopia.

Methods:-The study was conducted in Tigray Region, north Ethiopia. A retrospective patient record review and case control study designs were used. The source population for the case control study design were both men and women aged 18 years and above who have been attending their treatment in all zonal hospitals and Ayder Tertiary Hospital. Charts of all types of pneumonia patients treated from July, 2013 to July, 2015 in all zonal hospitals of Tigray and Ayder Tertiary Hospital were the source population for the retrospective record review. In this study cases were patients of community acquired pneumonia who had been on treatment and fulfilled the definition for community acquired pneumonia, while controls were clients who came for some other purposes to the hospitals but without community acquired pneumonia. To assess the magnitude of community acquired pneumonia all medical records from the selected hospitals of the period 2013 to 2015 were retrieved and the cost estimation was made from the records of the period 2014 to 2015.The sample size for the case control study was calculated using two proportion formula with a case to control ration of 1 to 2.To collect the data semi-structured interviewer-administrated questionnaire and check list were adapted from different literatures .Once the data were collected, it was entered into Epi info 2002 and exported to SPSS Version 20 statistical program for analysis. Ethical clearance was obtained from Institutional Review Board of the Addis Ababa University College of Health Sciences. Letter of agreement

was secured from the Regional Health Bureau. Individual written informed consent was solicited from the respondents at the time of data collection and examination.

Finally measures of central tendency & proportion were calculated. The association between the exposure and outcome variables were also determined using bivariate and multivariable analysis. Data for cost was analyzed using descriptive statistics, numerical summary measures, and simple linear regression analysis. The method of cost estimation employed, included a bottom-up approach in order to estimate direct patient side medical cost, whereas the indirect cost was calculated using a human capital approach.

Results: During the study period, there were 36,005 patients of all types of pneumonia with 5877 cases of community acquired pneumonia, making the magnitude of community acquired pneumonia to be 16%, with proportions for males (16%) and females (17%). The proportion of admitted patients due to community acquired pneumonia was 9.8%, with a mean admission length of 6 (±5.59) days.

History of contact with pets, working in dusty environment, history of pulmonary tuberculosis, history of pneumonia, having contact with people who had respiratory infection, history of respiratory infection, history of tonsillectomy, history of upper airway problem, age and educational status had significant association with community acquired pneumonia in the bivariate logistic regression analysis, while working in dusty environment [OR (95% CI);2(1.1,4.1)], history of respiratory infection [OR (95% CI); 2.3(1.5,5.7)], contact with people who had respiratory infection [OR (95% CI);2.5(1.2,5.3)] and previous history of pneumonia confirmed by radiograph [OR (95% CI); 39(19.4,78,6)] were significantly associated in the multivariate analysis.

The total amount of money incurred over the study year was 319,056.52 Ethiopian Birr ($15,193.2**)**. The direct medical expenditure was 242889.60 Eth.B ($11,566.20) and the cost of lost working days by the patients due to community acquired pneumonia was 76166.92 Ethiopian Birr ($3627). From the cost of direct medical expense, 47.6 % was used for medication, 18% for imaging (X-ray), 15% for laboratory, 16% for bed and 3% for registration.

Conclusion: The study revealed that the magnitude of community acquired pneumonia in the study area was 16% and most prevalent among younger population. Working in dusty environment, having history of pneumonia, history of respiratory infection and having contact with people who had respiratory infections are the risk factors of community acquired pneumonia confirmed in this study.

The cost of illness among adult patients of community acquired pneumonia in the study area was substantially high. Of the total cost incurred, 76 % was due to direct medical expense and 24 % for the lost working days.

Hence, appropriate prevention strategies should be designed and implemented so that the magnitude of community acquired pneumonia would be minimized and terminally the treatment cost incur by the community acquired pneumonia will be reduced. Besides, Treatment guideline has to be developed and proper management should be offered to prevent the re-occurrences of previous pneumonia and other respiratory infections as a result the development of community acquired pneumonia would be minimized. Moreover, safety measures like personal protective equipments should be used when there is contact with patients having respiratory tract infections.

More so, further prospective studies should be conducted to estimate the magnitude and comprehensive costs of community acquired pneumonia. Larger studies are also needed to assess the effect of some risk factors in the general population.

Keywords: Community acquired Pneumonia, Magnitude, Risk factors, Cost, Adults, Ethiopia

I. INTRODUCTION

1.1 Background

Pneumonia is a disease in the lungs and it is a common cause of infection related to the mortality that challenges most of health care providers and the community(1). When an individual has pneumonia, the alveoli in the lungs are filled with pus and fluid, which makes breathing painful and limits oxygen intake (2).

Currently accepted classifications of pneumonia include community acquired pneumonia (CAP), hospital-acquired pneumonia (HAP), ventilator-associated pneumonia (VAP), and nursing home–associated pneumonia (NHAP). Healthcare-associated pneumonia (HCAP) was recently introduced to describe a non hospitalized population of nursing home residents, long-term care patients, those undergoing same-day procedures, patients receiving home or hospital-based intravenous therapy, dialysis patients, and patients recently discharged from the hospital(3,4).

CAP is the most common type of pneumonia that occurs either in the community setting or within the first 48 hours after hospitalization and is defined as a lower respiratory tract infection characterized by cough, fever, chills, fatigue, dyspnea, rigors, and pleuritic chest pain with or without new infiltrate on chest radiography (1,5, 6).

CAP is widely recognized as a disease common for the elderly (age ≥65 years) and the very young (age <5 years) (7). However, it can be potentially life threatening in the adult patients with other co-morbid diseases, and with poor therapeutic intervention. Its clinical spectrum ranges from rapid resolution of symptoms to severe medical complications and death. In addition, Community-acquired pneumonia (CAP) is an acute disease which represents a common cause of hospital admission and mortality in developed and developing countries and hence consumes a great proportion of health care budgets (8).

A study from Utah, USA revealed that about 600,000 persons with pneumonia are hospitalized each year and there are 64 million days of restricted activity due to this illness (9). Another study in the Netherlands showed that clinical and economic burden of CAP is particularly high in older adults (10). Although the number of pneumonia hospitalizations was more than twice greater in

elderly adults than in nonelderly adults, the mean lengths of hospital stay—5.6 and 5.5 days, respectively were remarkably similar in USA (11). Like in elderly adults, the presence of pneumonia in younger individuals (ages 18-64 years) who are still actively employed has an impact on employers most notably, lost productivity costs associated with workplace sick time and short-term disability (12).

Currently, there are many studies on CAP from developed countries but the studies focus on elderly people and it is known that the incidence, risk factors and cost of illness of CAP varies widely between countries. In addition robust national epidemiological study on CAP among adults is largely missing across many countries, including Ethiopia and other sub-Saharan Africa.

1.2 Statement of the Problem

A study in Italy reported that the number of physician consultation accounts for 25% due to respiratory system infections. Pneumonia accounts for 2-3%, of which the majority of these cases are community-acquired pneumonia (13). The estimated incidence of community acquired pneumonia varies between countries, by age and gender. The rate is higher among male individuals aged more than 65 years. In the United States, 4 million adults are affected each year of which 20% need hospitalization for management (14). Furthermore, about 50,000 adults in the US die from Pneumonia disease every year (15).

In the United Kingdom**,** 345 people for every 100,000 had one or more episodes of pneumonia in 2012. Around 220,000 people receive diagnosis of pneumonia each year and 28,952 deaths occurred from pneumonia in 2012 (5.1 per cent of all deaths and 25.3 per cent of deaths from lung disease) **(**16)

In Latin America, a population weighted average incidence of hospitalized pneumonia in persons over 50 years of age was 519.6 hospitalizations per 100 000 person years, with an average fatality rate of 19.0 per 100 hospitalizations, representing 436,402 hospitalizations and 82,852 deaths in 2009. Extrapolating forward to 2020, with a projected adult population of 1.49 billion, pneumonia could account for up to 617,993 hospitalizations and 112,680 deaths in a single year (17)

Pneumonia ranks among the top three diagnoses in hospital admissions in sub-Saharan Africa (18) and the fifth largest killer in South Africa, accounting for 3.9% of all deaths (19). Likewise,

,CAP is the leading cause of hospitalization and mortality among adult patients accounting for 10% in Kenya (8), 11.9% in Nigeria (20), 8.3% in Botswana, and 51,000 admissions per year with 10,000 deaths per year in Malawi (21).

According to a study at Jimma University by Ali and Woldie infectious diseases are major reasons for admission and a high mortality rate accounting for 12.3% and respiratory illness of 15.9% (22). Parallel to a report from sub-Saharan Africa (SSA) by Etyang and Scot, respiratory diseases remained the leading causes of admission, accounting for 27.4% of all admissions (23).

Several risk factors are recognized for the development of community acquired pneumonia, including older age, smoking, alcoholism, immunosuppressive conditions, and condition such as COPD, cardiovascular disease, chronic liver or renal disease, diabetes mellitus and dementia (24).

Pneumonia is a huge burden on healthcare systems. As reported by a study in the US, Pneumonia expenses accounted for $16.2 billion in 2013 only (25).Likewise, in Europe, pneumonia costs nearly € 10.1 billion annually (26). CAP has an effect towards the patient's recovery to return to a full range of daily activity of about 7 to 43 days. However, the length of stay in the hospitals is variable primarily affecting the cost of care (27).

In a study from Spain, the cost of inpatient care for community-acquired pneumonia was € 1,553, whereas the mean cost of treating pneumonia in outpatient was € 196 (28). Another study reported that hospitalization represents over 90% of the direct costs of treatment in Czech Republic, Hungary, Poland and Slovakia in which adults aged 65 years and above accounting for 73% of the costs (29).

Being among the leading cause for hospitalization, mortality and costly, little is known about it in Ethiopia and no available literature shows the magnitude, determinants and the cost of hospital expenditure regarding CAP in Ethiopia and other sub-Saharan Africa countries.

Hence, the aim of this research was to determine the epidemiology of CAP among adults in Tigray hospitals including the magnitude, risk factors and measure the cost of illness that can have a consequence for the well-being of patients affecting the life of a whole populace.

1.3. Rationale of the study

Community-acquired pneumonia is a global disease that is an acute disease which represents a common cause of hospital admission and mortality in developed as well as developing countries.

Nonetheless, Pneumonia does not have effective advocacy**.** It is not the subject of fund-raising walks or runs. It does not have a ribbon or other symbol around which people rally. It does not get the attention it needs from biomedical scientists or from research funders. Hence, more effort is needed now(15).

Moreover, the burden of community acquired pneumonia will be felt even more acutely in the years to come due to environmental pollution, climate change and increment of the proportion of older adults worldwide. This problem will also hold true for Ethiopia. Hence, conducting research on the epidemiology of community-acquired pneumonia in adults in Ethiopia where little is known can provide a baseline information on the burden, risk factors and cost of illness pertaining community acquired pneumonia.

The study will benefit policy makers to develop treatment guideline, design prevention and control mechanisms for community acquired pneumonia. Likewise, it will be important for health institutions to improve the quality of service being provided for community acquired pneumonia.

Moreover, health care professionals will gain a good knowledge on the magnitude, risk factors and cost of illness on community acquired pneumonia in Ethiopia and will enable them provide health education on the area which can contribute for the improvement of health seeking behavior of patients, early treatment and prevention. In addition, the research would help health care providers to improve quality of care, design appropriate treatment, prevention and promotional approaches.

II. Literature Review

2.1. The Biology of Community-Acquired Pneumonia

2.1.1. Definition of Community-Acquired Pneumonia

Pneumonia is an infection of the alveolar area where gas exchanging takes place in the respiratory tract. The clinical symptoms of pneumonia include, but not limited to cough, fever, sputum production and pleuritic chest pain accompanied with presence of infiltrates on chest radiography (30)

Suspected community-acquired pneumonia (CAP) is defined as, an acute illness with cough and at least one of new focal chest signs, fever >4 days or dyspnoea/tachypnoea, and without other obvious cause. A definite community-acquired pneumonia (CAP) is same as suspected CAP, but supported by chest radiograph findings of lung shadowing that is likely to be new. In the elderly, the presence of chest radiograph shadowing accompanied by acute clinical illness (unspecified) without other obvious cause (31).

Patients with typical community acquired pneumonia classically present with fever, a productive cough with purulent sputum, dyspnea, and pleuritic chest pain. Characteristic pulmonary findings on physical examination include tachypnea, rales heard over the involved lobe or segment, increased tactile fremitus, bronchial breath sounds, and egophony may be present if consolidation has occurred (32).

2.1.2. Pathogenesis of Community-Acquired Pneumonia

The underlying mechanism in all cases of pneumonia is constant exposure to contaminated air and common aspiration of nasopharyngeal flora that makes lung parenchyma susceptible to virulent microorganisms.Most microorganisms reach lower respiratory tract as inhaled and contaminated micro droplets.Complex interactions exist between virulence and quantum of aspirated or inhaled microorganisms that arrive at lower respiratory tract, the integrity of defense barriers and host immunity status (33). Once pathogens have successfully passed the first line of defense like the surface boundaries, the host initiates an immune reaction in an attempt to eliminate the invading microorganisms, beginning with the local release of a vast number of inflammatory mediators, such as cytokines and chemokines (34).These mediators also induce resting neutrophils to transition to cells primed for enhanced responses and finally to fully

activate cells. Activated neutrophils engulf and sequester microorganisms through phagocytosis and kill ingested bacteria by a combination of the production of toxic oxygen radicals, proteolytic enzymes, myeloperoxidase, defensins, and other bactericidal peptides (35)

There are series of immune and nonimmune respiratory defense mechanisms working effectively at different levels to keep the lung a bacterial free zone. Failure of these defense mechanisms and presence of certain predisposing factors render the person susceptible to infection causing CAP. As a consequence of the failure of defense mechanism, this can lead to alteration of normal oropharyngeal flora which is common in late adult and elderly patient having diabetes mellitus, malnutrition, chronic disorder alcoholism and other chronic systemic diseases reduce the levels of salivary fibronectin. As an outcome, this can result to increase colonization by gram-negative bacilli. Next is depression of a cough and glottis reflexes causing aspiration of gastric aspirate in old age patients. Furthermore, healthy adults have 10 to 100 million bacteria per milliliter of oropharyngeal secretions and up to 50% of healthy adults aspirate small volumes of pharyngeal secretions during deep sleep. Oropharyngeal contents may be aspirated more often in situations like alcoholism wherein it is an associated risk factor of CAP (36).

Moreover, effective mucociliary clearance is dependent on substantial ciliary motion and physical properties of mucus. The protection offered by the slime covered ciliated epithelium from the larynx to the terminal bronchioles is impaired in many situations like chronic cigarette smoking, exposure to hot/cold air of other harmful gasses and old age(36).

Lastly, is immune dysfunction, wherein the immune response is the primary mode of defense against infection by pathogenic microorganisms. Such case will include those that come through and dwell in the respiratory tract. On the other hand, such immune responses depend on the specific recognition of antigens by T and B lymphocytes. These reactions are regulated and supplemented by nonspecific inflammatory cells of the immune system, such as pulmonary dendritic cells, macrophages, neutrophils, eosinophils and mast cells. Disorders of granulocytes, lymphocytes, acquired immunodeficiency and immunosuppressive therapy predispose to pneumonia (37).

2.1.3. Etiology of Community-Acquired Pneumonia

Sir William Osler proclaimed Streptococcus pneumonia (or pneumococcus) as “the captain of all deaths of men” (38). This statement remains true today. Severe community-acquired pneumonia is the most common cause of death from infection in developed and developing countries, where pneumococcus is the most frequent cause of lower respiratory tract infection (39). Pertinent history can sometimes point to the etiology of pneumonia. Travel to endemic areas, sick contacts, exposure to specific pathogens and risk factors may help point to an etiology. However, the clinical features and history cannot reliably tell the precise etiology of CAP or separate viral from bacterial infection.

Although there are many pathogens that are associated with CAP, pneumonia is usually caused by bacteria or viruses in which the exact proportions of each microorganism may vary between countries. A review article from North America showed that the organisms responsible for CAP in hospitalized patients are *Streptococcus pneumonia* (20-60%), *Haemophilus influenza* (3-10%), *Mycoplasma pneumoniae* (1-6%), *Chlamydia pneumonia* (4%), *Legionellae sp*. (2-8%) viruses (2%), Aspiration (6-10%), Staphylococcus aureus (3%), Gram-negative bacilli (3-5%) and the other identified organisms (10-20%) (39).

A study in Finland showed that *S. pneumonia* occurrence is 41%, followed by chlamydiae 12%, *Mycoplasma pneumoniae* 10%, viruses 9%, Haemophilus Influenza infection 4% and Moraxella catarrhalis 3% (36). The etiology of CAP according to age and sex revealed that pneumococcal, chlamydial and viral infections were consistent with the distribution of all cases of age, with a peak at 60 to 75 years. The pneumococcal disease was significantly more frequent among patients aged above 60 years (48%) than among patients aged <60 years (35%). In contrast, Mycoplasma infection accounted for 24% in patients aged 15 to 44 years, compared only to 3% of older adults. The pneumococcal disease was significantly more frequent among men aged above 60 years than women of the same age group. Streptococcus pneumoniae was the most common (51%) in predefined patients with chronic conditions; Mycoplasma infection is frequent among outpatients accounting for 14% (50% pneumococcus infection, 23% M. pneumonia and 37%. unidentified organism). For admitted patients aged more than 60 years, the most common ethiologic agent was chlamydiae accounting for 89% (36).

A study in Kenya, on the etiologic agents of CAP among 225 patients showed that Streptococcus pneumonia was the most common causative microorganism, accounting for 46% and Mycobacterium pneumoniae 9% (8). In a study at the intensive care unit in South Africa, it was reported that there was a high incidence of Klebsiella pneumoniae (40). In Uganda, the most common bacterial etiologies were S. pneumoniae, H. influenza, Moraxella catarrhalis, Staphylococcus aureus and Klebsiella pneumoniae (41).

2.1.4 Transmission mechanisms and clinical course of CAP

Most CAP is of bacterial origin and often follow brief viral upper respiratory tract infection. In the upright position, lower lobes are best ventilated therefore, deposition of inhaled microorganisms is higher in these lobes. Inhalation pneumonia is most often due to microorganisms (a) that can remain suspended in air so as to be transported far away, (b) survive long enough while in transit, (c) have a size less than 5 μm (d) carry a high inoculum, and (e) evade local host defence mechanisms. Infection by intracellular bacteria such as Mycoplasma pneumoniae, Chlamydophila and Coxiella burnetii occurs through a contaminated aerosol inhalation route. CAP due to Streptococcus pneumoniae, Haemophilus and gram-negative bacilli occurs through microaspiration (42).

In a study of the time course of community-acquired pneumonia in ambulatory patients with CAP, the median time to resolution of fever was three days, five days for myalgia, six days for dyspnoea, and 14 days for both cough and fatigue. Symptoms can last even longer in critically ill patients (43).Fine and colleagues in their study on the process and outcomes of CAP have noted that 86% of patients had at least one persisting pneumonia-related symptom at 30 days (44).

2.1.5. Diagnosis of CAP

The American Thoracic Society (ATS) on its guideline for the management of CAP recommendes : 1) Patients should be investigated for specific pathogens that would significantly alter standard management decisions when the presence of such pathogens is suspected on the basis of clinical, epidemiologic clues; 2) Routine diagnostic test to identify etiologic diagnosis are optional for outpatient with CAP; 3) Pre-treatment blood samples for culture and expectorated sputum sample for stain and culture(in patients with a productive cough) should be obtained from hospitalized patients with the clinical indications; 4) Pre-treatment gram stain and culture of expectorated sputum should be performed only if a high-quality specimen can be

obtained and quality performance measures for collection, transport and processing of samples can be met; 5) Patients with severe CAP should at least have blood samples drawn for culture, urinary antigen test for Legionella pneumophilia and Streptococcus pneumonia performed and expectorated sputum samples collected for culture. For intubated patients, an endotracheal aspirate should be obtained (39).

The consequence of incorrect diagnosis can be severe. In the case of a false negative classification, there will be a delay in treatment; this can occur in young and middle-aged patients, who are otherwise healthy, or in elderly patients without typical signs of pneumonia. Due to unfavorable consequences of misleading diagnosis, a chest radiographic test ought to be performed, to have a definitive diagnosis of pneumonia. The classical microbiological methods, such as gram staining and culture have a low sensitivity and there is a delay before results from culture are available. Isolation of pneumococci from blood provides a specific aetiological diagnosis that does not only allow effective treatment to be given to the patient but can also be used for surveillance of the epidemiology of pneumococcal infections. Unfortunately, a blood culture method only detects pneumococci in about 10 to 20% of pneumococcal pneumonia cases, and this detection rate can be lower (45).

The diagnosis of pneumonia in developing countries varies according to the patient's access to medical care. Often the diagnosis is made simply by cough and fever. For patients with access to a hospital, the likelihood of obtaining a chest x-ray increases; the infection is bacteriologically confirmed only in the most sophisticated medical centers (46).S. pneumoniae is invariably found more frequently than any other pathogen in etiological series of pneumonia in Africa. However, the clinical evidence is scarce, not same, as the USA and United Kingdom (47).

Diagnosis is hampered by lack of a gold standard. Although blood and lung aspirate cultures are regarded as highly accurate, they typically lack sensitivity (48). Thus antimicrobial treatment makes the evaluation of culture-based diagnostic tests yet more complicated. In a study in Nigeria, majority of the patients did not have thorough laboratory workup that would have been useful both in severity assessment and the holistic management of these patients (39).

The diagnosis of respiratory symptoms in Africa is hampered by lack of available diagnostic facilities, particularly at the level of primary care. Likewise, this is supported in Ethiopia, though

there is no literature that points out what particular microorganism predominate as well as accurate diagnostic test among CAP infected patients.

2.1.6. Treatment of Community Acquired Pneumonia

Initial treatment of CAP is based on physical examination findings, laboratory results and patient characteristics (e.g., age, chronic illnesses, history of smoking, history of the disease). Physicians should begin their treatment decisions by assessing the need for hospitalization, using a prediction tool for increased mortality, such as the Pneumonia Severity Index combined with clinical judgment. Likewise, patients are treated for pneumonia depending upon what organism triggered the disease. The majority of patients are managed out of the hospital. Of those who are hospitalized, no more than 10 to 20% require intensive care unit. The decision to admit a patient with CAP depends on many variables, including severity of illness, associated disease, adequacy of home support, and the probability of adherence to treatment. Although guidelines vary on the emphasis placed on obtaining a chest radiograph for ambulatory patients is necessary to differentiate it from another respiratory disease (49).

The preliminary management of CAP depends on the patient's severity of illness, underlying medical conditions and risk factors, such as smoking and ability to adhere to a treatment plan. Over the past two decades, hospitalization with pneumonia has increased by 20 – 50% of aging European and US population (50).

The primary treatment for a patient with CAP is antibiotic therapy. The main goals of pharmacotherapy for patients with CAP include eradicating the causative pathogens, resolving the clinical signs and symptoms, minimizing hospitalization and preventing reinfection. Physicians should choose a medication based on the pharmacokinetic profile, adverse reactions, drug interactions and cost-effectiveness (51). Further, patient evaluation should focus on the severity of illness, patient age, comorbidities, clinical presentation, epidemiologic setting and previous exposure (52).

The majority of patients with CAP are treated empirically based on the most common pathogen associated with the condition. It has long been used as a management of CAP, antibiotic therapy like Penicillin had been the treatment of choice since 1940, but resistance to this and other antibiotics has grown (53). A study in Brazil revealed that substantial increases in penicillin

resistance in strains of S. pneumonia to 300% increase in strength and 61% increase in moderate resistance from 1998 to 2003 (54).

A study showed doxycycline to be comparable to levofloxacin (Levaquin) in effectiveness, length of hospital stay and failure rate for empiric treatment of CAP. Doxycycline is also a less expensive option for hospitalized patients who are not admitted to the ICU (55). In a recently completed study of severe CAP, it was reported that an increase the value of adding hydrocortisone to antibiotic therapy in severe CAP.In this study, hydrocortisone was administered for seven days in a placebo-controlled trial, and led to a delay in the onset of septic shock and improved oxygenation, as well as reduced length of stay and improved mortality(56). Although the role of steroids in severe CAP is still uncertain, it reminds the audience that this therapy is valuable when patients with pneumococcal pneumonia have associated meningitis. As a conclusion the role of steroids should be explored and not overlooked, because antibiotics have limitations in efficacy, and there are no very promising new drugs in development (57).

Another form of treatment is the pathogen-directed approach which is particularly used for moderate to severe CAP, where more sensitive diagnostic tests become more widely available. However, there has been some concern that narrowing the coverage spectrum of antibiotics when a specific pathogen is identified may undertreat patients who have a concurrent infection with atypical organisms. This concern was not borne out in a prospective randomized trial comparing pathogen-directed treatment (PDT) and empiric broad-spectrum antibiotic treatment (EAT) in 262 hospitalized patients with CAP.PDT was based upon microbiologic studies (rapid diagnostic tests) or clinical presentation; EAT patients received a beta-lactam/beta-lactamase inhibitor plus erythromycin or if admitted to the intensive care unit (ICU), ceftazidime and erythromycin . Overall, clinical outcomes (length of stay, 30-day mortality, fever resolution, and clinical failure) were the same for both groups. Adverse events were more frequent in the EAT group but were primarily related to the particular antimicrobial choice (i.e., erythromycin) (58,59).

2.2. The Epidemiology of CAP

2.2.1. Magnitude and burden of Community-Acquired Pneumonia

The 2010 Global Burden of Disease Study reported that lower respiratory tract infections (LRTIs), including pneumonia, are the fourth most common cause of death globally, exceeded

only by ischaemic heart disease, strokes and chronic obstructive pulmonary disease (COPD) and second most common frequent reason for loss of life (60). Another study showed that lower respiratory tract infections (LRTIs), which include community-acquired pneumonia (CAP), are a leading cause of mortality worldwide, causing 1.6 million deaths annually in adults aged 60 years and above (61). In developed regions of the world, LRTIs have been reported to account for 4% of overall deaths; while in Latin America, mortality due to LRTIs has been reported as 6% (62). LRTIs in persons aged 65 years and above were the third most frequent cause of death in 31 Latin American Countries, during the period 2001 to 2003 (63). In comparison, pneumonia was found to be the 8th leading cause of death in the USA (64). In aging adults, the burden of CAP is a greater concern when considering that the number of persons aged 60 years and above globally is projected to triple, from 673 million in 2005 to 2 billion by 2050(65). This will be most apparent in developed regions of the world, where this age group is projected to increase from 64% (2005) to 80% (2050) of the total population. The 50 least developed countries will realize more than 200% increase in their population, from 0.8 billion in 2007 to 1.7 billion by 2050 compared with developed regions, which are projected to remain stable at a population of 1.2 billion (65).

CAP was the second most frequent reason for hospital admission in Brazil in 2003 (66). A prospective study of 84 patients in five Latin American countries (Argentina, Brazil, Chile, Mexico and Uruguay) showed that 50-52.8% of CAP patients were admitted to hospitals (67). This high rate of hospitalization increased the economic burden of CAP through utilization of more expensive health care resources in contrasts with the rest of the world, where 80% of CAP patients are treated as outpatients (68). In a retrospective study in Argentina that assessed 436 patients admitted to 12 hospitals, 30% were admitted to the intensive care unit (ICU) (69). The clinical burden associated with CAP is in part related to its bacteremic and invasive potential. The clinical and economic burden of invasive pneumococcal disease (IPD) like CAP is particularly high in older adults. This is usually observed in more than 50 years old patients in the U.S. that it represent only 6% of all pneumococcal pneumonia. But the case fatality rate was 24.4% comparing to 9.7% for nonbacteremic pneumonia. Pneumococcal disease remains a substantial burden for American adults aged more than 50 years (70)

In Nigeria, community-acquired pneumonia (CAP) is a leading infectious disease requiring hospital admission, and it is a common cause of illness and death that constitutes a significant burden on health care resources (71). Although, data on the specific diseases that indicate reasons for admission to hospitals in Ethiopia and their outcomes is scarce, a study revealed that in Addis Ababa, Ethiopia mortality among admitted patients with CAP was found to be 11.5% (72).

Furthermore, the magnitude of community acquired pneumonia differs in different settings. Studies from Canada showed that the proportion of community acquired pneumonia was 63% (73). Likewise, a study conducted in 55 hospitals in Italy concluded that 61.6% of all pneumonia patients admitted in the hospitals had community-acquired pneumonia (74). Another study from Japanese community hospital revealed almost similar results of 62% of community acquired pneumonia among the total pneumonia patients (75). On the other hand, a study in USA showed lower proportion of CAP (32.6%) than reported from the studies mentioned above (76). However, there are no available literatures that show the level of community acquired pneumonia among hospital treated adults in Ethiopian and other sub-Saharan Africa countries.

2.2.2. Risk factors of Community-Acquired Pneumonia

In general, there are different factors identified in different countries as risks for the development of community acquired pneumonia albeit contradicting findings are documented. Different studies showed that the primary risk factor is age, specifically for children below 2 years old and adults 65 years and above. Findings of a study based on a nationwide database in Germany showed a clear relationship between age and hospital fatality rates for adult patients hospitalized with CAP (77). Another study showed that incidence of CAP is increased dramatically with aging, achieving the highest rate in people aged 85 years or more, where 29 cases per1,000 person-years were observed(78). According to sex and age strata, elderly men are at the greatest risk considering that one episode of CAP can be expected every year for every 25 people aged 85 years or older. Similar trends in the incidence rates stratified by age have been reported in most prior epidemiological studies, considering that the frequent association between increasing age and presence of underlying diseases accounts for a greater morbid-mortality due to CAP in the oldest adults . In a study of 30-days case-fatality rate, it was reported that CAP has a threefold increment among patients 85 years or older than in patients aged 65–74 years, which

supports the particularly important role of age as a predictor of 30-days mortality among patients with CAP (79).

A study in Finland showed that the incidence of CAP rose dramatically with age, with a six-fold increase in incidence between ages 30–44 & 75 years and above (80). In Portugal, case fatality rates were 4.5% for patients aged 18–50 years, 19.4% for those aged 50 years & above and 24.8% for those aged 75 years and above (81). A UK study reported case-fatality rates of 5.6% in those aged lower than 65 years and 47.2% for those aged 85 years and above. That study also found a 12-fold higher for death within 30 days of hospital admission for adults aged 85 years and above compared to those aged below 65 years (82);with the projected increase of those aged 65 years and above to 20% of the adult population in developed regions of the world by 2025 (83).

The incidence of primary medical condition such as chronic heart, lung (including asthma), renal and liver disease are reported to be risk factors for potential pneumococcal disease resulting in a poorer outcome (84). Cigarette smoking is reported to be the strongest independent risk factor for invasive pneumococcal disease in immune-compromised non-elderly adults (85). On the other hand, underlying malignancy, cardiovascular disease and smoking are believed to be risk factors for Gram-negative pneumonia (85).

Studies showed that modifiable risk factors such as smoking, high alcohol intake, underweight, living in a large household or having regular contact with children were associated with an increased risk of CAP (77). Smoking is an established risk factor for CAP, due to its adverse effects on the respiratory epithelium and the clearance of bacteria from the respiratory tract (86). Being underweight may predispose patients to CAP due to the consequences of under nutrition or underlying conditions on immune function (87). Regular contact with children has also been identified as a risk factor for CAP, possibly due to the high carriage of Streptococcus pneumoniae by children (88). Studies also reported that heart disease and history of diabetes as being risk factors for CAP (81, 89, 90,). However, other studies failed to conclude that history of diabetes and heart disease to be associated with CAP (90-93).

According to different studies globally, community acquired pneumonia is associated with upper repeated respiratory infections (81,89,91,94,95,96). Likewise, chronic bronchitis, diagnosed asthma and Pulmonary TB were identified as risk factors for community acquired pneumonia among adults (89-91,94). Findings also showed that patients with history of previous pneumonia confirmed by radiograph had higher risk of a subsequent community acquired pneumonia (90,91,96,97,98).

A different prototype of CAP as an acute respiratory infection has been recognized primarily in sub-Saharan Africa, where there is a high seroprevalence of HIV infection (99). Although the incidence of opportunistic infection in HIV-positive individuals decrease in industrialized countries following the initiation of antiretroviral therapy, the social and medical situation of HIV-infected persons in Sub-Saharan Africa remains unchanged (100). Thus the high HIV infection rate among patients with pneumonia on acute respiratory illness supports that HIV infection is an important risk factor (101). A study estimated that the proportion of bacterial pneumonia attributable to HIV in Sub-Saharan Africa is approximately 73% (102).

Concerning exposure to dusty environment, contradictory findings were reported from different countries. A hospital based study from Great Britain showed that working in a dusty environment as one of the major risk factors for the development of community acquired pneumonia (90). In contrary a recent community based study confirmed that working in a dusty environment is not a risk for community acquired pneumonia (89).

The risk factors observed among Malawian adults also included, alcohol abuse, cigarette smoking, and other use of biomass fuel(103). Cigarette smoking men and smoky cooking fuel in women are significantly related to a chronic cough in southern Africa (104).

2.3. Economic Burden of CAP

Pneumonia places a considerable burden on healthcare resources and society mainly due to hospitalization and loss of working days (105).It is well established that older adults carry a disproportionately higher epidemiologic burden of CAP than their younger counterparts, with increased incidence, hospitalization and mortality rates with advancing age (106). Given the strong correlation between older age and the presence of CAP, it is perhaps not surprising that the bulk of epidemiologic data focuses on older adults, and that there is a widely acknowledged

lack of contemporary information in the nonelderly adult population. Nonetheless, limited information is available on working-age adults in the United States (106).

Over the past several years, CAP has become a difficult condition to manage. Drugs used for the treatment of CAP are launching to get more awareness and are increasing gradually in quantity. Some new drugs emerge in the market for the treatments of CAP that are projected to become the prime cost contributors, as a result of its expected increased use. For those reasons, medications for the treatment of patients with CAP have to turn out to be a major concern for patients, including health insurance companies. Fortunately, much is recognized about CAP in the young and in the elderly populations that can allow further efficient healthcare strategies to be implemented in the working-age population. Further, it has been estimated that, in Europe, pneumonia direct costs (inpatient care, outpatient care, and drugs) account for €6.2 billion and indirect (working days lost) for €3.6 billion (107). A study also showed that CAP remains as under-recognized burden among employers, payers, healthcare providers and the nonelderly adult population (108).

In a study in the countries including Czech Republic, Hungary and Poland, hospitalization represents over 90% of the direct costs of treatment(109).Adults aged 65 years and above , who represent 41% of the combined population, account for 73% of the expenses. The costs per case remain relatively stable both for inpatient and outpatient of CAP across all age groups. By contrast, the overall cost of outpatient care declined with age since the incidence was steady and population sizes were larger in the younger groups (109).

The variability of indirect cost is explained principally by the length of stay (110), and there is a general agreement that a substantial number of patients with community-acquired pneumonia that could be treated as outpatients are hospitalized (111). A study indicated that 14% of hospital admissions could be avoided with a reduction in the total cost of community-acquired pneumonia attributable to hospitalized patient. Patients that are hospitalized for a shorter period of time may be associated with an increase in the number of readmissions. Thus, the cost of CAP expenditure will increase with readmission (112). Furthermore, readmission of patients diagnosed with CAP aged 65 years or older is associated with greater investment in the acute care setting (113). Readmission to hospital occurs when a patient returns to either the same or

different acute facility with a similar diagnosis (78).Readmission is costly both from the healthcare system and patient perspective (114).

Several studies have evaluated the economic burden of CAP on the elderly population, but data are scarce on the working –age population (108).A recent study from USA showed that CAP is a common and costly infection in the working-age population, especially in adults with comorbidities, with estimated social, direct and indirect cost of $8.5 billion and $2.1. Billion respectively (115).

Moreover, a study from Italy showed that the mean cost per episode of community acquired pneumonia (CAP) was Euro 1586 (116). Likewise a study from France revealed that the pooled cost of ambulatory and hospitalized patients was Euro 357.1 (117). Another study from New Zealand concluded that the annual cost (a societal perspective for the adult population aged 15 years and over) estimated to be 63 million Newzland's dollars, (direct medical costs of 29 million dollars; direct non-medical costs of 1 million dollars; lost productivity of 33 million dollars) (118). Similarly, a study from China confirmed that the median total hospital cost was US$556.50 (mean US$705.60) (119). Another study from USA showed that the mean cost of hospitalization per admission (excluding physician cost) was $US3490±3058 (median $US2430) (120).

2.4 Conceptual frame work

In order to show the link between determinant factors and CAP, a conceptual framework was developed based on findings of the literature review (Figure 1). The framework broadly explains the determinants of CAP and the link among them by classifying them in to four groups namely Socio-demographic factors, Health related factors, Environmental factors, Behavioural and Lifestyle factors.

Socio-demographic factors include age, sex, educational status, residence, marital status, occupation, number of people living with, income, height and weight.

Health related factors include Diabetes, cardiovascular problem, renal problem, mental problem, dental problem, Gastro intestinal problem, cancer and liver problem

Environmental factors include working and /or living environment, contact with children, pets, birds and animals

Lifestyle & behavioural factors include alcoholism, tobacco smoking and physical exercise

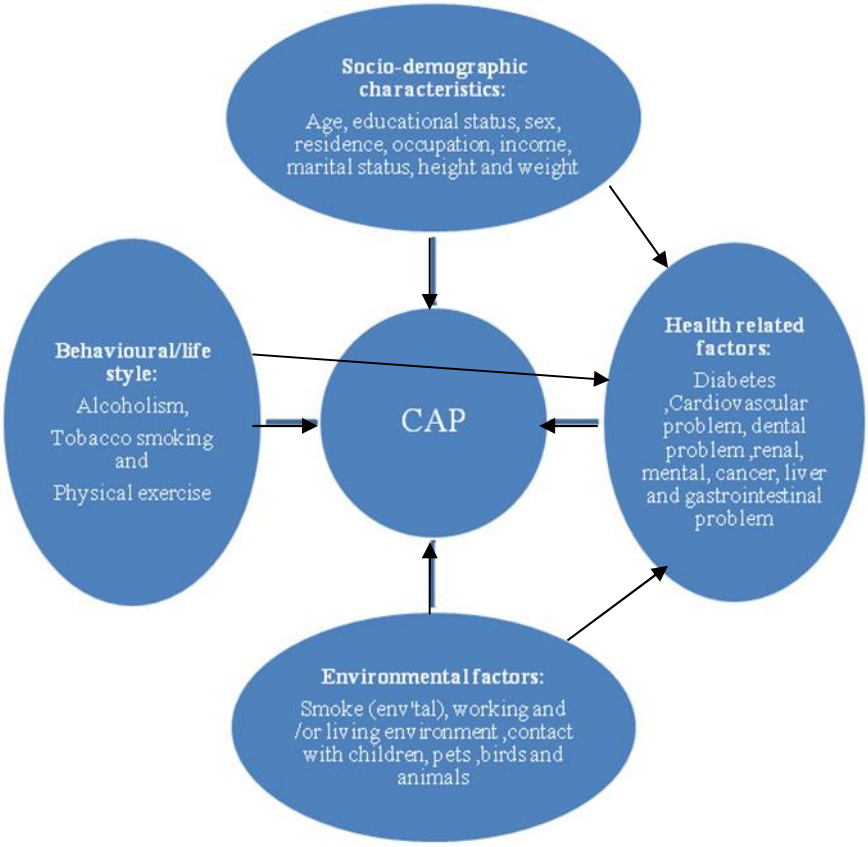

Figure -1- Conceptual frame work of the determinants of community acquired pneumonia (Developed by PI).

III. Objectives

3.1. General objective:

To assess the epidemiology of community acquired pneumonia among hospital treated adults in Tigray, Ethiopia.

3.2. Specific objectives

1. To determine the magnitude of community acquired pneumonia among hospital treated adults in Tigray

2. To identify risk factors of community acquired pneumonia among hospital treated adults in Tigray

3. To estimate the cost of illness of community acquired pneumonia among hospital treated adults in Tigray

IV. Material and Methods

4.1. Study Area:

The study was conducted in Tigray Region. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the Region has an estimated total population of 4,314,456, of whom 2,124,853 are males and 2,189,603 females; urban inhabitants account for 842,723 (19.53%) of the population. With an estimated area of 50,078.64 square kilometers, the region has an estimated population density of 86.15 people per square kilometer. For the entire Region 985,654 households were counted, which results in an average family size for the region of 4.4 persons to a household, with urban households having on average 3.4 and rural households 4.6 people. The Region is predominantly Tigrian people at 96.55% of the population; other ethnic groups include Amhara (1.63%), Irob or Saho (0.71%), Afar (0.29%), Agaw (0.19%), Oromo (0.17%), and Kunama people (0.07%). About 95.6% of the population are followers of the Ethiopian Orthodox Christianity, 4.0% Islam, 0.4% Roman Catholic and 0.1% P'ent'ay. There are 712 health posts, 201 health centres and 15 hospitals (6 zonal or general hospitals, 1 referral and the remaining are primary hospitals) in the Region. There are 3, 4, 77, 60, and 50 Hospitals, Health centres, Medium clinics, Primary clinics and Specialty clinics respectively owned by private and nongovernmental organizations (121,122). The study was conducted from August to October, 2016

4.2 Study Design

To determine the magnitude of community acquired pneumonia retrospective hospital based medical-record review was used.

To identify the risk factors of CAP unmatched case control study design was employed.

Cases- were patients of community acquired pneumonia (patients having a new pulmonary infiltrate on chest radiograph plus at least one of: cough, fever, leukocytosis, or leukopenia).

Controls- were patients without community acquired pneumonia that have been attending their treatments in the same hospitals with the cases in Tigray Region.

The cases and controls were ascertained by two internists in consultation with a radiologist after taking history of the patients and undergone necessary diagnostic procedures (Sputum, blood and X-ray examinations).

To estimate the cost of illness of the study, retrospective hospital based medical-record review was used.

4.3 Source and Study population

4.3.1 Source population

For Magnitude: All types of pneumonia patients that occurred in the period of July, 2013 to July, 2015 and got medical services in all zonal hospitals of Tigray and Ayder Tertiary Hospital were the source population.

For Risk factors: The source popultion for cases were both men and women patients with community acquired pneumonia who were 18 years and above, visited the zonal hospitals and Ayder Tertiary Hospital during the data collection period.

The source popultion for the controls were both men and women patients with out community acquired pneumonia who were 18 years and above, visited the zonal hospitals and Ayder tertiary Hospital during the data collection period to get medical services.

For Cost of illness: All community acquired pneumonia patients who had been treated in all zonal hospitals of Tigray and Ayder Tertiary Hospital between the period of july,2014 to July,2015 were the source population.

4.3.2 Study Population

For Magnitude: All community acquired pneumonia patients treated in the period of July, 2013 to July, 2015 in all zonal hospitals of Tigray and Ayder Tertiary Hospital.

For Risk factors: The study population for cases were sampled men and women patients with community acquired pneumonia who were 18 years and above, treated in the zonal hospitals and Ayder Tertiary Hospital during the data collection period. The study population for the controls were selected men and women patients without community acquired pneumonia who were 18

years and above, treated in the zonal hospitals and Ayder Tertiary Hospital during the data collection period.

For Cost of illness: All community acquired pneumonia patients who had been treated in all zonal hospitals of Tigray and Ayder Tertiary Hospital between the period of july,2014 to July,2015

4.3.3. Eigibiity criteria

4.3.3.1. Inclusion criteria

For magnitude**:** Charts of community acquired pneumonia patients that occurred during the period of July, 2013 to July, 2015 aged 18 years and above, treated in all zonal hospitals of Tigray and Ayder Tertiary Hospital were included in this study.

For case control**:** Patients with/without community acquired pneumonia aged 18 years and above of both sexes and had been on treatment during the data collection period in the government Zonal hospitals and Ayder Tertiary Hospital were included in the study.

For the cost: Charts of community acquired pneumonia patients that occurred during the period of July, 2014 to July, 2015 aged 18 years and above, treated in all zonal hospitals of Tigray and Ayder tertiary hospital were included in this study.

4.3.3.2. Exclusion criteria

For Magnitude**:** exclusion was done if the patients had history of hospital admission 14 days before their current visit to the hospitals, if the pneumonia was developed 48 hrs following admission, patients with tuberculosis (TB) or previous chest X-ray which may conflict with diagnosis of CAP, chronically debilitated patients, patients with lung cancer and asthma . Moreover, incomplete charts were also excluded.

For Risk factors**:** Patients who had history of hospital admission 14 days before the data collection period, patients who developed pneumonia 48hrs following admission, patients with tuberculosis (TB) or previous chest X-ray, which might conflict with diagnosis of CAP, chronically debilitated patients and patients with lung cancer and asthma were excluded from the study.

For cost**:** if the patients had history of hospital admission 14 days before their arrival in the hospitals, if the pneumonia was developed 48 hrs following admission, patients with tuberculosis (TB) or previous chest X-ray which may conflict with diagnosis of CAP, chronically debilitated patients, patients with lung cancer and asthma were excluded from the study. Moreover, incomplete charts were also excluded

4.3.4. Sample Size and Sampling Methods

4.3.4.1 Sample size determination

For the magnitude: considering 95% confidence interval, probability of 50% (as there is no similar research), and 3% precision, the sample size was calculated to be **1056** using the following single proportion formula.

$$N = \frac{z^2 p(1-p)}{d^2}$$

But finally all medical records (registers) of community acquired pneumonia cases that had been diagnosed and treated, in the period of July, 2013 to July, 2015 from the six zonal hospitals and Ayder Tertiary Hospital were included.

For the case control: Sample size was calculated using double population proportion formula with the assumptions of 26 % exposure in controls (considering smoking as a risk factor) and (123) (OR=2.0), power of 80%, a confidence interval of 95% and a ratio of cases to controls of two.Then, the required sample size was 120 cases and 240 controls.

For the cost study: considering 95% confidence interval, probability of 50% (as there is no similar research), and 3% precision, the sample size was calculated to be **1056** using the following single proportion formula.

$$N = \frac{z^2 p(1-p)}{d^2}$$

Finally, to estimate the cost of illness all medical records (registers) of community acquired pneumonia cases that had been diagnosed and treated during the period of July,2014 to July,2015 from the six zonal hospitals and Ayder Tertiary Hospital were included.

4.3.4.2 Sampling Methods

For Magnitude: all medical charts of CAP treated during the period of July,2013 to July,2015 were needed; First the eligible charts were identified then, reviewed from each study hospital.

For case control: cases were selected from CAP patients who came to the zonal hospitals and Ayder tertiary hospital for treatment, whose age was 18 years and above, who consented to participate in the study were selected for the interview and for diagnosis of CAP signs and other examinations. Similar procedure was followed in selecting the controls. Since the number of cases were rare all cases were included in the study until the required number was met and controls were selected through systematic sampling method after proportional allocation to each zonal hospital and Ayder Tertiary Hospital.

For the cost study: all medical charts of CAP treated during the period of July,2014 to July,2015 were needed; First the eligible charts were identified then reviewed from each hospital.

4.4 Data collection

4.4.1 Data collection tools

For magnitude: Data were collected using a checklist which was adapted from relevant literatures (73-76). Socio-demographic characteristics of the patients, diagnosis, treatment given and any other management provided were collected from the medical records in each hospital.

For risk factors: A semi-structured interviewer-administered questionnaire was adapted from different literatures (81, 84, 89-98). The questionnaire included structured information on the socio-demographic characteristics, life styles and habits, medical history and environmental conditions of both cases and controls. The questionnaire was prepared in English and translated into Tigrigna, and back-translated to English to ensure consistency in phrasing of questions.

For cost of illness: Data were collected using a checklist which was adapted from relevant literatures(116-120) to explore the socio-demographic characteristics of the patients, diagnosis, treatment given and cost of the illness.

4.4.2 Data collection procedures

Data collectors and supervisors were health care professionals (nurses and health officers). A total of 21 data collectors and 7 supervisors were enrolled. Intensive training was given for the data collectors and supervisors for three days on the objectives of the study, data collection tools and procedures to ensure consistency of interviewing and generation of high-quality data.

For magnitude: first all patient charts with CAP that fulfilled the case definition, in both sexes aged $\geq$ 18 years and patients who had been treated in that particular hospital were screened. Then all cards that fulfilled the eligibility criteria within the specified period were reviewed using the developed checklist.

For risk factors: first the required number of questionnaire were distributed to each hospital according to the calculated sample size and patients flow then data were collected using the questionnaire within two months period.

For cost: first all patient charts with CAP that fulfilled the case definition, in both sexes and aged $\geq$ 18 years and patients who had been treated in that particular hospital were screened. Then all cards that fulfilled the eligibility criteria within the specified period were reviewed using the developed checklist.

4.4.3 Variables of the study

For the magnitude: Socio-demographic variables (age, sex, economic status, educational status, marital status, etc) and clinical characteristics.

For the risk factors:

Outcome variable: Community acquired pneumonia

Exposure variables:

Socio-economic and demographic characteristics (age, sex, economic status, educational status, marital status, etc)

Life styles and habits (smoking, alcohol use, physical exercise, etc)

Environmental variables (living/working environment, history of contact with animals and birds, etc.)

Variables of medical history (diabetes, cardiovascular, dental, renal, mental, cancer, liver and gastrointestinal problems)

For the cost: Socio-demographic variables, clinical characteristics and cost of illness related variables (cost spent for drugs, hospital admissions, radiograph and laboratory etc)

4.5 Data management and Analysis

Once the data were collected it was handled confidentially, code book was prepared, the data were coded and double entered into Epi info 2002 on a daily basis. Data checking was done to verify the consistency and backups were saved. Data cleaning were conducted for errors.

Data analysis for the magnitude: after exporting the data from EPI INFO 2002 to SPSS Version 20 frequency distributions, proportions and measures of central tendency had been calculated.

Data analysis for the risk factors: after exporting the data from EPI INFO 2002 to SPSS Version 20 frequency tables and proportions were used to present the descriptive part of the results. In addition, the associations between the exposure and outcome variables were determined using bivariate and multivariable logistic regression analysis. Odds ratios with 95% confidence intervals and p-value were calculated to measure the strength of associations.

Data analysis for the cost was conducted using descriptive statistics, numerical summary measures, and simple linear regression analysis. The methods of cost estimation employed in this study included a bottom-up approach in order to estimate direct patient side medical cost of Community acquired pneumonia whereas the indirect cost was calculated in terms of productivity time losses (work days) due to hospitalization, using a human capital approach.

The direct costs estimated were medical costs, like diagnostics, medications and cost of hospitalization. Indirect costs were defined as work days lost due to the illness. The indirect cost

estimates constitute earnings lost because of hospital stay related to community acquired pneumonia.

Individual cost items were summed up to the categories of medical costs and lost income because of hospitalization. The total cost of community acquired pneumonia for each patient was calculated as the sum of the direct costs and the indirect costs. All costs were first calculated in Ethiopian Birr and then converted into US dollars.

4.6 Data quality Assurance

For the magnitude: To assure the quality of data/research pre-test was conducted on 10% of the total charts to evaluate the completeness and consistency of the checklist. Accordingly, appropriate modifications and adjustments were made. Data were collected using trained nurses/health officers, with at least some years of work experience on data collection and research with supervision. At the end of every data collection day, each questionnaire was examined and pertinent feedback was given to the data collectors and supervisors. Data entry were carried out by an experienced data entry clerk with close supervision by the principal investigator. Data cleaning were conducted exclusively by the principal investigator, and finalized check list was stored in a well secured cabinet.

For the case control: To assure the quality of the data/research the adapted questionnaire was prepared using a simple and easily understandable Tigrigna Language. Standardization on translation was given emphasis during training. Pre-test was conducted on 10% of study subjects to evaluate the completeness and consistency of the tools. Accordingly, appropriate modification and corrections were made. At the end of every data collection day, each questionnaire was examined and pertinent feedback was given to the data collectors and supervisors. Data entry were carried out by an experienced data entry clerk with close supervision by the principal investigator. Data cleaning were conducted out exclusively by the principal investigator, finalized questionnaires and the data were stored in a well secured cabinet.

For the cost: To assure the quality of the data/research pre-test was conducted on 10% of the total charts to evaluate the completeness and consistency of the checklist. Accordingly, appropriate modifications and adjustments were made. Data were collected using trained nurses/health officers with at least some years of work experience on data collection and research

with supervision. At the end of every data collection day, each questionnaire was examined and pertinent feedback was given to the data collectors and supervisors. Data entry were carried out by an experienced data entry clerk with close supervision by the principal investigator. Data cleaning was conducted exclusively by the principal investigator, and finalized check list was stored in a well secured cabinet.

4.7 Ethical Considerations

Ethical clearance was obtained from Institutional Review Board (IRB) of the Addis-Ababa University, College of Health Sciences. Letter of agreement was secured from Tigray Regional Health Bureau.

For the record review of the study, waiver of consent was obtained from IRB of AAU and additional consent was obtained from the hospital administrators after explaining the purpose of the study and they were informed that every patient record would be kept confidential at any time.

All documents used in this research were kept private and confidential (data were password protected and filled questionnaire and check lists were kept locked in a cabinet). No information other than for the purpose of this study was collected from the patients charts. Moreover, respondents were not identified by names or any other identifiers.

For the case control study: all participants were informed about the purpose of the study and individual written informed consent was solicited to the selected respondents at the time of data collection and examination, the data collectors and the principal investigator were blinded about the cases and controls of CAP, only the physicians in charge were aware because they were in charge of providing all necessary management in relation to CAP. Respondents were not identified by name; they were also informed that they had the right to participate, not to totally participate and to withdraw any time they like during the study. Furthermore, health education about prevention and treatment of CAP had been provided.

The beneficiaries of this research will be primarily CAP patients, the scientific society, the government, and the public in general.

V. Tabular Summary of the Methods Applied in the Dissertation

Table 1: Summary of methods based on objectives of the study

S/no	Objectives	Study design	Study subjects	Sample size utilized	Data collection tools	Data analysis
1	To determine the magnitude of CAP among hospital treated adults in Tigray,Ethiopia	A retrospective hospital based medical-record review	Medical records of community acquired pneumonia patients aged ≥ 18 years that occurred in the years July,2013 to July, 2015 in all zonal hospitals and Ayder Teritary Hospital	All Charts (5877)	Check list adapted from different literatures	Descriptive analysis (Frequency distributions , proportions and measures of central tendency)
2	To identify risk factors of CAP among hospital treated adults in Tigray,Ethiopia	A case control study design	Sampled men and women with/without Community acquired pneumonia, age ≥ 18 years and who had been treated at Ayder Teritary Hospital and all zonal hospitals of Tigray region.	360 (120 cases and 240 controls)	Semi structured Interviewer administered questionnaire (adapted from different literatures)	Descriptive analysis and logistic regression analysis (Bivariate and multi variable)
3	To estimate the cost of illness of CAP among	A retrospective hospital based	Medical records of community acquired	All charts (1174)	Check list adapted from	Descriptive analysis, Bottom-

	hospital treated adults in Tigray,Ethiopia	medical-record review	pneumonia patients, aged ≥ 18 years that occurred in the year July,2014-July,2015 in all the zonal hospitals and Ayder Teritary Hospital		different literatures	Up approach, human capital approaches and simple linear regression analysis

VI. Results (Review of Main Findings in the Manuscripts I–III)

In this section, main findings from the three manuscripts are outlined and reviewed.

Table 2: Summary of main findings from the three manuscripts

MS	Objective	Main findings
I	To determine the magnitude of CAP among hospital treated adults in Tigray,Ethiopia	• There were a total of 36,005 patients (20,764 males and 15,241 females) with all types of pneumonia treated during the study period (July, 2013 to July, 2015) in the six zonal hospitals and one teritiary hospital of Tigray regional state. • During the study, there were 5877 medical records of adult community acquired pneumonia cases • The proportion of community acquired pneumonia was 16%, with male to female ratio of 0.94 to 1 (16 and 17% for males and females, respectively). • Overall, patients treated at inpatient department accounted for 9.8%. • For the total 574 admitted patients due to community acquired pneumonia, the mean length of hospital stay was 6 days with SD of 5.59 days.
II	To identify risk factors of community acquired pneumonia among hospital treated adults	• Only 7(5.8%) of the cases and 12(5%) of the controls were current smokers of any tobacco products, such as cigarettes. • In the last 30 days, 18 of cases and 34 of controls consumed 2 glasses of alcohol drink on average in one drinking occasion • Only 15(12.5%) cases and 34(14.2%) controls were involved in

		vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate • Fifty one (42.5%) cases and 86(35.8%) controls were ever admitted in the last five years. • Twenty six (21.7%) cases and 43(18%) controls were ever bedridden for the last three months. • In the last one year, 71(59.2%) cases and 98(40.8%) controls had upper airway problem • Eighty five (70.1%) cases and 16(6.7%) of the controls had previous history of pneumonia confirmed by radiography • Seventy (58.3%) of the cases and 107 (44.6%) of the controls had a history of contact with pets, • Thirty two (26.7%) cases and 51(21.2%) controls had history of contact with birds. About 61% of the cases and 46% of the controls had been exposed to dusty environment • Only four of the variables, namely working in a dusty environment **[OR=2.0, 95% CI 1.1-4.1)]**, history of respiratory infection in the last year**[OR=2.5, 95% CI 1. 2-5.3]**, contact with people who had respiratory infection **[OR=2.3, 95% CI 1.5-5.7]** and previous history of pneumonia confirmed by radiograph **[OR=39, 95% CI 19.4-78.6]** had statistically significant association with CAP.

III	To estimate the cost of illness of CAP among hospital treated adults in Tigray,Ethiopia	• The mean hospital stay for participants treated at the inpatient department was 7.43 (±7.7) days**.** • The hospital bed occupancy rate for the admitted patients of community acquired pneumonia over the study year was 0.3% • The total amount of money incurred over the study year was 319,056.52 Ethiopian Birr ($15,193.2**)** • The mean cost of illness per episode of community acquired pneumonia was 168 Eth.Birr ($8) for out pts and 775 ($37) for in patients respectively. • About 76% (242889.60 Ethiopian Birr (US$11,566.20)) of the total money was attributed for direct medical expenditure • The work related cost lost by the patients because of the community acquired pneumonia was 76166.92 Eth B ($3627) • Using linear regression model, we obtained a regression equation **Y= 454.95X+22** indicating that for every single day increment in inpatient hospital stay there is an equivalent increment of ETB 22 ($1.05).

6.1. Magnitude of Community Acquired Pneumonia

There were a total of 36,005 patients (20764 males and 15241 females) aged 15 years and above with all types of pneumonia treated during the study period between July, 2013 and July, 2015 in the six zonal hospitals and one referral hospital of Tigray Regional State. In this study, a total of 6477 charts were registered on the health information management system of the study hospitals as community aquired pneumonia but 600 charts were excluded during the reviewing process because of misclassification and misdagnosis. Finally only 5877 medical records of adult community acquired pneumonia cases fulfilled the case definition for the study, making the proportion of community acquired pneumonia 16%, with male to female ratio of 0.94 to 1 (16 and 17% for males and females, respectively) (Table 3).

The mean age of community acquired pneumonia cases treated in all the study hospitals was 37.5 (±16.65) ranging from 18 to 92 years. Of the total patients aged below 65 years 504 (9.5%) were treated at inpatient department and 70 (12%) of patients aged 65 years and above were treated at the inpatient department.Atotal of 3322(56.5%) were males among which 399(11.8%) were treated at inpatient, while 181(7.1%) of females were inpatient. Farmers constitute higher proportion (51.5%) of the total cases of CAP, of whom 326(10.8%) were treated at inpatient. Overall 9.8 % of patients were treated at inpatient (Table 3).

Table 3. Socio-demographic characteristics of the study participants versus site of treatment, 2016 (n=5877)

Characteristics	Department patients treated		Total
	Inpatient No (%)	Outpatient No (%)	No (%)
Age			
Below 65	504 (9.5)	4789 (90.5)	5293 (90.1)
65 and above	70 (12.0)	514 (84.0)	584 (9.9)
Mean (SD)			37.5(±16.65)
Sex			
Male	393(11.8)	2929(88.2)	3322(56.5)
Female	181(7.1)	2374(92.9)	2555(43.5)
Occupation			
Farmer	326(10.8)	2703(89.2)	3029(51.5)
Student	121(8,5)	1297(91.5)	1420(24.2)
Civil Servant	44(6,7)	606(93.3)	653(11.1)
House wife	56(11.6)	428(88.4)	484(8.2)
Private employee	25(8.6)	266(91.4)	291(5.0)
Total No (%)	574(9.8)	4603(90.2)	5877

6.2. Clinical characterstics of the study participants

One thousand four hundred eleven (24%) community acquired pneumonia patients were treated in Adigrat hospital, of whom 91% were treated as outpatients. Higher proportion of cases were treated at the inpatient departments of Suhul and Kahsay Abera hospitals (29 and 18%, respectively) as compared to the other public hospitals which had less than 10% of inpatient treatments. Of the total 574 admitted patients due to community acquired pneumonia, the mean length of hospital stay was 6 days with SD of 5.59 days. **(Table_4)**.

Table 4. Clinical characteristics of the study participants versus site of treatment, 2016 (n=5877)

Characteristics	Department patients treated		Total
	Inpatient No (%)	Outpatient No (%)	No(%)
Treatment Hospital			
Adigrat	124 (8.8)	1287 (91.2)	1411 (24.0)
Ayder	47 (10.9)	385 (89.1)	432 (7.4)
Kahsay Abera	39 (18.4)	173 (81.6)	212 (3.6)
L.Karl	57 (6.3)	887 (83.7)	944 (16.1)
Mekelle Hospital	50 (4.0)	1269 (96.0)	1319 (22.4)
St.Marry	57 (6.5)	811 (93.5)	873 (14.9)
Suhul	200 (29.2)	486 (71.8)	686 (11.7)
Referal status			
Reffered	204 (61.8)	126 (38.2)	330 (5.6)
Not referred	370 (6.7)	5177 (93.3)	5547 (94.4)
Length of hospital stay			
1-6 Days	424(74)	1	
≥ 7 Days	150(26)		
Mean(SD)	6(±5.59)		
Total No (%)	574 (9.8)	4603(90.2)	5877

6.3. Risk factors of community acquired pneumonia

6.3.1. Community acquired pneumonia by Socio-demographic characteristics

Among the socio -demographic factors, age and education were significantly associated with CAP. The mean age of the cases and controls was 37.2 (±14.4) and 33.8(±13.6), respectively. Fifty six (46.7%) of the cases and 130 (54.2%) of the controls were males. Forty nine (40.8%) cases and 67(27.9%) controls had no formal education. One hundred eleven (92.5%) cases and 222(92.5 %) controls were Tegaru by ethnicity. One hundred twelve (50%) of the controls and 62(51.7%) cases were married. Forty seven (39.2%) of the cases and 88(36.7%) controls were self employed. Two or more persons sleep in one room in 43 (35.8%) of cases and 72(30%) of controls. Only one window was available in 86 (71.7%) of cases and 183(76.25%) controls. The mean BMI of the cases and controls was 20.99 (Min 12, Max 30) and 21.45(Min 15, Max 30) respectively (Table 5).

Table 5. Community Acquired Pneumonia by socio-demographic characteristics, 2016 (n=360)

Characteristics		Cases n=120(%), Mean(SD)	Controls n=240(%), Mean(SD)	COR[95%CI], t(df), p
Age	Uncategorized	37.2(14.4)	33.8(13.6)	t(358)= -2.2 **P=0.03**
Sex	Male Female	56(46.7) 64(53.3)	130(54.2) 110(45.8)	1.3(0.87,2.1) 1
Level of education	No formal education Educated	49(40.8) 71(59.2)	67(27.9) 173(72.1)	**1.8(1.1,2.8)** 1
Marital status	Never married Currently married Divorced Widowed	41(34.2) 62(51.7) 7(5.8) 10(8.3)	99(41.3) 120(50) 11(4.6) 10(4.2)	2.4(0.93, 6.23) 1.9(0.76, 4.89) 1.5(0.43, 5.71) 1
Number of people live in a household	One Greater than one	13(10.8) 107(89.2)	32(13.3) 208(86.7)	0.79(0.39,1.5) 1
Number of people use/sleep in a single room	One Two and above	17(14.2) 103(85.8)	49(20.4) 191(79.6)	0.64(0.35,1.2) 1
Number of windows in a room	No Yes	7(5.8) 113(94.2)	13(5.42) 227(94.58)	1.1(0.42, 2.8) 1
BMI	Uncategorized	20.99(2.965)	21.45(2.782)	t(358)= 1.5 P=0.15

6.3.2. Community acquired pneumonia by Life style and Habits

None of the life style or habit related variables were associated with CAP. Only 7(5.8%) of the cases and 12(5%) of the controls were current smokers of any tobacco products, such as cigarettes. All, 12(100%) of the smokers from the control group and 4 (57.1%) of the smokers from the case group smoke 1-9 cigarettes per day where as 3(42.9%) of the smokers from the cases did not know how many cigarette they smoke daily (Table-6).

Ninety two (76.7%) of the cases and 179(74.6%) of the controls ever consumed alcohol. Of the alcohol consumers, 41(44.5%) cases and 111(62%) controls consumed alcohol in the last thirty days,among whom 26 (63.4%) of cases and 59(53.1%) of controls consumed alcohol 1-3 days per month. In the last 30 days 18 of cases and 34 of controls consumed 2 glasses of alcohol drink on average in one drinking occasion. The largest alcohol intake they had in one occasion in the last 30 days was 3 and 5 by most cases and controls (Table 6).

Regarding involvement in vigorous-intensity activity, 32 (26.7%) cases and 68(28.3%) controls were involved in vigorous intensity activity.Twelve (37.5%) of the cases and 18(26.5%) of controls spent 5 days each in vigorous intensity activities, respectively (Table 6).

About half(49.5%) of the cases and 46.4% of the controls walk or use bicycles for at least 10 minutes continuously to get to and from places for seven days a week. Forty (36%) cases and 79(35.6%) controls spent in walking or using a bicycle for thirty minutes per day.

Only 15(12.5%) cases and 34(14.2%) controls were involved in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate. Six (40%) of those cases and 10(29.4%) controls were involved for 1 day per week. From the cases 4(26.7%) and controls 9(26.5%) were involved in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate for 30 minutes in a typical day (Table 6).

Table 6. Community Acquired Pneumonia by lifestyle and habits of study participants, 2016 (n=360)

Life style/Habit	Category	Cases n=120 (%)	Controls n=240 (%)	COR[95%CI]
Currently smoke tobacco product	Yes No	7(5.8) 113(94.2)	12(5) 228(95)	0.85(0.32,2.22) 1
Ever consumed alcohol drink	Yes No	92(76.7) 28(23.3)	179(74.6) 61(25.4)	0.89(0.53, 1.49) 1
Involve vigorous-intensity activity that causes large increases in breathing or heart rate	Yes No	32(26.7) 88(73.3)	68(28.3) 172(71.7)	1.08(0.66, 1.78) 1
Involve moderate-intensity activity, that causes small increases in breathing or heart rate	Yes No	42(35) 78(65)	85(35.4) 155(64.6)	1.02(0.64, 1.61) 1
Walk or use a bicycle (pedal cycle) for at least 10minutes continuously to get to and from places	Yes No	111(92.5) 9(7.5)	222(92.5) 18(7.5)	1.0(0.43, 2.29) 1
Do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate	Yes No	15(12.5) 105(87.5)	34(14.2) 206(85.8)	1.15(0.60, 2.22) 1
Do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate	Yes No	12(10) 108(90)	43(18) 197(82)	0.51(0.26, 1.0) 1

6.3.3. Community acquired pneumonia by Medical History

Among previous medical histories, history of upper airway problem, tonsillectomy, contact with persons who had respiratory infection, confirmed pneumonia and history of pulmonary tuberculosis were significantly associated with CAP. As shown in Table 7 , 51 (42.5%) cases and 86(35.8%) controls were ever admitted in the last five years. In addition, 26(21.7%) cases and 43(18%) controls were ever bedridden for the last three months. In the last one year, 71(59.2%) cases and 98(40.8%) controls had upper airway problem. Only 8(6.7%) cases and 5(2.1%) controls had history of tonsillectomy. None of the cases were vaccinated for influenza in the last year where as only 1(0.4%) control was vaccinated for influenza last year. In the last year, 59(49.2%) of the cases and 51(21.3%) of controls had any infection of the respiratory system. Thirty two (26.7%) cases and 29(12.1%) controls had history of contact with people who had respiratory infection. 85(70.1%) cases and 16(6.7%) of the controls had previous history of pneumonia confirmed by radiography (Table-7).

Table 7. Community Acquired Pneumonia by medical history of study participants, 2016(n=360)

History	Category	Cases n=120(%)	Controls n=240(%)	**COR[95%CI]**
Ever admitted in the last five years	Yes No	51(42.5) 69(57.7)	86(35.8) 154(64.2)	0.75(0.48,1.18) 1
Ever bedridden in the last three months	Yes No	26(21.7) 94(78.3)	43(18) 197(82)	0.78(.45, 1.36) 1
Had upper air way problem last year	Yes No	71(59.2) 49(40.8)	98(40.8) 142(59.2)	**2.1(1.3,3.3)**
Had history of tonsillectomy	Yes No	8(6.7) 112((93.3)	5(2.1) 235(97.9)	**3.4(1.1,10.5)** **1**
Had history of dental visit last month	Yes No	11(9.2) 109(90.8)	30(12.5) 210(87.5)	1.41 (0.68, 2.93) 1
Get vaccinated for influenza last year	Yes No	0(0) 120(100)	1(0.4) 239(99.6)	.0(0) 1
Get vaccinated for any respiratory infection last year	Yes No	2(1.7) 118(98.3)	6(2.5) 234(97.5)	0.6(0.1,3) 1
Had any respiratory infection last year	Yes No	59(49.2) 61(50.8)	51(21.3) 189(78.7)	**3.6 (2.2,5.8)** **1**
Had contact with people who had respiratory infection	Yes No	32(26.7) 88(73.3)	29(12.1) 211(87.9)	**2.6(1.5,4.6)** **1**
Previous history of pneumonia confirmed by radiograph	Yes No	85(70.8) 34(29.2)	16(6.7) 224(93.3)	**34(17.9,64.6)** **1**
History of diabetes	Yes No	8(6.7) 112(93.3)	18(7.5) 222(92.5)	1.13(0.48, 2.69) 1
History of cardiopathy	Yes No	9(7.5) 111(92.5)	23(9.6) 217(90.4)	1.3(0.58, 2.92) 1
History of chronic bronchitis	Yes No	4(3.3) 116(96.7)	13(5.4) 227(94.6)	0.6(0.2,1.9) 1
History of diagnosed asthma	Yes No	5(4.2) 115(95.8)	18(7.5) 222(92.5)	1.86(0.67,5.15**)** 1
History of pulmonary TB	Yes No	18(15) 102(85)	18(7.5) 222(92.5)	**2.2 (1.1,4.4)** **1**
History of gastric Diseases	Yes No	61(50.8) 59(49.2)	129(53.8) 111(46.2)	0.9(0.6,1.4) 1
History of CLD	Yes No	4(3.3) 116(96.6)	7(2.9) 233(97.1)	1.1(0.3,4.0) 1

6.3.4. Community acquired pneumonia by Environmental factors

History of contact with pets and history of working in dusty environments were significantly associated with CAP. Seventy (58.3%) of the cases and 107 (44.6%) of the controls had a history of contact with pets, while (26.7%) cases and 51(21.2%) controls had history of contact with birds. About 61% of the cases and 46% of the controls had been exposed to dusty environment (Table 8).

Table 8. Community Acquired Pneumonia by environmental factors of study participants, 2016(n=360)

Variable	**Category**	**Cases n=120(%)**	**Controls n=240(%)**	**COR[95%CI]**
History of contact with children	Yes No	93(77.5) 27(22.5)	175(73) 65(27)	1.2(0.8, 2.1) 1
History of contact with birds	Yes No	32(26.7) 88(73.3)	51(21.2) 189(78.8)	1.4(0.8, 2.2) 1
History of contact with Animals	Yes No	42(35) 78(65)	82(34.2) 158(65.8)	1(0.7, 1.6) 1
History of contact with pets	Yes No	70(58.3) 50(41.7)	107(44.6) 133(55.4)	**1.7(1.1, 2.7)** 1
History of working in a dusty environment	Yes No	73(60.8) 47(39.2)	111(46.3) 129(53.7)	**1.8(1.2,2.8)** 1
Cooking fuel	Electric stove Wood Electric, coal & wood Electric, coal& kerosene	16(13.3) 67(55.8) 1310.8) 24(20)	48(20) 118(49.2) 19(7.9) 55(22.9)	1 1.3(0.62,2.74) 0.76(0.43, 1.35) 0.64(0.27, 1.49)

In the final logistic regression model, we included variables that were significantly associated with CAP at the univariate analysis, and found that only four of the variables, namely working in a dusty environment, history of respiratory infection in the last year, contact with people who had respiratory infection and previous history of pneumonia confirmed by radiograph having statistically significant association with CAP. As shown in Table 9, the odds of developing community acquired pneumonia among those working in a dusty environment was two times higher as compared to their counterparts [OR=2.0, 95% CI **1.1-4.1)**], the odds of developing CAP among those who had history of contact with people who had respiratory infection was 2.5 times higher as compared to those who did not have history of contact [OR=2.5, 95% CI **1. 2-5.3**], those who had history of respiratory infection were about twice more likely to develop community acquired pneumonia than those who did not have the same history [OR=2.3, 95% CI **1.5-5.7**] and the odds of developing pneumonia among those who had history of pneumonia confirmed by radiography was 39 times higher compared to those who had not [OR=39, 95% CI **19.4-78.6**](Table 9)

Table 9. Potential risk factors for Community Acquired Pneumonia among the study participants, 2016 (n=360)

Variable	Category	Cases n=120(%)	Controls n=240(%)	AOR[95%CI]
Age	Uncategorized			0.9(0.9,1.0)
Educational level	No formal edu Educated	49(40.8) 71(59.2)	67(27.9) 173(72.1)	1.7(0.8,3.9) 1
Contact with pets	Yes No	70(58.3) 50(39.2)	107(44.6) 133(55.4)	1.3(0.7,2.4) 1
Working in dusty environment	Yes No	73(60.8) 47(39.2)	111(46.3) 129(53.7)	**2.0(1.1,4.1)** **1**
Had upper air way problem last year	Yes No	71(59.2) 49(40.8)	98(40.8) 142(59.2)	1.6(0.8,3.2) 1
Had history of tonsillectomy	Yes No	8(6.7) 112((93.3)	5(2.1) 235(97.9)	0.7(0.14, 3.3) 1
Had any respiratory infection last year	Yes No	59(49.2) 61(50.8)	51(21.3) 189(78.7)	**2.3(1.5,5.7)** **1**
Had contact with people who had respiratory infection	Yes No	32(26.7) 88(73.3)	29(12.1) 211(87.9)	**2.5(1.2,5.3)** **1**
History of pneumonia confirmed by radiograph	Yes No	85(70.8) 34(29.2)	16(6.7) 224(93.3)	**39(19.4,78.6)** **1**
History of pulmonary TB	Yes No	18(15) 102(85)	18(7.5) 222(92.5)	0.9(0.3,2.6) 1

6.4. Cost of illness among hospital treated adults

6.4.1 Socio-demographic and clinical characteristics

In this study, we reviewed one thousand and one hundred seventy four medical records of community acquired pneumonia adult patients treated in Tigray Zonal and tertiary hospitals. Two hundred twenty three (19%) and 951(81%) patients were treated at inpatient and outpatient departments, respectively. One hundred ninety one (17.8%) and 881(82.2%) patients treated at inpatient and outpatient departments, respectively were below the age of 65 years. From the total patients 663(56.5%) were males of whom 530(79.9%) were treated at outpatient department. One thousand and twenty eight patients (87.6%) were treated in the hospitals without being referred, of whom 147(14.3) patients were treated at inpatient department (Table 10).

Higher proportion (about 73.5%) of patients were treated at three zonal hospitals namely Suhul(27%), Adigrat (24%) and Mekelle (22.5%). Mekelle hospital had highest (60) number of patients treated at inpatient department while no patient had been treated at inpatient department of Ayder referral hospital. Moreover, the mean hospital stay for participants treated at the inpatient department was 7.4 ($\pm$7.7) (**Table-10).**

Furthermore, the hospital bed occupancy rate for the admitted patients of community acquired pneumonia over the study year was 0.3% ; there were a total of 1522 beds in the study hospitals and a total of 1657 inpatient days were observed.

Table 10. Socio-demographic and clinical characteristics of the study participants versus site of treatment, 2016 (n=1174)

Characteristics	Department patients treated		Total
	Inpatient No (%)	Outpatient No (%)	No (%)
Age			
Below65	191(17.8)	881(82.2)	1072(91.3)
65 and above	32 (31.4)	70(68.6)	102(8.7)
Sex			
Male	133(20.1)	530(79.9)	663(56.5)
Female	90(17.6)	421(82.4)	511(43.5)
Occupation			
Farmer	133(21.5)	485(78.5)	618(52.6)
Student	38(12.3)	270(87.7)	308(26.2)
Civil Servant	19(18.8)	82(81.2)	101(8.6)
House wife	15(15.5)	82(84.5)	97(8.3)
Private employee	18(36.0)	32(64.0)	50(4.3)
Referral Status			
Referred	76(52.1)	70(47.8)	146(12.4)
Not referred	147(14.3)	881(85.5)	1028(87.6)
Treatment Hospital			
Sihul	37(27.0)	100(73.0)	137(11.7)
St.Marry	21(12.1)	153(87.9)	174(14.8)
Kahsay Abera	21(50.0)	21(50.0)	42(3.6)
Adigrat	49(17.4)	233(82.6)	282(24)
Mekelle	60(22.7)	204(77.3)	264(22.5)
Ayder	0	86(100)	86(7.3)
Lemlem Karl	35(18.5)	154(81.5)	189(16.1)
Length of hospital stay			
7.4 days or lower	161(72.2)		
More than 7.4days	62(28)		
Mean(SD)	7.43 (7.7)		
Total	223(19.0)	951(81.0)	1174

6.4.2 Cost of treatment for community acquired pneumonia

The total amount of money incurred over the study year was 319,056.52 Birr ($15,193.2**)** with the mean cost per episode of community acquired pneumonia of 168($8) Birr for outpatients and 775 Birr ($37) for in patients, respectively. About 76% (242889.60(11,566.20)) of the money was attributed for direct medical expenditure of which 126,415.8(6,019.8) was incurred by outpatients and 116473.8 (5546.4) by the inpatients. The work related cost lost by the patients due to the community acquired pneumonia was 76166.92 Eth B ($3627) (Table-11).

Table 11. Cost of treatment among patients with community acquired pneumonia according to site of care, 2016(n=1174)

Expenditure category	**Inpatient EthB(USD)**	**Outpatient EthB(USD)**	**Sub Total**
Registration Fee	1554(74)	6430(306.2)	7984(380.2)
Bed stay	38634.75(1839.75)	-	38634.75(1839.75)
Blood Test	9804 (466.85)	22847.34(1087.96)	32651.34(1554.8)
Other Tests	1183(8.7)	2368.6(112.8)	3551.6(169)
X-Ray	11925(567.85)	32606.5(1552.7)	44531.5(2120.5)
Antibiotic	50361.24(2398.15)	60153.66(2864.46)	110514.9(5262.6)
Anti Pain	755.7 (36)	1105.5 (52.6)	1861.2(88.10)
Other drugs	2256.1(107.4)	904.2 (43)	3160.3(150.5)
Sub-total	116473.8 (5546.4)	126,415.8(6,019.8)	242889.60(11,566.20)
Grand total of patient side cost: Medical expenditure cost (242889.60(11,566.20)) **+ Loss of productivity cost** (76166.92 Eth B($3627)) = **319,056.52 Birr ($15,193.2)**			

Using simple linear regression model, we obtained a regression equation **Y= 454.95X+22** indicating that for every single day increment in inpatient hospital stay there is an equivalent increment of ETB 22 ($1.05).

Though the regression equation had a poor fit, describing only 28 % of the variance in total cost of illness due to community acquired pneumonia (R^2adj = 28%), the overall relationship helped us to understand whether the model that we used is appropriate to predict the cost for each inpatient hospital stay was statistically significant(F = 86 , p= 0.00).

VII. Discussion

This study was conducted for the first time in Ethiopia and other sub-Saharan Africa countries that attempted to assess the magnitude, risk factors and cost of illness among hospital treated adult patients (aged ≥18 years) of community acquired pneumonia in Tigray zonal and tertiary hospitals.

7.1. Magnitude of community acquired pneumonia

The mean age of the treated patients for CAP in the current study was 37.5 (±16.65) years , which is much lower than compared to studies conducted in Canada and Switzerland with mean ages of 64.4 years and 70.4 years respectively (73,124). Likewise, a study from Germany confirmed that the median age of community acquired pneumonia patients was 76 years (125). Similar study from USA concluded that the median age of CAP patients was 57 years (126). Moreover, another study from USA confirmed that the mean age of admitted patients with pneumonia was 58.9 years (76). This difference could be because of the small number of elderly adults participated in our study and higher proportion of elderly adults in the developed nations in general.

The proportion of community acquired pneumonia in our study was 16% (16 and 17% for males and females, respectively). Our finding was much lower than previously conducted studies. Studies conducted in Canada, Italy and Japan reported that the proportion of community acquired pneumonia ranging between 62 and 63% (73-75),while a study in USA among community acquired and health care associated pneumonia patients requiring hospital admission showed that the proportion of CAP was lower (32.6%) than the above reports (76).

The variation might be justified as the difference in environmental condition and diagnosis of community acquired pneumonia and b.c we didn't adjust age also.Moreover, it could be due to biological difference of the study participants where most of our participants were young, physically active, probably have better immunity and health.

In the current study, of all the community acquired pneumonia patients in the study years, only 9.8% patients have been treated as in patients with a mean hospitalization of 6 days, which was shorter than studies conducted in different countries. A study from Canada confirmed that the average length of hospitalization in community acquired pneumonia patients was 17 days, a study from British hospitals revealed that hospital stay in survivors of community acquired patients averaged 10.8 days (73,127). Likewise, study from Switzerland concluded that the mean

treatment duration of community acquired pneumonia patients was 12.1 days (124), However, the mean length of stay in our study was longer than a study conducted in one community and three university teaching hospitals in USA which showed that the adjusted inter hospital differences in mean length of stay ranged from 0.9 to 2.3 days (128). This difference could be explained by the difference of the severity of the problem,small number of our participants with comorbidity diseases and pathogenic difference of the admitted patients.On the other hand due to the low availability of beds admission rates which might differ from place to place in general and from hospital to hospital in particular.

7.2. Risk factors of community acquired pneumonia

This finding has showed no significant association between smoking and community acquired pneumonia, while other studies conducted in different countries reported that smoking as one risk factor for the development of community acquired pneumonia (89-91, 81,92,94,129). Perhaps only few (19) of our study participants reported to have been smokers which may be a small number to give a significant information.

Although, some studies have reported that alcohol consumption as being a risk factor for developing community acquired pneumonia (84,93,130), our study showed no significant association between alcohol consumption and CAP. Similar to the current study there are findings which indicated that alcohol consumption is not a risk factor for community acquired pneumonia (90, 91, 94, 129).This could be justified by difference in the number of users, type, amount and frequency of the alcohol consumption.

Having history of respiratory infections and contact with people who had respiratory infection were found to be risk factors for the development of community acquired pneumonia which was also reported by different studies globally (81,89, 91, 94- 96). Similar to previous findings our study showed that patients with history of pneumonia confirmed by radiograph had higher risk of a subsequent CAP (89, 91, 96, 97, 98).

In line with a study from Great Britain (90), working in a dusty environment was identified in our study as one of the major risk factors of community acquired pneumonia. However, contrary result was also reported by others (89). This dissimilarity could be because of different working environment, difference in the number of exposure and the nature of the dust.

History of diabetes and heart disease were not significantly associated with CAP in this study, which was also reported by many other studies (90-93), however**,** studies from different countries reported that heart disease and diabetes being significant risk factors for CAP (89,90,93). These differences may be due to that many of our respondents might have not known their status or not diagnosed for diabetes and heart diseases.

Chronic bronchitis, diagnosed asthma and Pulmonary TB were not associated with CAP in the current study, as was also reported by others (91, 92). Unlike this, findings showed that chronic bronchitis, diagnosed asthma and Pulmonary TB are risk factors for community acquired pneumonia among adults (89-91, 94).

Similar to a finding by Schnoor et al, contact with birds and pets were not significantly associated with community acquired pneumonia when adjusted for other variables in the current study(96), but Almirall et al reported that contact with birds and pets as being a risk factor for the development of community acquired pneumonia (89).

7.3. Cost of illness for community acquired pneumonia

This study attempted to address cost of illness of adult CAP patients which is rarely considered in Ethiopia and Africa by in large.

In the present study, it is confirmed that the total amount of money incurred over the study year was 319,056.52 Birr (\$15,193.2**)** and the mean cost of illness per episode of community acquired pneumonia was 168 Eth.Birr (\$8) for out pts and 775 (\$37) for in patients respectively which is much lower than a study from Italy that showed the mean cost per episode of CAP was Euro 1586 (116). Likewise, a study from France showed that the pooled cost of ambulatory and hospitalized patients was Euro 357.1 (117**).** The difference may be due to variations in prices of the treatment packages and resources used.

The mean direct medical expense per episode (of the patients) was 522.3 Ethiopian Birr ($25.9) for inpatients and 132.9 ($6.3) for outpatients. Our finding was not in line with studies from developed countries, such as a study from France revealed that the mean direct medical cost of a disease episode of CAP was EU 118.8 for strictly ambulatory patients with an equal weight for medical time, drugs, diagnostic procedures and tests. This direct cost was EU102.1 before admission for patients who were finally hospitalized. The mean cost of hospital admissions was EU 3522.9 **(**117**).** Another study from New Zealand concluded that the annual cost (of a societal perspective for the adult population aged 15 years and over) was estimated to be 63 million dollars, (direct medical costs of 29 million dollars; direct non-medical costs of 1 million dollars; lost productivity of 33 million dollars) **(**118**).** Furthermore, a study from USA showed that the mean cost of hospitalization per admission (excluding physician cost) was $US3490 ± $US3058 (median $US2430) **(**120**).** Likewise, a study from China confirmed that the median total hospital cost was $556.50 (mean $705.60) **(**119**).** The discrepancies could be because of differences in severity of the problem, length of the treatment, service consumption and price variations among the countries.

In the current study the mean working days lost due to CAP for the productive age group of inpatients (18-64years) was 7.43±7.7 days. As a result the mean amount of money incurred per episode due to work loss by the in patients and out patients was 256 Eth.Birr (US$12.2) and 34.4 (US$1.6) respectively. Our finding was much lower than the study from France which showed that the mean number of non-worked days was 10.8 (SD 8.0) for ambulatory patients and 31.0 (SD 27.2) days for patients who were hospitalized: the impact of the disease episode on productivity was EU 1980 (SD 1400) per ambulatory episode and EU 5425 (SD 4760) per episode leading to hospital admission **(**117**).**

From the total patients in this study, 72% undergone X-ray examination, 98.4% got medication prescription with the most common being antibiotics and 83.2% undergone laboratory tests. Unlike ours, a study from France showed that one hundred and seventy-two (19%) patients were managed without X-rays. White blood cell count was measured in 316 (36%) patients; C-reactive protein (CRP) and pro-calcitonin levels were respectively assessed in 314 (35%) and 13(1%) patients. Microbiological tests were rarely prescribed (1%), antibiotics were prescribed medications for most (94%) patients at the inclusion visit **(**117). Similarly, a study from Australia confirmed that at least one medication was prescribed (or provided) for 63% of pneumonia problems, with the most common being antibiotics. Imaging was requested for 29% of pneumonia contacts, with chest radiology (92%) the most common form. Pathology testing was sought for 10%, with chemistry, hematology and microbiology, the most common categories recorded **(**131). The variations could be because of the availability of different diagnostic options, knowledge & skill gap of the professionals and lack of standardized management guideline for community acquired pneumonia in our country.

Of the total direct medical expense, 47.6 % was used for medication, 18% for imaging (X-ray), 15% for laboratory, 16% for bed and 3% for registration which is different from a study conducted in USA that confirmed bed costs accounted for 55.6% of total costs, followed by laboratory (9.9%) and pharmacy (9.8%) costs **(**132**).** Another study from USA indicated that from the cost of hospitalization per admission (excluding physician cost) hospital room/board accounted for the largest percentage (83.7%), followed by laboratory (8.1%), antibacterial (4.6%), radiology (2.6%) and respiratory (0.9%) cost centers **(**120**).** Likewise, a study from Australia showed that of the total costs of community acquired pneumonia, 60% was used for medication and 23% for imaging cost **(**131**).** Similar study in China revealed that from the total hospital cost 48.9% was used for drugs, 21.9% for laboratory tests, 8.6% for radiology, 6.3% for hospital beds and 5.3% for examination **(**119**).** The explanation for the discrepancy could be because of differences in diagnostic and treatment standards among the countries.

VIII. Validity

In quantitative research, validity (internal validity) refers to ability to measure correctly what is supposed to measure (getting the true value). It needs the evaluation of chance, bias and confounding as alternative explanations for research findings.

In this dissertation, the role of chance was addressed by having adequate and representative samples to answer each specific objective. Its effect was also detected using the confidence intervals. In some of the categories of independent variables, small sample sizes were observed during multivariate analysis. In such situations, re-categorizing by merging or excluding very small categories were done.

Various actions, starting from questionnaire designing to data analysis, were taken to reduce the role of bias as alternative explanations for research findings. Use of questionnaires adapted from standard data collection instruments, use of educated and experienced data collectors, presence of intensive trainings and close supervision were among the major inputs to reduce interviewer and other measurement biases.

To control the effect of potential confounders for the case control study, Binary logistic regression was applied when assessing the associations.

Generalizability (external validity) refers whether results are applicable to other populations. Since the health care system organizations in the country are similar, the findings can reasonably be informative about the magnitude, risk factors and cost of illness for community acquired pneumonia in other health institutions of the country.

IX. Strengths and Limitations

This study had a number of strengths. First, in two of the study objectives the study utilized all medical records of patients who had been treated over the study years which gave us the true image of the target population and can avoid selection bias .Secondly, the strong side of this research is that the ascertainment of the cases and controls i.e similar procedures were undertaken to identify cases and controls by experienced physicians in fully equipped hospitals. Moreover, data collectors and supervisors were kept blinded from knowing who is a case and who is a control during interviewing the study participants.

There were also a number of limitations throughout the process of the study. The issue of incompleteness was one of the limitations of the medical record review design, but the potential limitation was minimized by cross checking the charts with electronic medical record. Besides, since the current study is hospital based, it might not be generalized to the whole community in the region and the country.

In addition, comparison of our findings with previous Ethiopian and/or other sub-saharan Africa countries data were not possible for there have been no studies examining the cost, magnitude and risk factors of community acquired pneumonia. Hence, some of the comparisons made with studies conducted in the advanced countries would be of limited value because of the difference in the categories of cost, the methods used, the pattern of health services utilization and the health care system.

Moreover, as the data collected to estimate the cost of illness were from medical records, all patient side expenses might not be recorded in the charts of the patients. Furthermore, direct non medical costs and care giver's costs were not studied. Hence, the cost of illness for the study might be under estimated.

Furthermore, the Adj.R^2 value for the linear regression was small (28%) which is because of that we didn't include multiple variables which could be one of the limitations of this study.Besides,since we used convenient sampling technique to select the cases of community acquired pneumonia (for the case control study) selection bias might have been introduced.

X. Conclusion

In conclusion, the current study revealed that the magnitude of community acquired pneumonia among adults in Tigray zonal and tertiary hospitals was 16%, Community acquired pneumonia was higher among younger population.

Working in dusty environment, history of pneumonia, history of respiratory infection and having contact with people who had respiratory infections are confirmed as the risk factors of community acquired pneumonia in the current study.

The cost incurred among adult patients of community acquired pneumonia in Tigray hospitals is significant. During the one year period, of the total cost incurred, 76 % was due to direct medical expense and 24 % was for non-worked days.

XI. Recommendation

Tigrai Regional Health Bureau/Federal Ministry of Health

- ✓ It is good if Prevention strategies for adults are introduced in the region/country.
- ✓ Management guideline has to be developed and uniformly used for the treatment of CAP.

Health care professionals

- ✓ Should provide health education on prevention and promotion strategies of CAP
- ✓ Should not undermine the prevalence of community acquired pneumonia and get appropriate trainings that enable them diagnose and manage the problem properly
- ✓ Whenever respiratory tract infections including pneumonia are occurred proper management should be given so that subsequent infections or complications would be minimized
- ✓ To minimize the risk of developing CAP, health professionals/health care institutions should promote the use of safety measures like PPE when there is contact with patients having respiratory tract infections including pneumonia.

Research institutions/ Researchers

- ✓ Larger prospective studies are needed:
- to minimize the problem and improve the prevention, promotion and treatment modalities
- to estimate the comprehensive cost of CAP illness
- to assess the effect of some risk factors in the general population

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Annex

Annex 1: Original Papers

Original Paper-One

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Magnitude ofCommunity AcquiredPneumonia amongHospital Treated AdultsinTigray,Ethiopia:AHospitalBased Retrospective Study

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Abstract

Background: Of thetotalrespiratory system infectionsworldwide,pneumoniaaccounts2-3%andcommunity-acquiredpneumoniatakesthemajorityalbeitlittleisknownabouttheproblemamongadultsinEthiopia.
Objective:Todeterminethemagnitudeofcommunity acquiredpneumoniaamonghospitaltreatedadultsin Tigray,Ethiopia.Methods: Aretrospectivepatientrecordreviewwasused.Chartsofallpneumoniapatients treatedfrom July,2013to June,2015inzonalandtertiary hospitalsofTigraywereincludedinthestudy. Data werecollectedusingachecklistandenteredintoEpiinfo2002andanalysedusingSPSSVersion20.Results: Duringthestudyperiod,therewere36,005patientsofalltypesofpneumonia&5877communityacquired pneumoniacases.Hence,themagnitudeofcommunityacquiredpneumoniawas16%,withproportionsformales (16%)andfemales(17%).Themean ageofthestudy participantswas37.5 (±16.65).Theproportionofadmitted patientsduetocommunityacquiredpneumoniawas9.8%with amean admissionlength of6(±5.59) days.Conclusion: Thestudyrevealedthatthemagnitudeofcommunityacquiredpneumoniaamongthestudy participants inthestudy areawassignificant andmostprevalent amongyoungerpopulation.Hence,prevention strategiesshouldbedesignedandimplementedtominimizetheproblem.
Keywords: Magnitude,CAP,Adults,Tigray,Ethiopia

Introduction

Respiratorysysteminfectionsarewidelyspreadaroundtheworld,accountingfor25%ofthetotalnumberof physicianconsultations,ofwhichpneumoniaaccountsfor2-3%;andmajority ofthesearecasesofcommunity-acquiredpneumonia(RossiGPetal,1998).Itsestimatedincidencevariesbetweencountriesandby ageand gender. In theUnitedStatesalone,4million adults areaffectedeachyearofwhich 20%needhospitalizationfor management(DeshpandeA,2012).

Community-acquiredpneumonia(CAP)isanacutediseasewhich representsacommon causeof hospitaladmission andmortality indevelopedanddevelopingcountriesandhenceconsumesagreatproportion ofhealthcarebudgets((CDC,2003),(JokinenJ, ScottJA,2010)).

Themagnitude ofcommunity acquiredpneumonia differs in differentcountries.Resultsfrom Canada showedthatthe proportion ofcommunity acquiredpneumoniawas 63%(ChowC etal,1995).Likewise,astudy conductedin55hospitalsin Italyconcludedthat61.6%of allpneumoniapatientsadmittedinthehospitalshad community-acquiredpneumonia(MarioVendittietal,2009).Anotherstudyfrom Japanesecommunityhospital revealedalmostsimilarresults of 62%of communityacquiredpneumoniaamongthetotalpneumoniapatients (YuichiroShindo etal.2009).On theotherhand,astudy inUSAshowed lower proportionofCAP(32.6%) than reportedfromthestudiesmentionedabove(ScottT.Miceketal.2007).However,therearenoavailableliterature thatshowsthelevelofcommunityacquiredpneumoniaamonghospitaltreatedadultsinEthiopianandothersub-SaharanAfricacountries.

Thus,theaim ofthisstudywastodeterminethemagnitudeofcommunityacquiredpneumoniaamong hospitaltreatedadultsof18 yearsandaboveinTigray,Ethiopiathatcanbeimportantfordecisionsofprevention, treatmentandpromotion.

Methods

Institutionalbasedmedicalrecordsreviewwasconductedin Tigrayregion.Theregionhasanestimatedtotal populationof 4,314,456, of which 2,124,853 malesand2,189,603females.Theregion is predominantly of Tigrianethinicgroup accountingfor96.55% of thepopulation.About 95.6% of thepopulation arefollowersof EthiopianOrthodox Christianity.Thereare 712health posts,201healthcentresand15hospitals (6zonalor generalhospitals,onereferralandtheremainingareprimary hospitals)intheregion((CSA,2007), (FMoH,2007)).

Allpneumoniapatientsthatoccurredduringtheperiod July,2013andJune,2015aged18yearsand abovetreatedin allzonalhospitals of TigrayandAyderreferralhospitalwereincludedin thisstudy.If pneumoniawasnotthemain reasonforadmission,ifthepatientshadhistoryofhospitaladmissioninthelast 14

days,ifthepneumoniawasdeveloped48hrsfollowingadmission,patientswithtuberculosis(TB)orprevious chestX-raywhichmayconflictwithdiagnosisofCAP,chronicallydebilitatedpatients,patientswithlungcancer andasthmawereexcludedfromthestudy.

Datawerecollectedusingachecklistwhichwasadaptedfrom relevantliteratures.Socio-demographic characteristicsofthepatients,diagnosis,treatmentgiven andany othermanagement providedwerecollected fromthemedicalrecordsineachhospital.

A totalof 21datacollectorsand7supervisors(nursesandhealth officers)wererecruitedfordata collection. Trainingwasgiven forthedatacollectorsandsupervisorsforthreedays on theobjectiveof thestudy, datacollectionchecklistandproceduretoensureconsistencyofthedatacollectionandhigh-qualitydata.

Oncethe datawas collecteditwas handledconfidentially,coded,anddoubleenteredintoEpi info2002. Datacheckingwasdonetoverifytheconsistencyand backup was saved.Datacleaningwasconductedforerrors andimplausiblevalues andexported toSPSSVersion20.Frequency distributions,proportionsandmeasuresof centraltendencyhadbeencalculated.

Pre-testwasconductedon10%ofthetotalchartstoevaluatethecompletenessandconsistency of the checklist.Accordingly,appropriatemodifications andadjustmentswasmade.Datawascollectedusing trained nurses/health officerswith atleastsomeyears ofworkexperienceon datacollectionandresearchwith supervision.Attheendofeverydatacollectiondayeachquestionnairewasexaminedandpertinentfeedback wasgiventothedatacollectorsandsupervisors.Dataentrywascarriedoutby anexperienceddataentry clerk withclosesupervisionbythe principalinvestigator.Data cleaningwasconductedout exclusivelybythe principalinvestigator,and finalizedchecklist was storedinawell securedcabinet.

Ethicalclearancewasobtainedfrom InstitutionalReviewBoardofAddis-AbabaUniversity,Collegeof HealthSciences.LetterofagreementwassecuredfromTigrayregionalhealthbureau.andadditionalconsent wasobtainedfromthe hospitaladministratorsafterexplainingthepurposeofthe study.

Anydocumentused inthisresearchwas keptprivateandconfidential(datawaspasswordprotectedand filledchecklistwaskeptlockedinacabinet).Noinformationotherthanforthepurposeofthisstudywas collectedfromthepatients'charts.

Results

Therewereatotalof36,005 patients(20764 malesand15241females)aged15yearsandabovewithalltypes ofpneumoniatreatedduring thestudy periodbetween July,2013andJune,2015inthesixzonalhospitalsand onereferralhospitalofTigray regionalstate.Inthisstudy,wereviewed5877medicalrecordsofadult communityacquiredpneumoniacases,makingtheproportionofcommunityacquiredpneumonia16%,with maletofemaleratioof 0.94to1 (16and17%formalesandfemales,respectively).Themeanageof community acquiredpneumoniacases treated inthehospitalswas37.5(±16.65)rangingfrom18 to92years.Five hundredfour(9.5%)ofthepatientstreatedatinpatientdepartmentwereagedbelow 65yearsandofthepatients treatedasinpatient,70(12%)wereabove65yearsold.About3322(56.5%)weremalesamongwhich 393(11.8%)wereinpatients.About3029(51.5%)werefarmers,ofwhom326(10.8%)treatedattheinpatient department.Overall,patientstreatedatinpatientdepartmentaccountedfor9.8%(Table1).

Table 1. Socio-demographic characteristics of the study participants versus site of treatment, 2016 (n=5877)

Characteristics	Departmentpatientstreated		Total No(%)
	Inpatient No(%)	Outpatient No(%)	
Age			
Below65	504 (9.5)	4789(90.5)	5293(90.1)
65andabove	70(12.0)	514 (84.0)	584 (9.9)
Mean(SD)			37.5(±16.65)
Sex			
Male	393(11.8)	2929(88.2)	3322(56.5)
Female	181(7.1)	2374(92.9)	2555(43.5)
Occupation			
Farmer	326(10.8)	2703(89.2)	3029(51.5)
StudentCivil	121(8,5)	1297(91.5)	1420(24.2)
ServantHousewif	44(6,7)	606(93.3)	653(11.1)
ePrivateemployee	56(11.6)	428(88.4)	484(8.2)
	25(8.6)	266(91.4)	291(5.0)
TotalNo(%)	574(9.8)	4603(90.2)	5877

Onethousandfourhundredeleven(24%)communityacquiredpneumoniapatientsweretreatedin Adigrathospital,ofwhom91%weretreatedasoutpatients.Higherproportionofcasesweretreatedatthe

inpatient departmentsofSuhulandKahsayAberahospitals(29and18%, respectively)ascomparedtotheother publichospitalswhichhadlessthan10%ofinpatienttreatments.Forthetotal574admittedpatientsdueto communityacquiredpneumonia,themeanlengthof hospitalstaywas6 days withSDof 5.59days.(Table_2). Table2. Clinicalcharacteristicsofthestudyparticipantsversussiteoftreatment,2016(n=5877)

Characteristics	Departmentpatientstreated		Total No(%)
	Inpatient No(%)	Outpatient No(%)	
TreatmentHospital			
Adigrat	124 (8.8)	1287(91.2)	1411(24.0)
AyderKahsay	47(10.9)	385 (89.1)	432 (7.4)
AberaL.Karl	39(18.4)	173 (81.6)	212 (3.6)
MekelleHospital	57(6.3)	887 (83.7)	944 (16.1)
St.MarrySuhul	50(4.0)	1269(96.0)	1319(22.4)
	57(6.5)	811 (93.5)	873 (14.9)
	200 (29.2)	486 (71.8)	686 (11.7)
Referalstatus			
Reffered	204(61.8)	126(38.2)	330(5.6)
Notreferred	370(6.7)	5177(93.3)	5547(94.4)
Lengthofhospitalstay			
1-6Days	424(74)	1	
≥7 Days	150(26)		
Mean(SD)	6(±5.59)		
Total No(%)	574(9.8)	4603(90.2)	5877

Discussion

Thisstudyattemptedtoassessthemagnitudeofcommunityacquiredpneumoniaamonghospitaltreatedadults (aged≥18years)inTigrayzonalandtertiaryhospitals.

Themean ageof thetreatedpatients forCAPin thecurrentstudy was 37.5 (±16.65) years ,which is muchlowerthancomparedtostudiesconductedinCanadaandSwitzerlandwithmeanagesof 64.4yearsand 70.4years respectively((ChowCetal,1995),(GarbinoJetal,2002)).Likewise,astudyfrom Germany confirmed thatthemedianageofcommunity acquiredpneumoniapatientswas76years(SEwigetal,2009).Similarstudy from USAconcludedthatthemedian ageofCAPpatientswas57years(S.Jainetal.2015).Moreover,another studyfromUSAconfirmedthatthemeanageofadmittedpatientswithpneumoniawas58.9years(ScottT. Miceketal.2007).Thisdifferencecouldbebecauseofthesmallnumberof elderlyadultsparticipatedinour studyandhigherproportionofelderlyadultsinthedevelopednations ingeneral.

Theproportion of community acquiredpneumonia in ourstudy was 16% (16and17%formalesand females,respectively).Ourfindingwasmuchlowerthanpreviously conductedresearches. Studiesconductedin Canada, Italy andJapanreportedthattheproportionofcommunityacquiredpneumoniarangingbetween62and 63%((Chow Cetal,1995),(MarioVendittietal,2009),(YuichiroShindoetal.2009)),whileastudyinUSA among community acquired andhealth careassociatedpneumoniapatientsrequiringhospitaladmissionshowedthatthe proportion of CAPwaslower(32.6%)thantheabovereports (ScottT. Miceketal.2007). Thevariationmight be justifiedasthedifferenceinprevalence/distributionand/ordifferenceinthediagnosisofcommunityacquired pneumonia.

Inthecurrentstudy,ofallthecommunity acquiredpneumoniapatientsin thestudyyears,only 9.8% patientshavebeentreatedasin patientswithameanhospitalizationof 6days,whichwas shorterthanstudies conductedindifferentcountries.Astudyfrom Canadaconfirmedthattheaveragelengthofhospitalization in communityacquiredpneumoniapatientswas17days,astudyfromBritishhospitalsrevealedthathospitalstay insurvivorsofcommunityacquiredpatientsaveraged10.8 days((Chow Cetal,1995),(BTS,1982)). Likewise, studyfrom Switzerlandconcludedthatthemeantreatmentdurationofcommunityacquiredpneumoniapatients was12.1days(GarbinoJetal,2002),However,themeanlemgthofstay inourstudywaslongerthanastudy conductedinonecommunityandthreeuniversityteachinghospitalsinUSAwhichshowed thattheadjusted inter hospitaldifferencesinmeanlengthof stayrangedfrom0.9to2.3days(DannyMcCormicketal,1999).This differencecouldbeexplainedby thedifferenceoftheseverity oftheproblem andpathogenicdifferenceofthe admittedpatients.Ontheotherhandduetothelowavailabilityofbedsadmission ratesmightdifferfromplace toplaceingeneraland fromhospitalto hospitalinparticular.

Inconclusion,thestudyrevealedthatthemagnitudeofcommunityacquiredpneumoniaamongadults in Tigrayzonalandtertiaryhospitalswas16%,Community acquiredpneumoniawashigheramongyounger population.Healthcareprofessionalsshouldnotunderminetheprevalenceofcommunityacquiredpneumonia

andgetappropriatetrainingsthatenablethem diagnoseandmanagetheproblem properly.Moreover,prevention strategies likehealth education and immunization shouldbedesignedand implementedtominimizethe magnitudeofcommunityacquiredpneumoniaamongadultsinTigray,Ethiopia.

Abbreviations
CAP:CommunityAcquiredPneumonia,EDHS,Ethiopiandemographichealthsurvey,
SPSS,statisticalpackageforsocialscience,TB-Tuberculosis,

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Competinginterests
Theauthorsdeclarethat we havenocompetinginterests.

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Original Paper-Two

RISK FACTORS OF COMMUNITY ACQUIRED PNEUMONIA AMONG ADULTS IN TIGRAY, ETHIOPIA: A CASE CONTROL STUDY,

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Abstract

Background : Community acquired pneumonia is a worldwide major health problem that varies among countries. Though several studies have been conducted to determine its risk factors they have been clearly established in middle aged or elderly people. Hence, little is known on the risk factors among adults globally including Ethiopia.

Objective: To identify risk factors of community acquired pneumonia among adults treated in Tigray hospitals, Ethiopia

Methods : A case control study was conducted on 120 cases and 240 controls in Tigray region, north Ethiopia. Cases were patients with community acquired pneumonia while controls were patients without the problem. A structured questionnaire was used to collect the data and entered using EPI Info version 2002 and exported to SPSS version 20. Associations between the exposure and outcome variables were determined using bivariate and multivariable logistic regression analysis. Odds ratios with 95% confidence interval were calculated to measure the strength of associations.

Result: History of contact with pets, working in dusty environment, history of pulmonary tuberculosis, history of pneumonia, having contact with people who had respiratory infection, history of respiratory infection, history of tonsillectomy, history of upper airway problem, age and educational status had significant association with community acquired pneumonia in the bivariable analysis While working in dusty environment [OR (95% CI);2(1.1,4.1)], history of respiratory infection [OR (95% CI); 2.3(1.5,5.7)] , contact with people who had respiratory infection [OR (95% CI);2.5(1.2,5.3)] and previous history of pneumonia confirmed by radiograph [OR (95% CI); 39(19.4,78,6)] were significantly associated in the multivariate analysis.

Conclusion: Working in dusty environment, having history of pneumonia, history of respiratory infection and having contact with people who had respiratory infections are the risk factors of community acquired pneumonia confirmed in this study. Hence much has to be done to prevent and properly treat the problem.

Key words: Community acquired pneumonia, risk factors, adults, Tigray, Ethiopia

Introduction

Community acquired pneumonia (CAP) is a worldwide major health problem that is associated with considerable morbidity and mortality. It is a global problem with multi facet of risks and outcomes. A study in Finland showed that the incidence of CAP rose dramatically with age, with a six-fold increase in incidence between ages 30–44 years and ≥75 years(1).

Studies conducted in different countries globally showed that smoking is a risk factor for the development of community acquired pneumonia (**2-8)**. Some findings confirmed that alcohol is a risk factor for the development of community acquired pneumonia (8,9**,**10), But also other studies showed that alcohol is not a risk factor for the development of community acquired pneumonia (2,3,6,7).

Concerning exposure to dusty environment, contradictory findings were reported fro different studies. A hospital based study from Great Britain showed that working in a dusty environment as one of the major risk factors for the development of community acquired pneumonia(3). In contrary a recent community based study confirmed that working in a dusty environment is not a risk for community acquired pneumonia (5).

Studies from different countries reported that heart disease and history of diabetes as being risk factors for CAP **(3,5,8)**. However, other studies failed to conclude that history of diabetes and heart disease to be associated with CAP (2**,**3, 4,9).

According to different studies globally, community acquired pneumonia is associated with upper repeated respiratory infections (2,5,6,8,11,12). Likewise, Chronic bronchitis, diagnosed asthma and Pulmonary TB were identified in different studies as risk factors for community acquired pneumonia among adults (2**,3,5,6**). Studies also showed that patients with history of Previous pneumonia confirmed by radiograph had higher risk of a subsequent community acquired pneumonia (2**, 5,13,14,12**).

In summary, contradicting findings are documented concerning the risk factors of CAP. Besides there is no available literature on risk factors of community acquired pneumonia generally in all age groups and specifically among adults aged 18 years and above in Ethiopia. Thus, the aim of this research was to identify the potential risk factors of community acquired pneumonia among adults in Tigray, Ethiopia.

Methods

The study was conducted in Tigray region. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the region has an estimated total population of 4,314,456 (2,124,853 males and 2,189,603 females), urban inhabitants account, 842,723 (19.53%) of the population. With an estimated area of 50,078.64 square kilometers, the region has an estimated population density of 86.15 people per square kilometer. The region is predominantly Tegaru people at 96.55% of the population; other ethnic groups include Amhara (1.63%), Irob or Saho (0.71%), Afar (0.29%), Agaw (0.19%), Oromo (0.17%), and Kunama (0.07%). About 95.6% of the population are followers of Ethiopian Orthodox Christian, 4.0% Islam, 0.4% Roman Catholic and 0.1% P'ent'ay. In the region there are 712 health posts, 201 health centres and 15 hospitals (6 Zonal or general hospitals, one referral/tertiary and the remaining are primary hospitals). There are 3, 4, 77, 60, and 50 Hospitals, Health centres, Medium clinics, Primary clinics and Specialty clinic respectively owned by private and nongovernmental organizations (15 and 16).

Cases were patients of community acquired pneumonia (having a new pulmonary infiltrate on chest radiograph plus at least one of cough, fever, leukocytosis, or leukopenia). The cases were labelled by two internists in consultation with radiologists after taking history of the patients and undergone necessary diagnostic procedures (Sputum, blood and X-ray examinations). Controls were patients who visited the hospitals for any other reason but without community acquired pneumonia.

All CAP patients aged 18 years and above in both sexes and had been on treatment during the data collection period in the government Zonal hospitals and Ayder referral hospital were included in the study. Patients who had history of hospital admission 14 days before the data collection period, patients who developed pneumonia 48hrs following admission, patients with tuberculosis (TB) or previous chest X-ray which might conflict with diagnosis of CAP,

chronically debilitated patients and patients with lung cancer and asthma were excluded from the study.

The sample size for the study was calculated using two proportion formula. Assuming 26% exposure to smoking has twice risk (OR=2) for CAP (17), with power of 80% and significance level of 5%, a case control ratio of 1 to 2, the required sample size was 120 cases and 240 controls.

A semi-structured interviewer-administered questionnaire was adapted from different literatures. The questionnaire included structured information on the socio-demographic characteristics, life styles and habits, medical history and environmental conditions of both cases and controls. The questionnaire was prepared in English and translated into Tigrigna, and back-translated to ensure consistency in phrasing of questions.

Data collectors and supervisors were Nurses and health officers. Training was given for the data collectors and supervisors for three days on the objective of the study, data collection tools and procedures to ensure consistency of interviewing and high-quality data.

Once the data were collected,it was handled confidentially, code book was prepared, the data were coded, and be double entered into Epi info 2002 on a daily basis. Data checking were done to verify the consistency and backups were saved. Data cleaning were conducted for errors and implausible values that might result from incorrect reading, incorrect reporting, incorrect filling, and incorrect sensing, incorrect coding, and incorrect typing.

After cleaning the data, frequency tables, graphs and proportions were used to present the results. In addition, the associations between the exposure and outcome variables were determined using bivariable and multivariate logistic regression analysis.Odds ratios with 95% confidence intervals and p-value were calculated to measure the strength of associations.

To assure the quality of the data/research the adapted questionnaire and check list was prepared using a simple and easily understandable Tigrigna language. Standardization on translation was given emphasis during training. Pre-test was conducted on 10% study subjects to evaluate the completeness and consistency of the tools. Accordingly, appropriate modification and corrections were made. At the end of every data collection day each questionnaire was examined and pertinent feedback was given to the data collectors and supervisor. Data entry was carried

out by an experienced data entry clerk with close supervision by the principal investigator. Data cleaning was conducted out exclusively by the principal investigator, and finalized questionnaires/check lists and the data were stored in a well secured cabinet.

Ethical clearance was obtained from Institutional Review Board (IRB) of the Addis-Ababa University, College of Health Sciences. Letter of agreement was secured from Tigray regional health bureau. All participants were informed about the purpose of the study and individual written informed consent was solicited from the selected respondents at the time of data collection, the data collectors and the principal investigator were blinded about the cases and controls of CAP, only the physicians in charge were aware because they were to provide all necessary management in relation to CAP. Respondents were not identified by name; they were also informed that they had the right to participate, totally not to participate and to withdraw any time they like during the study. Furthermore, health education about prevention and treatment of CAP had been provided. The beneficiaries of this research will be primarily CAP patients, the scientific society, the government, and the public in general.

Results

CAP by Socio-demographic characteristics factors

Among the socio -demographic factors, age and education were significantly associated with CAP. The mean age of the cases and controls was 37.2 (±14.4) and 33.8(±13.6) respectively. Fifty six (46.7%) of the cases and 130 (54.2%) of the controls were males. Forty nine (40.8%) cases and 67(27.9%) controls had no formal education. One hundred eleven (92.5%) cases and 222(92.5 %) controls were Tegaru by ethnicity. One hundred twelve (50%) of the controls and 62(51.7%) cases were married. Forty seven (39.2%) of the cases and 88(36.7%) controls were self employed. Two or more persons sleep in one room in 43 (35.8%) of cases and 72(30%) of controls. Only one window was available in 86 (71.7%) of cases and 183(76.25%) controls. The mean BMI of the cases and controls was 20.99 (Min 12, Max 30) and 21.45(Min 15, Max 30) respectively (Table 1).

Table 1. Community Acquired Pneumonia by socio-demographic characteristics of study participants, 2016(n=360)

Characteristics		Cases n=120(%), Mean(SD)	Controls n=240(%), Mean(SD)	COR[95%CI], t(df), p
Age	Uncategorized	37.2(14.4)	33.8(13.6)	t(358)= -2.2 **P=0.03**
Sex	Male Female	56(46.7) 64(53.3)	130(54.2) 110(45.8)	1.3(0.87,2.1) 1
Level of education	No formal education Educated	49(40.8) 71(59.2)	67(27.9) 173(72.1)	**1.8(1.1,2.8)** 1
Marital status	Never married Currently married Divorced Widowed	41(34.2) 62(51.7) 7(5.8) 10(8.3)	99(41.3) 120(50) 11(4.6) 10(4.2)	2.4(0.93, 6.23) 1.9(0.76, 4.89) 1.5(0.43, 5.71) 1
Number of people live in a household	One Greater than one	13(10.8) 107(89.2)	32(13.3) 208(86.7)	0.79(0.39,1.5) 1

Number of people use/sleep in a single room	One Two and above	17(14.2) 103(85.8)	49(20.4) 191(79.6)	0.64(0.35,1.2) 1
Number of windows in a room	No Yes	7(5.8) 113(94.2)	13(5.42) 227(94.58)	1.1(0.42, 2.8) 1
BMI	Uncategorized	20.99(2.965)	21.45(2.782)	t(358)= 1.5 P=0.15

CAP by Life style and Habits

None of the life style or habit variables were associated with CAP. Only 7(5.8%) of the cases and 12(5%) of the controls were current smokers of any tobacco products, such as cigarettes. All, 12(100%) of the smokers from the control group and 4 (57.1%) of the smokers from the case group smoke 1-9 cigarettes per day where as 3(42.9%) of the smokers from the cases did not know how many cigarette they smoke daily (Table-2).

Ninety two (76.7%) of the cases and 179(74.6%) of the controls ever consumed alcohol. From the alcohol consumers, 41(44.5%) cases and 111(62%) controls consumed alcohol in the last thirty days. Among this 26 (63.4%) of cases and 59(53.1%) of controls consumed alcohol 1-3 days per month. In the last 30 days 18(43.9%) of cases and 34(30.6 %) of controls consumed 2 glasses of alcohol drink on average in one drinking occasion. The largest alcohol intake they had in one occasion in the last 30 days was 3 and 5 by most cases and controls (Table 2).

Regarding involvement in vigorous-intensity activity,32(26.7%) cases and 68(28.3%) controls were involved in vigorous intensity activity.Twelve(37.5%) of the cases and 18(26.5%) of controls spent 5 days each in vigorous intensity activities, respectively.

About half(49.5%) of the cases and 46.4% of the controls walk or use bicycles for at least 10 minutes continuously to get to and from places for seven days a week. Forty (36%) cases and 79(35.6%) controls spent in walking or using a bicycle for thirty minutes per day.

Only 15(12.5%) cases and 34(14.2%) controls were involved in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate. Six (40%)

of those cases and 10(29.4%) controls were involved for 1 day per week. From the cases 4(26.7%) and controls 9(26.5%) were involved in vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate for 30 minutes in a typical day (Table 2).

Table 2. Community Acquired Pneumonia by lifestyle and habits of of study participants, 2016(n=360)

Life style/Habit	**category**	**Cases n=120 (%)**	**Controls n=240 (%)**	**COR[95%CI]**
Currently smoke tobacco product	Yes No	7(5.8) 113(94.2)	12(5) 228(95)	0.85(0.32,2.22) 1
Ever consumed alcohol drink	Yes No	92(76.7) 28(23.3)	179(74.6) 61(25.4)	0.89(0.53, 1.49) 1
Involve vigorous-intensity activity that causes large increases in breathing or heart rate	Yes No	32(26.7) 88(73.3)	68(28.3) 172(71.7)	1.08(0.66, 1.78) 1
involve moderate-intensity activity, that causes small increases in breathing or heart rate	Yes No	42(35) 78(65)	85(35.4) 155(64.6)	1.02(0.64, 1.61) 1
Walk or use a bicycle (pedal cycle) for at least 10minutes continuously to get to and from places	Yes No	111(92.5) 9(7.5)	222(92.5) 18(7.5)	1.0(0.43, 2.29) 1
Do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate	Yes No	15(12.5) 105(87.5)	34(14.2) 206(85.8)	1.15(0.60, 2.22) 1
Do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate	Yes No	12(10) 108(90)	43(18) 197(82)	0.51(0.26, 1.0) 1

CAP by Medical History

Among previous medical histories, history of upper airway problem, tonsillectomy, contact with persons who had respiratory infection, confirmed pneumonia and history of pulmonary tuberculosis were significantly associated with CAP. As shown in Table 3, 51 (42.5%) cases and 86(35.8%) controls were ever admitted in the last five years. In addition, 26(21.7%) cases and 43(18%) controls were ever bedridden for the last three months. In the last one year, 71(59.2%) cases and 98(40.8%) controls had upper airway problem. Only 8(6.7%) cases and 5(2.1%) controls had history of tonsillectomy. None of the cases were vaccinated for influenza in the last year where as only 1(0.4%) control was vaccinated for influenza last year. In the last year, 59(49.2%) of the cases and 51(21.3%) of controls had any infection of the respiratory system. Thirty two (26.7%) cases and 29(12.1%) controls had history of contact with people who had respiratory infection. 85(70.1%) cases and 16(6.7%) of the controls had previous history of pneumonia confirmed by radiography. (Table-3)

Table 3. Community Acquired Pneumonia by medical history of study participants, 2016(n=360)

History	Category	Cases n=120(%)	Controls n=240(%)	**COR[95%CI]**
Ever admitted in the last five years	Yes No	51(42.5) 69(57.7)	86(35.8) 154(64.2)	0.75(0.48,1.18) 1
Ever bedridden in the last three months	Yes No	26(21.7) 94(78.3)	43(18) 197(82)	0.78(.45, 1.36) 1
Had upper air way problem last year	Yes No	71(59.2) 49(40.8)	98(40.8) 142(59.2)	**2.1(1.3,3.3)**
Had history of tonsillectomy	Yes No	8(6.7) 112((93.3)	5(2.1) 235(97.9)	**3.4(1.1,10.5)** **1**
Had history of dental visit last month	Yes No	11(9.2) 109(90.8)	30(12.5) 210(87.5)	1.41 (0.68, 2.93) 1
Get vaccinated for influenza last year	Yes No	0(0) 120(100)	1(0.4) 239(99.6)	.0(.0,) 1
Get vaccinated for any respiratory infection last year	Yes No	2(1.7) 118(98.3)	6(2.5) 234(97.5)	0.6(0.1,3) 1
Had any respiratory infection last year	Yes No	59(49.2) 61(50.8)	51(21.3) 189(78.7)	**3.6 (2.2,5.8)** **1**

Had contact with people who had respiratory infection	Yes No	32(26.7) 88(73.3)	29(12.1) 211(87.9)	**2.6(1.5,4.6)** **1**
Previous history of pneumonia confirmed by radiograph	Yes No	85(70.8) 34(29.2)	16(6.7) 224(93.3)	**34(17.9,64.6)** **1**
History of diabetes	Yes No	8(6.7) 112(93.3)	18(7.5) 222(92.5)	1.13(0.48, 2.69) 1
History of cardiopathy	Yes No	9(7.5) 111(92.5)	23(9.6) 217(90.4)	1.3(0.58, 2.92) 1
History of chronic bronchitis	Yes No	4(3.3) 116(96.7)	13(5.4) 227(94.6)	0.6(0.2,1.9) 1
History of diagnosed asthma	Yes No	5(4.2) 115(95.8)	18(7.5) 222(92.5)	1.86(0.67,5.15**)** 1
History of pulmonary TB	Yes No	18(15) 102(85)	18(7.5) 222(92.5)	**2.2 (1.1,4.4)** **1**
History of gastric Diseases	Yes No	61(50.8) 59(49.2)	129(53.8) 111(46.2)	0.9(0.6,1.4) 1
History of CLD	Yes No	4(3.3) 116(96.6)	7(2.9) 233(97.1)	1.1(0.3,4.0) 1

CAP by Environmental factors

History of contact with pets and history of working in dusty environments were significantly associated with CAP. Seventy (58.3%) of the cases and 107 (44.6%) of the controls had a history of contact with pets, while (26.7%) cases and 51(21.2%) controls had history of contact with birds. About 61% of the cases and 46% of the controls had been exposed to dusty environment (Table 4).

Table 4 Community Acquired Pneumonia by environmental factors of study participants, 2016(n=360)

Variable	Category	Cases n=120(%)	Controls n=240(%)	COR[95%CI]
History of contact with children	Yes No	93(77.5) 27(22.5)	175(73) 65(27)	1.2(0.8, 2.1) 1
History of contact with birds	Yes No	32(26.7) 88(73.3)	51(21.2) 189(78.8)	1.4(0.8, 2.2) 1
History of contact with Animals	Yes No	42(35) 78(65)	82(34.2) 158(65.8)	1(0.7, 1.6) 1
History of contact with pets	Yes No	70(58.3) 50(41.7)	107(44.6) 133(55.4)	**1.7(1.1, 2.7)** 1
History of working in a dusty environment	Yes No	73(60.8) 47(39.2)	111(46.3) 129(53.7)	**1.8(1.2,2.8)** 1
Cooking fuel	Electric stove Wood Electric, coal & wood Electric, coal& kerosene	16(13.3) 67(55.8) 1310.8) 24(20)	48(20) 118(49.2) 19(7.9) 55(22.9)	1 1.3(0.62,2.74) 0.76(0.43, 1.35) 0.64(0.27, 1.49)

In the final logistic regression model, we included variables that were significantly associated with CAP at the univariate analysis, and found that only four of the variables, namely working in a dusty environment, history of respiratory infection in the last year, contact with people who had respiratory infection and previous history of pneumonia confirmed by radiograph having statistically significant association with CAP. As shown in Table 5, the odds of developing community acquired pneumonia among those working in a dusty environment was two times higher as compared to their counterparts [OR=2.0, 95% CI **1.1-4.1)**], the odds of developing CAP among those who had history of contact with people who had respiratory infection was 2.5 times higher as compared to those who did not have history of contact [OR=2.5, 95% CI **1. 2-5.3**], those who had history of respiratory infection were about twice more likely to develop community acquired pneumonia than those who did not have the same history [OR=2.3, 95% CI **1.5-5.7**] and the odds of developing pneumonia among those who had history of pneumonia confirmed by radiography was 39 times higher compared to those who had not [OR=39, 95% CI **19.4-78.6**](Table 5)

Table 5. Potential risk factors for Community Acquired Pneumonia among study participants, 2016(n=360)

Variable	category	Cases n=120(%)	Controls n=240(%)	AOR[95%CI]
Age	Uncategorized			0.9(0.9,1.0)
Educational level	No formal edu Educated	49(40.8) 71(59.2)	67(27.9) 173(72.1)	1.7(0.8,3.9) 1
Contact with pets	Yes No	70(58.3) 50(39.2)	107(44.6) 133(55.4)	1.3(0.7,2.4) 1
Working in dusty environment	Yes No	73(60.8) 47(39.2)	111(46.3) 129(53.7)	**2.0(1.1,4.1)** **1**
Had upper air way problem last year	Yes No	71(59.2) 49(40.8)	98(40.8) 142(59.2)	1.6(0.8,3.2) 1
Had history of tonsillectomy	Yes No	8(6.7) 112((93.3)	5(2.1) 235(97.9)	0.7(0.14, 3.3) 1
Had any respiratory infection last year	Yes No	59(49.2) 61(50.8)	51(21.3) 189(78.7)	**2.3(1.5,5.7)** **1**
Had contact with people who had respiratory infection	Yes No	32(26.7) 88(73.3)	29(12.1) 211(87.9)	**2.5(1.2,5.3)** **1**
History of pneumonia confirmed by radiograph	Yes No	85(70.8) 34(29.2)	16(6.7) 224(93.3)	**39(19.4,78.6)** **1**
History of pulmonary TB	Yes No	18(15) 102(85)	18(7.5) 222(92.5)	0.9(0.3,2.6) 1

Discussion

The study has attempted to determine potential risk factors for Community Acquired Pneumonia in the hospital setting of Tigray region in Ethiopia.
Our finding showed no significant association between smoking and community acquired pneumonia, while other studies conducted in different countries reported that smoking as one risk factor for the development of community acquired pneumonia (2-8). Perhaps only few (19) of our study participants reported to have been smokers which may be a small number to give a significant information.

Although, some studies have reported that alcohol consumption as being a risk factor for developing CAP (8-10), our study showed no significant association between alcohol consumption and CAP. Similar to our study there are findings revealed alcohol consumption is not a risk factor for community acquired pneumonia (2,3,6,7). This could be justified by difference in the type, amount and frequency of the alcohol consumption.

Having history of respiratory infections and contact with people who had respiratory infection were found to be risk factors for the development of community acquired pneumonia which was also reported by different studies globally (2,5,6,8,11,12). Similar to previous findings our study showed that patients with history of pneumonia confirmed by radiograph had higher risk of a subsequent CAP (2,5,12-14).

In line with a study from Great Britain (3), working in a dusty environment was identified in our study as one of the major risk factors of community acquired pneumonia. However, contrary results were also reported by others (5). This dissimilarity could be because of different working environment, difference in exposure and the nature of the dust.

History of diabetes and heart disease were not significantly associated with CAP in this study, which was also reported by many other studies (2,3, 9, 4), however, other studies from different countries reported that heart disease and diabetes being significant risk factors for CAP (3,5, 8). These differences may be due to that many of our respondents might have not known their status or not diagnosed for diabetes and heart diseases.

Chronic bronchitis, diagnosed asthma and Pulmonary TB were not associated with CAP in the current study as was also reported by others (2,4). Unlike to this, findings showed that chronic bronchitis, diagnosed asthma and Pulmonary TB are risk factors for community acquired pneumonia among adults (2,3,5,6).

Similar to a finding by Schnoor et al, contact with birds and pets were not significantly associated with CAP when adjusted by other variables in the current study(12) but Almirall et al reported that contact with birds and pets as being a risk factor for the development of CAP (5).

Since the current study is hospital based it might not be generalized to the whole community in the region. In addition there might be selection bias as the cases in the study had been enrolled continuously until the required sample size was met.

In conclusion working in dusty environment, history of pneumonia, history of respiratory infection and having contact with people who had respiratory infections are confirmed as the risk factors of community acquired pneumonia in the current study.

Hence, much has to be done to prevent community acquired pneumonia through health education and awareness raising interventions. On the other hand, to minimize the risk of developing community acquired pneumonia safety measures like personal protective equipments should be used when there is contact with patients having respiratory tract infections. Whenever respiratory tract infections including pneumonia are occurred proper management using standardized treatment guideline should be given so that subsequent infections or complications would be minimized . Moreover, Larger studies are also needed to assess the effect of some risk factors in the general population.

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Competing interests

The authors declare that we have no competing interests.

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Original Paper-Three

Cost of illness among hospital treated adults for community acquired pneumonia in Tigray, Ethiopia.

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Abstract

Background: Albeit pneumonia incurs a considerable burden on healthcare resources much is not known yet about the cost of illness among hospital treated adult patients globally and in Ethiopia specifically.

Objective: To estimate the cost of illness of community acquired pneumonia among hospital treated adults in Tigray

Methods: The study was conducted in Tigray region, north Ethiopia. A retrospective patient record review was used. Medical records of 1174 patients that had been diagnosed and treated for community acquired pneumonia between July, 2014-July, 2015 at zonal hospitals and Ayder referral hospital were reviewed. Cost of illness was estimated from individual database after developing a check list. Descriptive analysis and linear regression was performed using SPSS Version 20 statistical program.

Result: The total amount of money incurred over the study year was 319,056.52 **Ethiopian** Birr (**\$**15,193.2**)** of which the direct medical expenditure was 242889.60 Ethiopian Birr (US\$11,566.20) and the cost of lost working days by the patients due to community acquired pneumonia was 76166.92 Ethiopian Birr (\$3627). From the cost of direct medical expense, 47.6 % was used for medication, 18% for imaging (X-ray), 15% for laboratory, 16% for bed and 3% for registration.

Conclusion: The cost of illness among adult patients of community acquired pneumonia in the study area was substantially high. Of the total cost incurred, 76 % was due to direct medical expense and 24 % for the lost working days. Appropriate prevention strategies should be implemented so that the magnitude would be minimized and terminally the treatment cost incur by community acquired pneumonia will be reduced.

Key Words: Cost,CAP,Adults,Tigray

Introduction

Pneumonia is a disease in the lungs and it is a common cause of infection related to the mortality that challenges most of health care providers and the community (1).

Community-acquired pneumonia (CAP) is an acute disease which represents a common cause of hospital admission and mortality in developed and developing countries and hence consumes a great proportion of health care budgets (2).

A study in Italy reported that the number of physician consultation accounts for 25% due to respiratory system infections. Pneumonia accounts for 2-3%, of which the majority of these cases are community-acquired pneumonia (3). In the United States, 4 million adults are affected each year of which 20% need hospitalization for management (4). Furthermore, about 50,000 adults in the US die from Pneumonia disease every year (5). In the united kingdom around 220,000 people receive diagnosis of pneumonia each year and 28,952 deaths occurred from pneumonia in 2012 (5.1 per cent of all deaths and 25.3 per cent of deaths from lung disease) **(**6)

Pneumonia is a common cause of hospitalization and mortality in adults in Latin America. A population weighted average incidence of hospitalized pneumonia in persons over 50 years of age was 519.6 hospitalizations per 100 000 person years, with an average fatality rate of 19.0 per 100 hospitalizations, representing 436,402 hospitalizations and 82,852 deaths in 2009. Extrapolating forward to 2020, with a projected adult population of 1.49 billion, pneumonia could account for up to 617,993 hospitalizations and 112,680 deaths in a single year (7).

Pneumonia ranks among the top three diagnoses in hospital admissions in sub-Saharan Africa (8) and the fifth largest killer in South Africa, accounting for 3.9% of all deaths (9). Likewise, CAP is the leading cause of hospitalization and mortality among adult patients accounting for 10% in Kenya (2), 11.9% in Nigeria (10), 8.3% in Botswana, and 51,000 admissions per year with 10,000 deaths per year in Malawi (11).

Pneumonia is a huge burden on healthcare systems. As reported by a study in the US, Pneumonia expenses accounted for $16.2 billion in 2013 only (12).Likewise, in Europe, pneumonia costs nearly € 10.1 billion annually (13). Community acquired pneumonia has an effect towards the

patient's recovery to return to a full range of daily activity of about 7 to 43 days. However, the length of stay in the hospitals is variable primarily affecting the cost of care (14).

A study from Spain revealed that the cost of inpatient care for community-acquired pneumonia was € 1,553, whereas the mean cost of treating pneumonia in outpatient was € 196 (15). Another study reported that hospitalization represents over 90% of the direct costs of treatment in Czech Republic, Hungary, Poland and Slovakia in which adults aged 65 years and above accounting for 73% of the costs (16).

A study from Italy showed that the mean cost per episode of community acquired pneumonia was Euro 1586 **(**17**).** Likewise a study from France revealed that the pooled cost of ambulatory and hospitalized patients was Euro 357.1 **(**18**).** Another study from New Zealand concluded that the annual cost of (a societal perspective for the adult population aged 15 years and over) was estimated to be 63 million Newzland's dollars, (direct medical costs of 29 million dollars; direct non-medical costs of 1 million dollars; lost productivity of 33 million dollars) **(**19**).** Similarly, a study from China confirmed that the median total hospital cost was US$556.50 (mean US$705.60) **(**20**).** Another study from USA showed that the mean cost of hospitalization per admission (excluding physician cost) was $US3490±3058 (median $US2430) (21). Two recent studies showed that CAP is common and costly infection in working age population in USA, specially, adults with co-morbidities, with estimated national direct and indirect cost of US$8.5 billion and US$2.1 billion, respectively. Despite the data, CAP remains as under recognized burden among employers, payers, healthcare providers, and the nonelderly adult population **(22).**

In a study by Tichopad Mail et. al., in countries including Czech Republic, Hungary and Poland hospitalization represents over 90% of the direct costs of treatment. Adults aged 65 and above, who represent 41% of the combined population, account for 73% of the costs. The costs per case remain relatively stable both for inpatient and outpatient of CAP across all age groups. By

contrast, the overall cost of outpatient care declined with age since the incidence was generally steady and population sizes were larger in the younger groups **(**16**).**

However there is no available literature that shows the cost of hospital expenditure regarding CAP in Ethiopia and other sub-Saharan Africa countries. Hence, the aim of this research was to estimate the cost of illness of community acquired pneumonia among hospital treated adults in Tigray, Ethiopia.

Methods

The study was conducted in Tigray region. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the region has an estimated total population of 4,314,456, of whom 2,124,853 males and 2,189,603 females; urban inhabitants account for 842,723 (19.53%) of the population. With an estimated area of 50,078.64 square kms, the region has an estimated density of 86.15 people per square km. The region is predominantly Tigrian people at 96.55% of the population. About 95.6% of the population are followers of Ethiopian Orthodox Christianity. There are 712 health posts, 201 health centres and 15 hospitals (six zonal or general hospitals, one referral and the remaining are primary hospitals) in the region. There are 3, 4, 77, 60, and 50 Hospitals, Health centres, Medium clinics, Primary clinics and Specialty clinics, respectively owned by private and nongovernmental organizations (23, 24).

Hospital based medical-record review design was used. All community acquired pneumonia patients who had been treated in all zonal hospitals of Tigray and Ayder referral hospital between the periods July, 2014-July, 2015 were the source population.

All complete medical records of CAP patients aged 18 years and above were included in the study. Exclusion was done if the patients had history of hospital admission 14 days before their

arrival in the hospitals, if the pneumonia was developed 48 hrs following admission, patients with tuberculosis (TB) or previous chest X-ray which may conflict with diagnosis of CAP, chronically debilitated patients, patients with lung cancer and asthma. Moreover, incomplete charts were also excluded from the study.

First, all patient charts with CAP that fulfilled the case definition aged 18 years and above were retrieved. Accordingly only 1174 charts fulfilled the eligibility criteria. Data was collected using a checklist which was adapted from relevant literatures to explore the socio-demographic characteristics of the patients, diagnosis, treatment given and cost of illness.

Pre-test was conducted on 10% of the total charts to check the completeness and consistency of the checklist. Accordingly, appropriate modifications and adjustments were made. Data was collected using trained nurses/health officers with at least some years of work experience. At the end of every data collection day each questionnaire was examined and pertinent feedback was given to the data collectors and supervisors.

Ethical clearance was obtained from Institutional Review Board (IRB) of Addis-Ababa University, College of Health Sciences. Letter of agreement was secured from Tigray regional health bureau. In addition, waiver of consent was obtained from IRB of AAU and additional consent was obtained from the hospital administrators after explaining the purpose of the study and they were informed that every patient record will be kept confidential at any time.

Any document used in this research was kept private and confidential (data was password protected and filled checklist was kept locked in a cabinet). No information other than for the purpose of this study was collected from the patients charts. Moreover, respondents were not identified by names or any other indicators.

Data analysis was conducted using SPSS Version 20, descriptive statistics, numerical summary measures, and simple linear regression analysis was carried out using SPSS.

The methods of cost estimation employed in this study included a micro-costing bottom-up approach in order to estimate direct patient side medical cost of community acquired pneumonia. Indirect cost was calculated in terms of productivity time losses (work days) due to hospitalization using a human capital approach. This was applied only for the productive age group participants (18-64 year old).

Valuation of costs was calculated as follows: costs due to community acquired pneumonia were framed under direct and indirect cost components. The direct costs estimated were medical costs like diagnostics, medications, laboratory and cost of hospitalization. Indirect costs were defined as work days lost due to the illness.

The indirect cost estimates for the productive age participants constitute earnings lost because of hospital stay related to community acquired pneumonia.These work days were changed into monetary terms using a human capital approach. That is, considering the average daily income of the cases to be ETB 34.4 ($1.64). The time foregone in seeking care (productive time lost due to hospitalization) for the inpatients was converted into an indirect cost by multiplying the total hospital bed days, i.e.1420 by the average daily wage ETB 34.4 ($1.64) while for the out patients was one day(25).

Individual cost items were summed up to the categories of medical costs and lost income because of hospitalization. The total cost of community acquired pneumonia for each patient was calculated as the sum of the direct costs and the indirect costs. All costs were first calculated in Ethiopian Birr and then converted into US dollars. The average currency exchange rate during the period July, 2014 to July 01,2015 was used to convert ETB into US dollars (21 ETB=US $1). Furthermore, simple linear regression analysis was run to predict the amount of cost incurred for every increase in hospitalization day.

Results

In this study, we reviewed one thousand and one hundred seventy four medical records of community acquired pneumonia adult patients treated in Tigray Zonal and tertiary hospitals. Two hundred twenty three (19%) and 951(81%) patients were treated at inpatient and outpatient departments, respectively. One hundred ninety one (16.3%) and 881(75%) patients treated at inpatient and outpatient departments, respectively were below the age of 65 years. From the total patients 663(56.5%) were males of whom 530(79.9%) were treated at outpatient department. One thousand and twenty eight patients (87.6%) were treated in the hospitals without being referred, of whom 147(14.3) patients were treated at inpatient department.

Higher proportion (about 63%) of patients were treated at three zonal hospitals namely Adigrat (24%), Mekelle (22.5%) and Lemlem Karl (16%). Mekelle hospital had highest (60) proportion of patients treated at inpatient department while no patient had been treated at inpatient department of Ayder referral hospital. Moreover, the mean hospital stay for participants treated at the inpatient department was 7.4 ($\pm$7.7) (**Table-1).**

Moreover, the hospital bed occupancy rate for the admitted patients of community acquired pneumonia over the study year was 0.3% ; there were a total of 1522 beds in the study hospitals and a total of 1657 inpatient days were observed.

Table 1. Socio-demographic and clinical characteristics of the study participants versus site of treatment, 2016 (n=1174)

Characteristics	Department patients treated		Total
	Inpatient No (%)	Outpatient No (%)	No (%)
Age			
Below65	191(17.8)	881(73.2)	1072(91.3)
65 and above	32 (31.4)	70(68.6)	102(8.7)
Sex			
Male	133(20.1)	530(79.9)	663(56.5)
Female	90(17.6)	421(82.4)	511(43.5)
Occupation			
Farmer	133(21.5)	485(78.5)	618(52.6)
Student	38(12.3)	270(87.7)	308(26.2)
Civil Servant	19(18.8)	82(81.2)	101(8.6)
House wife	15(15.5)	82(84.5)	97(8.3)
Private employee	18(36.0)	32(64.0)	50(4.3)
Referral Status			
Referred	76(52.1)	70(47.8)	146(12.4)
Not referred	147(14.3)	881(85.5)	1028(87.6)
Treatment Hospital			
Sihul	37(13.0)	100(73.0)	137(11.7)
St.Marry	21(12.1)	153(87.9)	174(14.8)
Kahsay Abera	21(50.0)	21(50.0)	42(3.6)
Adigrat	49(17.4)	233(82.6)	282(24)
Mekelle	60(22.7)	204(77.3)	264(22.5)
Ayder	0	86(100)	86(7.3)
Lemlem Karl	35(18.5)	154(81.5)	189(16.1)
Length of hospital stay			
7.4 days or lower	161(72.2)		
More than 7.4days	62(28)		
Mean(SD**)**	7.43 (7.7)		
Total	223(19.0)	951(81.0)	1174

Cost of treatment for community acquired pneumonia

The total amount of money incurred over the study year was 319,056.52 Birr ($15,193.2**)** with the mean cost per episode of community acquired pneumonia of 168($8) Birr for outpatients and 775 Birr($37) for in patients, respectively. About 76% (242889.60(11,566.20)) of the money was attributed for direct medical expenditure of which 126,415.8(6,019.8) was incurred by outpatients and 116473.8 (5546.4) by the inpatients. The work related cost lost by the patients due to the community acquired pneumonia was 76166.92 Eth B ($3627) (Table 2).

Table 2. Cost of treatment among patients with community acquired pneumonia according to site of care,2016(n=1174)

Expenditure category	**Inpatient EthB(USD)**	**Outpatient EthB(USD)**	**Sub Total**
Registration Fee	1554(74)	6430(306.2)	7984(380.2)
Bed stay	38634.75(1839.75)	-	38634.75(1839.75)
Blood Test	9804 (466.85)	22847.34(1087.96)	32651.34(1554.8)
Other Tests	1183(8.7)	2368.6(112.8)	3551.6(169)
X-Ray	11925(567.85)	32606.5(1552.7)	44531.5(2120.5)
Antibiotic	50361.24(2398.15)	60153.66(2864.46)	110514.9(5262.6)
Anti Pain	755.7 (36)	1105.5 (52.6)	1861.2(88.10)
Other drugs	2256.1(107.4)	904.2 (43)	3160.3(150.5)
Sub-total	116473.8 (5546.4)	126,415.8(6,019.8)	242889.60(11,566.20)
Grand total of patient side cost: Medical expenditure cost 242889.60(11,566.20) **+ Loss of productivity cost** (76166.92 Eth B($3627) = **319,056.52 Birr ($15,193.2)**			

Using simple linear regression model, we obtained a regression equation **Y= 454.95+22** indicating that for every single day increment in inpatient hospital stay there is an equivalent increment of ETB 22 ($1.05).

Though the regression equation had a poor fit, describing only 28 % of the variance in total cost of illness due to community acquired pneumonia (R^2adj = 28%), the overall relationship help us to understand whether the model that we used is appropriate to predict the cost for each inpatient hospital stay was statistically significant(F = 86 , p= 0.00).

Discussion

This study attempted to address cost of illness of adult CAP patients which is rarely considered in Ethiopia and Africa by in large.

In the present study it is confirmed that the total amount of money incurred over the study years was 319,056.52 Birr ($15,193.2**)** and the mean cost of illness per episode of community acquired pneumonia was 168 Eth.Birr ($8) for out pts and 775 ($37) for in patients respectively which is much lower than a study from Italy that showed the mean cost per episode of CAP was Euro 1586 (17). Likewise a study from France showed that the pooled cost of ambulatory and hospitalized patients was Euro 357.1 (18**).** The difference may be b due to variations in prices of the treatment packages and resources used.

The mean direct medical expense per episode (of the patients) was 522.3 Ethiopian Birr ($25.9) for inpatients and 132.9 ($6.3) for outpatients. Our finding was not in line with studies from developed countries such as a study from France revealed that the mean direct medical cost of a disease episode of CAP was EU 118.8 for strictly ambulatory patients with an equal weight for medical time, drugs, diagnostic procedures and tests. This direct cost was EU102.1 before admission for patients who were finally hospitalized. The mean cost of hospital admissions was

EU 3522.9 **(**18 **).** Another study from New Zealand concluded that the annual cost (of a societal perspective for the adult population aged 15 years and over) was estimated to be 63 million dollars, (direct medical costs of 29 million dollars; direct non-medical costs of 1 million dollars; lost productivity of 33 million dollars) **(**19**).** Furthermore, a study from USA showed that the mean cost of hospitalization per admission (excluding physician cost) was $US3490 ± $US3058 (median $US2430) **(**21**).** Likewise, a study from China confirmed that the median total hospital cost was $556.50 (mean $705.60) **(**20**).** The discrepancies could be because of differences in severity of the problem, length of the treatment, service consumption and price variations among the countries.

In the current study the mean working days lost due to CAP for the productive age group of inpatients (18-65years) was 7.43±7.7 days. As a result the mean amount of money incurred per episode due to work loss by the in patients and out patients was 256 Eth.Birr (US$12.2) and 34.4(US$1.6) respectively. Our finding was much lower than the study from France which showed that the mean number of non-worked days was 10.8 (SD 8.0) days for ambulatory patients and 31.0 (SD 27.2) days for patients who were hospitalized: the impact of the disease episode on productivity was EU 1980 (SD 1400) per ambulatory episode and EU 5425 (SD 4760) per episode leading to hospital admission **(**18**).**

From the total patients in this study, 72% undergone X-ray examination, 98.4% got medication prescription with the most common being antibiotics and 83.2% undergone laboratory tests. Unlike to ours a study from France showed that one hundred and seventy-two (19%) patients were managed without X-rays. White blood cell count was measured in 316 (36%) patients; C-

reactive protein (CRP) and pro-calcitonin levels were respectively assessed in 314 (35%) and 13(1%) patients. Microbiological tests were rarely prescribed (1%), antibiotics were prescribed medications for most (94%) patients at the inclusion visit **(**18). Similarly, a study from Australia confirmed that at least one medication was prescribed (or provided) for 63% of pneumonia problems, with the most common being antibiotics. Imaging was requested for 29% of pneumonia contacts, with chest radiology (92%) the most common form. Pathology testing was sought for 10%, with chemistry, hematology and microbiology the most common categories recorded **(**26). The variations could be because of the availability of different diagnostic options, knowledge and skill gap of the professionals and lack of standardized management guideline for community acquired pneumonia in our country.

Of the total direct medical expense, 47.6 % was used for medication, 18% for imaging (X-ray), 15% for laboratory, 16% for bed and 3% for registration which is different from a study conducted in USA that confirmed bed costs accounted for 55.6% of total costs, followed by laboratory (9.9%) and pharmacy (9.8%) costs **(**27**).** Another study from USA indicated that from the cost of hospitalization per admission (excluding physician cost) hospital room/board accounted for the largest percentage (83.7%), followed by laboratory (8.1%), antibacterial (4.6%), radiology (2.6%) and respiratory (0.9%) cost centers **(**21**).** Likewise, a study from Australia showed that of the total costs of community acquired pneumonia, 60% was used for medication and 23% for imaging cost **(**26**).** Similar study in China revealed that from the total hospital cost 48.9% was used for drugs, 21.9% for laboratory tests, 8.6% for radiology, 6.3% for hospital beds and 5.3% for examination **(**20**).** The explanation for the discrepancy could be because of differences in diagnostic and treatment standards among the countries.

Limitations

Since the current study is retrospective review all patient side expenses might not be recorded in the charts of the patients. In addition, opportunity costs, direct non medical costs and care giver's cost were not studied. Hence, the cost of illness for this study might be under estimated.

In addition, comparison of our findings with previous Ethiopian and/or other sub-saharan Africa countries data was not possible for there have been no studies examining the cost of community acquired pneumonia. Hence, some of the comparisons made with studies conducted in the advanced countries would be of limited value because of the difference in the categories of cost, the methods used, the pattern of health services utilization and the health care system.

In conclusion the cost incurred among adult patients of community acquired pneumonia in Tigray hospitals is significant. During the two years period, of the total cost incurred 76 % was due to direct medical expense. Hence, prevention strategies like immunization and other interventions should be implemented so that the magnitude of the problem would be minimized and terminally the treatment cost incur by community acquired pneumonia will be reduced. Moreover, it is good if prospective studies are further conducted to estimate holistic costs of community acquired pneumonia.

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ANNEX2:DATA COLLECTION TOOLS

Annex 2.1 Checklist

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

General instruction for data collectors/supervisors

This is a checklist for collecting data from patient chart of community acquired pneumonia to be filled by the respective nurses/health officers, you as part of research team are responsible to adhere to the ethical issues in maintaining confidentiality and hand over the charts to the records office immediately after taking the necessary information needed, and say thank you to the record office staffs.

Name of the nurse/health officer: _____

Name of hospital: _____

Zone/wereda: _____

Identification information:

1. Registration no of the chart: _____
2. Age of the patient in years: _____
3. Sex of the patient:_____
4. Address of the patient: zone_____wereda_____
5. Occupation of the patient_____
6. Referral (if any)_____
7. Outpatient visits (OPD)_____
8. Date of admission: _____
9. Date of discharge from hospital: _____

Resource utilized & costs for diagnosis and treatment of CAP

Resource utilized	**Utilization frequency**	**Unit cost/Birr**	**Cost per resource**
Total Hospital bed-days			
Intensive care unit (ICU)			
Laboratory tests • Blood test • Urine test • Other tests			
• X-ray/any imaging (type) • Ultra sound			
Drugs • Antibiotics • Anti pains • Others (please specify)			
Registration fee			
N.B. Any special information available from the chart should be documented in this check list			

Suggestions after completing the checklist by the data collector (report any missing data, vague sentences, spoiled or unreadable statements, etc below)

_____

_____

_____

_____

_____

_____

_____

Data collector's Signature_____

Supervisor's Signature_____

ልጋብ I: ቃለ መሕትት ትግርኛ

ዩኒቨርሲቲ ኣዲስኣበባ

ኮሌጅ ጥዕና ሳይንስ

ክፍሊ ትምህርቲ ሓለዋ ጥዕና ማሕበረሰብ

<u>ሓፈሻዊ መምርሒ ን ኣከብቲ መረዳእታን መራሕቲ ጉጅለን</u>

እዚ ዝርዝር መረዳእታ ካብ ካርዲ ተሓከምቲ ሕብረተሰብ መንቀሊ ዝገበረ ሳንባ ምቹ ዝምላእ ኾይኑ ብ ዝምልከቶም ነርስን ላዕለዎት ጥዕና መኮንንን ይምላእ። ንሶም/ሰን ከም ኣካቢ መረዳእታ ኣብቲ መዕናዕቲ እዚ ኣገደስቲ ዝኾኑ መረዳእታ ብምእካብ ስነምግባር በዓል ሞያ ብዝጠልቦ መሰረት ሚስጥር ናይ ምዕቃብን ኣድሌቲ ዝኾኑ ሓበሬታ ብምውሳድ መረዳእታ ብእዋኑ ንዝምልከቶ ክፍሊ ማህደር ናይምርካብ ሓላፍነት ኣለዎም። ብተወሳኺ መረዳእታኹም ምስ ኣረከብኹም ንሰራሕተኛ ክፍሊ ማህደር ኣመስግኑ።

ሽም ሓኪም/ በዓል ሞያ ላዕለዋይ ጥዕና፡ _____

ሽም ሆስፒታል፡ _____

ዞባ/ወረዳ፡ _____

መፍለዪ ሓበሬታ

1. መዝገብ ቁፅሪ፡ _____
2. ዕድመ ተሓካማይ ብዓመት፡ _____
3. ፆታ፡ _____
4. ኣድራሻ ተሓካማይ፡ ዞባ_____ወረዳ_____
5. ዓይነት ስራሕ ተሓካማይ፡ _____
6. ቅብብል ሕክምና /እንተልዩ/፡ _____
7. ተመላለስቲ ሕክምና (OPD): _____
8. ዝደቀሰሉ ዕለት ፡ _____
9. ካብ ሆስፒታል ዝወፀሉ ዕለት፡ _____
10. ብዘይካ ሕብረተሰብ መንቀሊ ዝገበረ ናይሳንባ ምቹ ካልእ ዓይነት ሕማም እንተሃልዩ፡

_____

ንመነፀሪን ፤ ላብራቶሪን ሕብረተሰብ መንቀሊ ዝገበረ ናይሳንባ ምቲ **ዝተኽፈለ ዋጋ**

ዝተጠቐመ ሃፍቲ ገንዘብ	በዝሒ ግልጋሎት	ናይ ሓደ ዋጋ/ብብር	ዋጋ ሓደ ዓይነት ሕክምና
ኣብ ሆስፒታል ዝደቀስሉ በዝሒዕለት			
ክፍሊ ሕክምና ዝተፀንዑ ሑመማት (ICU)			
ምርመራ ላብራቶሪ • ምርመራ ደም • ምርምራ ሽንቲ • ካልዕ ዓይነት ምርመራ			
• ምርመራ ራጅን ምስልን • ምርምራ ኣልትራሳውንድ			
ኣፋውስ • ፀረ ረኽሲ • ፀረ ቃንዛ • ካልኣ እንተልዩ ይገለፅ			
ክፍሊት መመዝገቢ			
ኣብ ማህደር ተሓካማይ ዝርከብ ዝኾነ ኣድላዩ ሓበሬታ እንተልዩ ኣብዚ ይመዝገብ			

እዚ ቃለ መሕትት ምስተኻየደ ነዚ መረዳእታ ዝምዝግብ ኣካል ዘይበርሀሉ ዘይምዕሩይ ወይ ብንዑር ዘይንበብ ቃል እንተሃልዩ ኣብዚ ይፀሓፍ፡፡

_____

_____

_____

_____

_____

_____

ኣካቢ መረዳእታ

ክታም _____

መራሒ ጉጅለ

ክታም _____

Annex 2.2: A Semi-structured Questionnaire, to assess the risk of community acquired pneumonia among hospital treated adults, Tigray, Ethiopia.

Subject Information Sheet

Dear respondent

Good morning/Good afternoon. Thank you for your interest in talking with me today. I am _____ who is a member of a team conducting a study **to assess the risk of community acquired pneumonia among hospital treated adults** in your locality. The study is conducted as part of a PhD research under college of health sciences, Addis Ababa University; you are randomly selected to take part in this research interview.

The purpose of my visit today is to take information from you on the aforementioned issue. If you are willing to participate in the study, I will ask you few questions lasting for 30 minutes. I will also measure your body weight and height in order to assess your nutritional status. In addition. The questionnaire will not be used for any other analysis apart from this study and won't be stored in anyway. In the study if you are found to have any infection or disease, you will be referred for treatment and advice. However, no financial payment will be made for your participation.

Your name will not be written on this form and will never be used in connection with any of your information. You do not have to answer any question that you do not feel comfortable with, and you may end this task any time you want to. However, your honest answers to these questions and your continuous interest to participate in the study will help us in better understanding of the risk factors of CAP in your locality, and will eventually help in designing and implementing appropriate prevention and intervention programs to alleviate the problem. Hence we would greatly appreciate your help in involving in the study. Your participation in the study is fully based on your interest and choice. Your participation or non participation will not be related with the health service that you will get from governmental and non governmental institutions.

If you have any un-clarity on my visit you can ask me now so that I can elaborate it. If you come across with any concern during my stay with you, you can stop me and raise it anytime you want. It is also possible to communicate the principal investigator Haftu Berhe through the telephone address **+251914 725835** and Prof. Fikrie Enquselassie through **+251912 45 97 07**

Informed Consent Form

With due understanding of the aforementioned information, are you willing to participate in the study?

Yes	☐ (Proceed with the interview)

No	☐ (Terminate the interview)

Signature of the interviewer

Name _____ Signature _____ date _____

Supervisors/Researcher remark and signature

_____

Name _____ Signature _____ date _____

Part I Demographic information

	Question	Response	Code
1	Sex (*Record Male / Female as observed)*	Male 1 Female 2	C1
2	What is your date of birth?	⌊__⌋⌊__⌋ ⌊__⌋⌊__⌋ ⌊__⌋⌊__⌋⌊__⌋⌊__⌋ dd mm year *If known, Go to C4*	C2
3	How old are you?	Years ⌊__⌋⌊__⌋	C3
4	What is the **highest level of education** you have completed?	No formal schooling 1 Less than primary school 2 Primary school completed 3 Secondary school completed 4 Preparatory school completed 5 College/University completed 6 Post graduate degree 7 Refused 88	C4
5	What is your *ethnic group / racial group /* ?	Tigraway/ti ..... 1 Erop.....2 Amharay/ti .....*3* Afar .... 4 Other:---------- Refused 88	C5
6	What is your **marital status**?	Never married 1 Currently married 2 Divorced 3	C6

		Widowed 4 Cohabitating 5	
7	Which of the following best describes your **main work** status over the past 12 months?	Government employee 1 Non-government employee 2 Self-employed 3 Student 4 Homemaker 5 Retired 6	C7
8	How many people including yourself, live in your household?	Number of people └__┘└__┘	C8
9	How many people do you use/sleep in a single room?	Number of people └__┘└__┘	C9
10	How many windows do you have in a room ?	Number of windows in a room └__┘└__┘	C 10
11	Taking **the past year**, can you tell me what the average earnings of the household have been? *(RECORD ONLY ONE, NOT ALL 3)*	Per week └__┘└__┘└__┘└__┘└__┘└__┘└__┘	11a
		OR per month └__┘└__┘└__┘└__┘└__┘└__┘└__┘	11b
		OR per year └__┘└__┘└__┘└__┘└__┘└__┘└__┘	11c
12	If you don't know the amount, can you give an **estimate** of the annual household income if I read some	≤ Quintile (Q) 1 1 More than Q 1, ≤ Q 2 2 More than Q 2, ≤ Q 3 3	12C

	options to you? Is it *[INSERT QUINTILE VALUES IN LOCAL CURRENCY]*	More than Q 3, ≤ Q 4 4 More than Q 4 5 Don't Know 77	
13	Height of the respondent in CM		
14	Weight of the respondent in KG		

Part II . lifestyle and habits

Tobacco Use			
Now I am going to ask you some questions about your lifestyle and habits. This includes things like smoking, drinking alcohol, and physical activity. Let's start with tobacco.			
	Question	**Response**	**Code**
15	Do you currently smoke any **tobacco products**, such as cigarettes, cigars or pipes?	Yes 1 No 2	T1
16	Do you currently smoke tobacco products **daily**?	Yes 1 No 2	T2
17	How old were you when you **first started** smoking daily?	Age in years_____ Don't know 77_____	T3
18	Do you remember how long ago it was?	In years_____ In months____ In weeks_____	T4a T4b T4c
19	On average, How many cigarettes do you smoke each day?	1-9 cigarettes.day	T5a
		10-20 cigarettes.day	T5b
		>20 cigarettes.day	T5c
			T5d

Alcohol consumption			
Question		**Response**	**Code**
20	Have you **ever** consumed an alcoholic drink such as beer, wine, spirits, fermented cider or *[add other local examples]*?	**Yes 1** **No 2**	**A1**
21	Have you consumed an alcoholic drink within the **past 30 days**?	**Yes 1** **No 2**	**A2**
22	During the past 30 days, on how many **occasions** did you have at least one alcoholic drink?	Number Don't know 77 ⌊__⌋⌊__⌋	**A3**
23	During the past 30 days, **on average**, how many **glass alcoholic drinks** did you have during one drinking occasion?	Number Don't know 77 ⌊__⌋⌊__⌋	**A4**
24	During the past 30 days, what was the **largest number** of alcoholic drinks you had(glass, bottle and the like) on a single occasion, counting all types of alcoholic drinks together?	Largest number Don't know 77 ⌊__⌋⌊__⌋	**A5**

Physical Activity

Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active Person. There are various domains of activity which need to be included; work, activities in and around the home and garden, to get from place-to-place (transport-related) and recreation (discretionary or leisure-time) exercise or sports activities. This opening statement **should not** be omitted.			
Questions		**Response**	**Code**
Activity at work			
25	Does your work involve vigorous-intensity activity that causes Large increases in breathing or heart rate like *[carrying or lifting heavy loads, digging or Construction work*] for at least 10 minutes continuously?	**Yes 1** **No 2** **If no go to P4**	**P1**
26	In a typical week, on how many days do you do vigorous intensity activities as part of your work?	Number of days ⌊__⌋	**P2**
27	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋	**P3**
28	Does your work involve moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking *[or carrying light loads*] for at least 10 minutes continuously?	**Yes 1** **No 2** **If no go to P7**	**P4**

29	In a typical week, on how many days do you do moderate intensity activities as part of your work?	Number of days ⌊__⌋	**P5**
30	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋	**P6**
Travel to and from places			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship. [insert other examples if needed]			
31	Do you walk or use a bicycle (*pedal cycle*) for at least 10minutes continuously to get to and from places?	**Yes 1** **No 2** **If no go to P10**	**P7**
33	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ⌊__⌋	**P8**
33	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	**P9**
Recreational activities			
The next questions exclude the work and transport activities that you have already mentioned. Now I would like to ask you about sports, fitness and recreational activities (leisure),[insert relevant terms].			
34	Do you do any vigorous-intensity sports, fitness or recreational (*leisure*) activities that cause large increases in breathing or heart rate like [*running or*	**Yes 1** **No 2** **If no go to P13**	**P10**

	football,] for at least 10 minutes continuously?		
35	In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊__⌋	**P11**
36	How much time do you spend doing vigorous-intensity sports,fitness or recreational activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋	**P12**
37	Do you do any moderate-intensity sports, fitness or recreational *(leisure*) activities that causes a small increase in breathing or heart rate such as brisk walking,(*cycling, swimming, olleyball*)for at least 10 minutes continuously?	**Yes 1** **No 2** **If no go to P16**	**P13**
38	In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (*leisure*) activities?	Number of days ⌊__⌋	**P14**
39	How much time do you spend doing moderate-intensity sports, fitness or recreational (*leisure*) activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋	**P15**
Sedentary behaviour			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.			

40	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes └__┘└__┘ : └__┘└__┘	**P16**

Part -III. Medical history

I am going to ask you about your medical history and please provide me your response according to the questions I will ask you.

S/no	Question	Yes(1)	No(2)	I don't Know(3)
41	Have you ever been admitted to hospital in the last 5 yrs?			
42	Have you ever been a bedridden for the last 3 months?			
43	Did you have upper airway problem, last yr ?			
44	Did you have Tonsillectomy ?			
45	Did you visit to the dentist, last month ?			
46	Did you get vaccinated for Influenza last yr ?			
47	Did you get vaccinated for any respiratory vaccination, last yr ?			
48	Did you have any respiratory infection, last month?			
49	Have you had a contact with people who had respiratory infection?			
50	Do you have Previous history of pneumonia confirmed by radiograph?			
51	Do you have history of diabetes?			
52	Do you have history of Cardiopathy ?			
53	Do you have history of Chronic bronchitis?			
54	Do you have history of Diagnosed asthma ?			
55	Do you have history of Lung tuberculosis ?			
56	Do you have history of Gastric disease/symptoms?			
57	Do you have history of Chronic liver disease?			
58	Do you have history of Renal failure ?			
59	Do you have history of Depression/anxiety ?			

60	Do you have history of Cancer?			

Part-V- Environmental factors

I am going to ask you about your contact history with children, animals, birds and the like. Kindly provide me your response according to the response options provided below.

S/no	Question	Yes	No	I don't know
61	Do you have history of contact with children?			
62	Do you have history of contact with birds?			
63	Do you have history of contact with animals?			
64	Do you have history of contact with pets?			
65	Do you have history of working in a dusty environment?			

66. Would you please tell me the type of cooking fuel you usually use at your home?

67. Usually, where do you go first if you have any health problem?

Thank you for giving us your time

ልጋብ 2.2 መሕትት /ብቋንቋ ትግርኛ ዝተዳለወ/

ሓበሬታ

ዝኸበርኩም ሓበሬታ ወሃባይ፤

ከመይ ሓዲርኩም/ከመይ ኣርፊድኩም/ ከመይ ውዒልኩም ምሳይ ክተዋግዑን ከተዕልሉን ፍቓደኛ ብምኻንኩም ኣዝየ የመስግነኩም። ኣነ_____ ዝበሃል። ኣብዚ ከባቢኹም ነዚ መዕናዕቲ ዘካይድ ጉጅለ ኣባል እየ። እዚ መዕናዕቲ ኣብ ትሕቲ ዩኒቨርሲቲ ኣዲስ ኣበባ ዝርከብ ኮሌጅ ሳይንስ ጥዕና ንመመልኢ ትምህርቲ ዶክትሬት /ፒኤችዲ/ ዝግበር እዩ። እዚ ኣብ ሕማም ሕብረተሰብ መንቀሊ ዝገበረ ናይ ሳንባ ምቲ ዝግበር ዳህሳስ ከባቢኹም ዝጠመተ መዕናዕቲ እዩ። ስለዚ ኣነ ኣብዚ ምዕናዕቲ ከም ዕላማ ሒዘዮ ዘለኹ ብዛዕባኹም ዝምልከት ውልቀ ሓበሬታ ኩነታትኩም ንምውሳድ ጥራሕ እዩ። ኣብዚ መዕናዕቲ ክትሳተፉ ድልየት እንተሃልይኩም ንከባቢ 30 ደቓይቕ ዝወስድ ግዘ ሕቶታት ክሓተኩም እየ። ኩነታት ስነ ምግብኹም ንምድህሳስ ድማ ቁመትኩምን ክብደትኩምን ክዕቅን እየ። ውዕኢት እዚ ዓቕን ቁመትን ክብደትን ካብ ዕላማ እዚ መዕናዕቲ ወፃኢ ንካሊእ ዋኒን ኣይውዕልን። ድሕሪ እዚ መዕናዕቲ ድማ ኣይዕቀብን። ኣብዚ መዕናዕቲ ተሓታቲ ሕማም እንተተገኒይኩም ናብ ክኢላ ሓኪም ክትለኣኹን ሕክምናን ግልጋሎት ምኽርን ክትረኽቡ ክግበር እዩ። ኣብዚ ብተገብርዎ ንጥፈትን ተሳትፎን ብሙሉኡ ትኽፍልዎ ክፍሊት ወይድማ ዝህልወኩም ወፃኢ የለን።

ስምኩም ኣብዚ መሕትት ኣይፀሓፍን ወይድማ ምስዝሃብኩምና ሓበሬታ ብዝተኣሳሰረን ብዝተዛመደን ኩነታት ብዝሾነ መንገዲ ንዝሾነ ዓይነት ሓበሬታ ኣይውዕልን። ንዘይተሰማመዕኩምን ደስ ንዘይበለኩምን ሕቶ ዘይምምላስ ይኽእሉ ኢኹም። ካብዚ ብተወሳኺ ድማ ቃሕ ኣብዝበለኩም እዋን እውን ነዚ መሕትት ከተቋርፅዎ ትኽእሉ ኢኹም። ይኹን እምበር ትህቡና ቅኑዕን ትኽክለኛ መልስታት ከምኡ እውን ቀፃሊ ተሳትፎ ንክህልወኩም ተርእይዎ ድልየት ነዚ ነካይዶ ዘለና መዕናዕቲ ብወሳናይ መልክዑ ሓጋዛይ እዩ። ብፍላይ ድማ ኣብ ከባቢኹም ምስ ሕብረተሰብ ምንቀሊ ዝገበረ ናይ ሳንባ ምቲ ተዛመድቲ ጉዳያትን ንዝህልው ዳህሳስ ኣብ መወዳእታ እውን ነዚ ዝተዳህሰሰ ፀገም ንምእላይን ንምቅላልን ዝሕግዝ ሜላ ንምሕንፃፅ ኣዝዩ ሓጋዚ እዩ ዝኸውን። ነዚ ፀገም ንምክልኻልን ንምቁፅፃርን ዘኽእል መደብ ጥዕና ንምቕራፅን ኣተገባብርኡ ንምሕንፃፅን ምትላምን ወሳናይ ተራ ይህልዎ ማለት

እዩ። ስለዚ ኣብዚ መፅናዕቲ ክሳብ መወዳእታ ብንጥፈት ንኽትሳተፉ ኣዚና ንላቦ። ኣብዚ መፅናዕቲ ዝህልወኩም ተሳትፎን ንጥፈትን ኣብ ድልየትኩምን ምርጫኹምን ዝተመስረተ እዩ። እዚ ተሳትፎኹም ይኹን ዘይምስታፍኩም ኣብዝኾነ ይኹን ዓይነት መንግስታዊ ወይድማ ዘይመንግስታዊ ትካል ጥዕና ምስትረኽብዎ ግልጋሎት ጥዕና ፈፂሙ ዝዛመድን ዝተኣሳሰረን ኣይኮነን።

ናባኹም ንምንታይ ከምዝመፃኹን ንምንታይ ከምዝሓተኩም ዘለኹ ብዝምልከት ክሳብ ሕዚ ኣብዝገለፅኩልኩም ብምልኡ ዘይተረዳኣኩም እንተሃልዩ ሕዚ ክትሓቱኒ ትኽእሉ ኢኹም። ኣነ እውን ተወሳኺ መብርሂ ክህበኩም እኽእል። ኣብ እዋን እንገብሮ ምይይጥን እነካይዶ ዘለና ሕቶን መልስን ዝኾነ ዓይነት ዘገድሰኩም ጉዳይ ናብ ኣእምሮኹም እንተመፂኡ ሽዑ ንሽዑ ጠጠ ው ክተብሉንን ደስ ኣብዝበለኩም ወይድማ ኣብዝጠዓመኩም እዋን ክትሓትኑን ከብርህልኩም ክትገብሩ እውን ትኽእሉ ኢኹም። ካብዚ ሓሊፉ ድማ ብዛዕባ ዘገድሰኩም ጉዳይ ካባይ ሓሊፉ ነዚ መፅናዕቲ ብዋናነት ንዘካይድ ዘሎ ዋና ተመራማራይ እዚ መፅናዕቲ ሃፍቱ በርሀ ብቐፅሪ ስልኪ +251914 725835 ወይ ድማ ዶ/ ፍቅሬ እንቁስላሴ ብ +251912 45 97 07
ቁፅሪ ስልኪ ደዊልኩም ምሕታት ትኽእሉ ምኻንኩም ክነረጋግፀልኩም ንፎቱ።

ናይ ስምምዕነት ቅጥዒ

ብመሰረት ኣቐዲሙ ዝተገለፁምለን ዕላማ እዚ መፅናልቲ መሰረት ኣብቲ ዝካየድ መፅናዕቲ ዝርዝር ሓበሬታ መሰረት ብምግባር እዚ ይካየድ ዘሎ መፅናዕቲ ብግቡእ ስለተረዳእኹም ኣብዚ መፅናዕቲ ንምስታፍ ፍቓደኛ ዲኹም?

እወ ☐	(ናበቲ ቃለመሕትት ቀፅል)

ኣይፋሉን ☐	(ቃለ መሕትት ይቋረፅ)

<u>ክታም ኣካባይ ሓበሬታ</u> ሽም _____ ክታም _____ ዕለት _____

<u>ሪኢቶን ክታምን ተመራማራይ/ሱፐረቫይዘር</u>

_____

_____

ሽም _____ **ክታም** _____ **ዕለት** _____

ክፋል ሓደ ውልቓዊ ሓበሬታ			
1	ፆታ ብምርኣይ ምላእ	ተባዕታይ 1 ኣንስታይ 2	C1
2	ዝተወለድካሉ ዕለት	⌊__⌋⌊__⌋ ⌊__⌋⌊__⌋⌊__⌋⌊__⌋ ዕለት ወርሒ ዓመት እንተደኣ መሊስካ ናብ ኮድ *C4* ስገር	C2
3	ዕድመኻ ክንደይ እዩ?	ዓመታት ⌊__⌋⌊__⌋	C3
4	ዝለዓለ ብርኪ ትምህርቶም/ ተን?	ስሩዕ ትምህርቲ ኣይተምሃርኩን 1 ትሕቲ ቀዳማይ ብርኪ 2 ቀዳማይ ብርኪ ኣጠናቒቀ 3 ትምህርቲ ካልኣይ ብርኪ ኣጠናቒቀ 4 ትምህርቲ መሰናድኦ ዩኒቨርስቲ ኣጠናቒቀ 5 ኮሌጅ/ዩኒቨርስቲ ኣጠናቒቀ 6 ትምህርቲ ድሕረ ምርቃ 7 ንምምላስ ፍቃደኛ ኣይኮንኩን 88	C4
5	ድሕረባይታ ኻእንታይ ይመስል *[ክም ብሄር ዘርኢ]?*	ትግራዋይ/ ቲ 1 ኢሮፕ	C5

		2 ኣምሓራይ/ ረይቲ 3 ዓፋር 4 ካልኢ ይገለፅ ንምምላስ ፍቃደኛ ኣይኮንኩን 88	
6	ኩነታት ሓዳር	ባሕተላይ/ለይቲ 1 በዓል ሓዳር 2 ዝተፋተሐ/ት 3 በዓል/ቲ ገዛኣ ዝሞታ 4 ከይተመርዓዉ ብሓባረ ዝነብሩ 5	C6
7	ካብዞም ዝስዕቡ ስራሕትታት ኣብ ዝሓለፉ 12 ኣዋርሕ ካብ ዝሰራሕካዮ ኣውራ ስራሕ መኒኡ ይገልፅ?	ሰራሕተኛ መንግስቲ 1 ሰራሕተኛ ዘይመንግስታዊ ትካል 2 ዓርሰ ቁጣር 3 ተምሃሪ 5 ናይገዛ እመቤት 6 ጡረተኛ 7	C7
8	ኣብ ገዛኹም ንኣኦም ኣን ሓዊሱ ክንደይ ሰባት ትነብሩ?	በዝሒ ስድራ └─┴─┘	C8
9	ኣብ ሓንቲ ክፍሊ ገዛ ክንደይ ሰባት ትድቅሱ?	በዝሒ ሰብ └─┴─┘	C9
10	ኣብታ ክፍሊ ክንደይ መስኮት ኣሎ?	በዝሒ መስኮት ብቂዕሪ └─┴─┘	C 10

11	ስኣብ ዝሓለፈ ዓመት ናይ ገዛኩም ማእኸላይ እቶት ክንደይ ነይሩ? *(በሓዲኡ ጥራሕ መዝግብ)*	ብሰሙን └┴┴┴┴┴┴┴┘	11a
		ወይብወርሒ └┴┴┴┴┴┴┴┘	11b
		ወይብዓመት ☐☐☐☐☐☐☐	11c
12	ናይ ገዛኩም ዓመታዊ ኣታዊ እንተደኣ ብዕሊ ዘይትፈልጦ ኮይንካ ዝተወሰኑ መማረፅታት እንተደኣ እንቢበልካ ተቀራራቢ ዝኾን መልሲ ዶ ክትንግረኒ ምኽኣልካ? *[ናይ ኩንታል ዋጋ ብብር ኣቀምጥ]*	≤ኩንታል (ኩ) 1 1 ልዕሊ.ሓደ ኩ, ≤ 2ኩ 2 ልዕሊ. 2ኩ, ≤ 3ኩ 3 ልዕሊ. 3ኩ, ≤ 4ኩ 4 ልዕሊ. 4ኩ 5 ኣይፈለጥኩን 77	12 C
13	ቁመት ወሃባይ ሓበሬታ ብሴሜ		
14	ክብደት ወሃባይ ሓበሬታ ብ ኪሎግራም		

ክፋል II. ስርዓት ኣነባብራን/ልምድን ባህሪታትን

ምጥቃም ትንባሆ			
ሕዚ ምስ ኩነታት ጥዕናኻ ዝተኣሳሰሩ ሕቶታት ክሓተኩም እየ ኾይ ምእዚ ድማ ከም ምትኻኽ ሲጋራ ½ምፍራምረን ኣትክልቲ ምብላዕ½ምኣካላዊ ኩነታትን ወዘተ ዝሓወሰ እዩኾይ ብምትካኽ ሲጋራ ንጀምርኾይ.			
	ሕቶ	መልሲ	ኮድ
15	ኣብዚ ሕዚ እዋን ዝኾነ ይኹን ውዕኢታት ትንባሆ ከም ሲጋራ ፒፓ ዝኣምሰሉ ትጥቀም ዶ?	እወ 1 ኣይፋሉን 2	T1
16	ኣብ ዚ ሐዚ እዋን ውዕኢታት ትንባሆ በብመዓልቲ ዶ ትጥቀም?	እወ 1 ኣይፋሉን 2	T2
17	ፈለማ በቢመዓልቱ ሲጋራ ምትካኽ እንትትጅምር ከለኻ ዕድመኻ ክንደይ ነይሩ?	ዕድመ ብ ዓመት_____ ኣይፈለጥኩን 77_____	T3
18	እዋኑ መኣዝ ከምዝነበረ ትዝክሮዶ?	ብዓመት_____ ብኣዋርሕ____ ብሰሙን_____	T4a T4b T4c
19	ብማእኸላይ ኣብ መዓልቲ ክንደይ ሲጋራ ተትክኽ?	1-9 ሲጋራ ብመዓልቲ	T5a
		10-20 ሲጋራ ብመዓልቲ	T5b
		>20 ሲጋራ ብመዓልቲ	T5c
			T5d

ምጥቃም መስተ/ኣልኮል			
	ሕቶ	መልሲ	ኮድ
20	ዝኾነ ይኹን ኣልኮላዊ መስተ ዶ ሰቲኻ ትፈልጥ/ከም ቢራ ወይኒ ስዋ ሜስ ኣረቂ ወዘተ/?	እወ 1 ኣይፋሉን 2	A1a
21	ኣብ ዝሓለፉ30 መዓልትታት ኣልኮል/መስተ/ሰቲኻ ኬርካ ዶ?	እወ 1 ኣይፋሉን 2	A1b
22	ኣብ ዝሓለፉ 30 መዓልትታት ሓደ ኣልኮል/1 ዋንጫ ስዋ 1 ቢራ 1 መለኪያ ዊስኪ ን ካልኦትን/ በቢ ክንደይ ግዘ ትሰቲ?	በቢ መዓልቲ 1 5-6 መዓልቲታት ብሰሙን 2 1-4 መዓልቲታት ብሰሙን 3 1-3 መዓልቲታት ብወርሒ 4 ፅሕቲ ሓደ ግዘ ኣብ ወርሒሪ 5	A2
23	ኣብ ዝሓለፉ 30 መዓልቲታት ሓደ ኣልኮል/1 ዋንጫ ስዋ 1 ቢራ 1 መለኪያ ዊስኪ ን ካልኦትን/ ኣብ በቢ ክንደይ እዋን ትሰቲ?	ብቁፅሪ ኣይፈለጥኩን 77 └─┴─┘	A4
24	ኣብ ዝሓለፉ 30 መዓልትታት መስተ ክትሰቲ ከለኻ ብማእኸላይ ኣብ ናይ ሓደ እዋን መስተ ክንደይ ትሰቲ/ቢራ ዋንጫ መለኪያ ወዘተ/?	ብቁፅሪ ኣይፈለጥኩን 77 └─┴─┘	A5
25	ኣብ ዝሓለፉ 30 መዓልትታት ኣብ ሓደ እዋን እቲ ዝበዝሐ ዓቀን መስተ ዝሰተኻሉ ክንደይ/ጥርሙዝ ቢራ ዋንጫ መለኪያ ወዘተ ኩሎም ይቆፀሩ/ እዩ	ዝዓበየ ቁፅሪ ኣይፈለጥኩን 77 └─┴─┘	A6

ኣካላዊ እንቅስቃሴ

ብምቅላል ድማ ብዛዕባ ኣብ እተፈላለዩ እዋናት እትገብሮ ም ኣብሰሙን ኣካላዊ እንቅስቃሰታት ክሓተካ እየ ዋላ እካ ናይ ስፖርተኛ እየ ኢልካ እንተዘይ ሓሰብካ ኣብ ስራሕ ዘጋጥመካ ከበድቲ ስራሕቲን ካብ ቦታ ናብ ቦታ እትገብሮም እንቅስቃሴታት ስለ ዝሓውስ ነተም ሕቶታት መልሰለይኢኻ .			
ሕቶ		**መልሲ**	**ኮድ**
እንቅስቃሴ ኣብ ስራሕ			
26	ስራሕካ ብውስን መልክዑ ፍጥነት ስርዓት ምስትንፋስን ህርምት ልቢን ዝውስኹ ኣድኽምቲ ከበድቲን ዝኾኑ ስራሕትታት ከም ከበድቲ ነገራት ምሸካም ምኹዓት ዝኣምሰሉ ን ተኽታታሊ 10 ደቂቃ ምስራሕ የካትት ዶ??	**እወ 1** **ኣይፋሉን 2** **መልሱ ኣይፋሉን እንተደኣ ኮይኑ ናብ ኮድ P4 ስገር**	P1
27	ከም ኣካል ስራምካ ኣብ ሰሙነ ንክንደይ መዓልቲታት ብጣዕሚ ኣድኻሚ ዝኾኑ ስራሕትታት ትሰርሕ?	በዝሒ መዓልትታት └─┘	P2
28	ከም ኣካል ስራምካ ኣብ መዓልቲ ንክንደይ ሰዓታት ብጣዕሚ ኣድኻሚ ዝኾኑ ስራሕትታት ትሰርሕ?	ሰዓት : ደቂቃ └─┘└─┘ : └─┘└─┘	P3
29	ስራሕካ ብውስን መልክዑ ፍጥነት ስርዓት ምስትንፋስን ህርምት ልቢን ዝውስኹ ማእኽላይ ክብደት ብዙሕ ኣድኽምቲ ዘይዝኾኑ ስራሕትታት ከም ምሸካም ዝኣምሰሉ ን ተኽታታሊ 10 ደቂቃ ምስራሕ	**እወ 1** **ኣይፋሉን 2** **መልሱ ኣይፋሉን እንተደኣ ኮይኑ ናብ ኮድ P7 ስገር**	P4

	የካትት ዶ?		
30	ከም ኣካል ስራምካ ኣብ ሰሙን ንክንደይ መዓልትታት ማእኸላይ ክብደት ብዙሕ ኣድኽምቲ ዘይገበኑ ስራሕትታት ትሰርሕ?	በዝሒ መዓልትታት └─┘	P5
31	ከም ኣካል ስራምካ ኣብ መዓልቲ ንክንደይ ሰዓታት ማእኸላይ ክብደት ብዙሕ ኣድኽምቲ ዘይገበኑ ስራሕትታት ትሰርሕ?	ሰዓት : ደቂቃ └─┴─┘: └─┴─┘	P6
ካብ ቦታ ናብ ቦታ ምጉዓዝ			
ብምቅላል ድማ ብዛዕባ ካብ ቦታ ናብ ቦታ እትገብሮም ጉዕዞታት ክሓተካ እየ ንኣብነት ናብ ስራሕ ድኺን ዕዳጋ			
32	ካብ ቦታ ናብ ቦታ ንምንቅስቃስ እንተወሓደ ን10 ደቂቃ ብእግሪኻ ወይ ብሳይክል ዶ ትጓዓዝ?	እወ 1 ኣይፋሉን 2 **መልሱ ኣይፋሉን እንተደኣ ኮይኑ ናብ ኮድ P10 ስገር**	P7
33	ኣብ ሰሙን ንክንደይ መዓልትታት እንተወሓደ ንተኽታታሊ 10 ደቂቃታተ ብእግሪ ወይ ብሳይክለ ትጓዓዝ?	በዝሒ መዓልትታት └─┘	P8
34	ኣብ መዓልቲ ንክንደይ ሰዓታት እንተወሓደ ንተኽታታሊ 10 ደቂቃታተ ብእግሪ ወይ ብሳይክለ ትጓዓዝ?	ሰዓት : ደቂቃ └─┴─┘: └─┴─┘	P9
			ዘዝናንዩ

እንቅስቃሴታት			
ሕዚ ድማ ብዛዕባ ንመዝናነሪ እንጥቀመሎም እንቅስቃሴታትን ንሰብነት ጥንካረ እንሰርሖም ስፖርትታት ክሓተካ እየ			
35	ስርዓት ኣተነፋፍሳን ህርመት ልቢን ዝውስኹ ዘዝናንዩን ኣድኽምቲ ዝኾኑ ስፖረትታት ልተኽታታሊ 10 ደቂቃ ትሰረሕ ዶ /ከም ጉያ ዓወታ ኩዕሶ እግሪ /?	**እወ 1** **ኣይፋሉን 2** **መልሱ ኣይፋሉን እንተደኣ ኮይኑ ናብ ኮድ P13 ስገር**	P10
36	ኣብ ሰሙን ንክንደይ መዓልትታት ኽቢድን ኣድካሚ ዝኾነ ናይ ኣካል ብቕዓት እንቅስቃሴ ስፖርት ወይድማ ትገብር?	በዝሒ መዓልትታት └─┘	P11
37	ኣብ መዓልቲ ንክንደይ ሰዓታት ኢኻ ኽቢድን ኣድካሚ ናይ ኣካልበቕዓት እንቅስቃሴ ትገብር?	ሰዓት : ደቂቃ └─┴─┘: └─┴─┘	P12
38	ብዝተወሰነ መልክዕ ስርዓት ኣተነፋፍሳን ህርመት ልቢን ዝውስኹ ዘዝናንዩን ማእኽላይ ክብደት ዘለዎም ስፖረት ልተኽታታሊ 10 ደቂቃ ትሰረሕ ዶ /ከም ሳይክል ሓመሳ /?	**እወ 1** **ኣይፋሉን 2** **መልሱ ኣይፋሉን እንተደኣ ኮይኑ ናብ ኮድ P16 ስገር**	P13
39	ኣብ ሰሙን ንክንደይ መዓልትታት ማእኽላይ ዝኾነ ናይ ኣካል ብቕዓት እንቅስቃሴ ስፖርት ወይድማ ትገብር?	በዝሒ መዓልትታት └─┘	P14
40	ኣብ መዓልቲ ንክንደይ ሰዓታት ኢኻ ማእኽላይ ናይ ኣካልበቕዓት	ሰዓት : ደቂቃ	P15

	እንቅስቃሴ ትገብር?	╚═╩═╝ : ╚═╩═╝	
	ናይዕረፍቲ ሰዓታት		
ቀሊሎም ዘለዉ ሕቶታት ድማ ብዛዕባ ኣብ ስራሕ ምስ መሓዙትካ ንምዝንናይ ከፍ ዚልካ እተሕልፎም ሰዓታት ዝሓዙ እዮም ብዛዕባ ደቂስካ ዘሕለፍካዮም ሰዓተት ግና ኣይትሕወስ			
41	ኣብ መዓልቲ ንክንደይ ሰዓታት ኮፍ ትብል?	ሰዓት : ደቂቃ ╚═╩═╝ : ╚═╩═╝	P16

ክፋል -III. ታሪክ ሕክምና

ሕዚ ድማ ብዛዕባ ታሪኽ ሕክምናታትኻ ክሓተካ እየ ብቶም ዝሓተካ ሕቶታተ መሰረት ምላሽ ክትህበኒ ይላቦ .

ሪጋ	ሕቶታት	እወ	ኣይፋሉን	ኣይፈለጥኩን
1	ኣብ ዝሓለፈ 5 ዓመት ብሕማም ኣብ ሆስፒታል ደቂስካ ዶ ነይርካ?			
2	ንዝሓለፉ 3 ኣዋርሕ ብሰንኪ ሕማም ነዊሕ ግዚ ደቂስኻ /ማእሰ ሒዝካ/ ኔርካ?			
3	ኣብ ዝሓለፈ ሓደ ዓመት ሕማም ላዕለዋይ ክፍሊ ስርዓት ምስትንፋስ ኣጓኒፍካ ዶ ነይሩ			
4	መጥባሕታዊ ምውጋድ ሕማም ቶንሲል /ኣዲኖይክቶሚ/ ተገርልካ ዶ ኔይሩ?			
5	ኣብ ዝሓለፈ ወረሒ ናብ ናይ ስኒ ሓኪም ክይድኻ ኔርካዶ?			
7	ኣብ ዝሓለፈ ዓመት ክታበት ኢንፍሉንዛ ረኺብካ ዶ?			
8	ኣብ ዝሓለፈ ዓመት ክታበት ስርዓተ ምስትንፋስ ረኺብካ ዶ?			
9	ኣብ ዝሓለፈ ዓመት ረኽሲ ስርዓተ ምስትንፋስ ኣጋጢሙካ ዶ ነይሩ?			
10	ምስ ረኽሲ ስርዓተ ምስትንፋስ ዘለዎም ሰባት ርክብ ኔርካ ዶ?			
11	ብራጂ ዝተነፀረ ታሪኽ ሕማም ሳምባ ምቹ ኣለካዶ?			
12	ታሪኽ ሕማም ሽኮርያ ኣለካዶ			
13	ታሪኽ ሕማም ልቢ ኣለካዶ?			
14	ታሪኽ ሕማም ሕዱር ብሮንካይተስ ኣለካዶ			

15	ታሪኽ ሕማም ብበዓል ሞያ ዝተነፀረ ኣስሚ ኣለካዶ			
16	ታሪኽ ሕማም ዓባይ ሰዓል ኣለካዶ			
18	ታሪኽ ሕማም ጨንራ ወይ ምልክታት ሕማም ጨንራ ኣለካዶ			
19	ታሪኽ ሕዱር ሕማም ፀሊም ክብዲ/ጉበት/ ኣለካዶ			
20	ታሪኽ ናይ ኩላሊት ድኽመት/ ሬናል ፌለር/ ኣለካዶ			
21	ናይ ሕማም ድብርትን ጭንቀትን ታሪኽ ኣለካዶ			
22	ናይ ሕማም ካንሰር መንሽሮ ታሪኽ ኣለካዶ			

ክፋል 5- ኣከባቢያዊ ዕልዋታት

ክፋሕዚ ድማ ምስ ህፃናት እንስሳታትን ኣዕዋፍን ዘለካ ታሪኽነ ርክብን ክሓተካ እየ እቶም ሕቶተታት ምስ ተገንዘብካ ካብ ቶመ ዝህበካ መማረፅታት መሪፅካ ምላሽካ ትህበኒ ኢኻ

ሪጋ	ሕቶታት	እወ	ኣይፋሉን	ኣይፈለጥኩን
1	ምስ ህፃናት ቆልዑ ንክክእ ኣለካዶ /?			
2	ምስ ኣዕዋፍ ንክክእ ኣለካ ዶ? ከም ደርሆ ዛግራ			
3	ምስ እንስሳታት ንክክእ ኣለካ ዶ/?			
4	ምስ ድሙ ከልቢ ንክክእ ኣለካዶ?			
5	ኣብ ደሮና ዝበገዱ ከባቢ ስራሕ ናይ ምስራሕ ታሪክ ኣለካዶ?			

6. **ኣብ ገዛኹም ንመብሰሊ ምግቢ እትጥቀምሉ ዓይነት ነዳዲ ክትነግረኒ ዶ ምኽኣልካ?**

7. **መብዛሕትኡ ግዜ ሕማም እንትስመየም ናበይ ኣዘውቲሮም ይኽዱ**

የቀንየለይ ንዝሃብካኒ ሓበሬታ ኣገዩ እየ ዘመስግን

ANNEX 3: Declaration

Letter for declaration

I, the under signed, declared that this is my original work, has never been presented in this or any other University, and that all the resources and materials used for the dissertation, have been fully acknowledged.

Name: _____

Signature: _____

Date: _____

Place:_____

Date of Submission:

This dissertation has been submitted for examination with my approval as University Supervisor.

Name: _____

Signature: _____

Date: _____