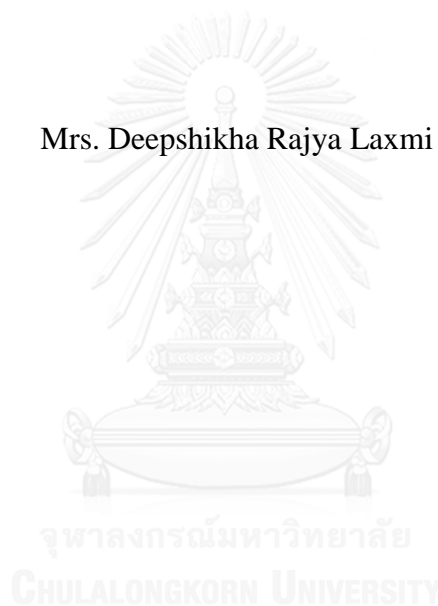Lung cancer in relation to smoking including relighting cigarette butts: Kathmandu
Valley Nepal "an unmatched case control study"

Mrs. Deepshikha Rajya Laxmi Rana

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Public Health Program in Public Health
College of Public Health Sciences
Chulalongkorn University
Academic Year 2016
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ความสัมพันธ์ระหว่างมะเร็งปอดกับการสูบเศษบุหรี่เหลือทิ้งในเมืองกาฐมาณฑุ ประเทศเนปาล:
การศึกษามีกลุ่มควบคุมโดยไม่จับคู่

นางดีฟชิการ์ ราจอูจยา ลักษมี รานา

Thesis Title	Lung cancer in relation to smoking including relighting cigarette butts: Kathmandu Valley Nepal "an unmatched case control study"
By	Mrs. Deepshikha Rajya Laxmi Rana
Field of Study	Public Health
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ดีฟชิการ์ ราจอูจยา ลักษมี รานา : ความสัมพันธ์ระหว่างมะเร็งปอดกับการสูบเศษบุหรี่เหลือทิ้งในเมืองกาฐมาณฑุ ประเทศเนปาล: การศึกษามีกลุ่มควบคุมโดยไม่จับคู่ (Lung cancer in relation to smoking including relighting cigarette butts: Kathmandu Valley Nepal "an unmatched case control study") อ.ที่ปรึกษาวิทยานิพนธ์หลัก: สถิรกร พงศ์พานิช, 67 หน้า.

คำค้นหา: มะเร็งปอด, การสูบบุหรี่, เศษบุหรี่เหลือทิ้ง, การศึกษามีกลุ่มควบคุม

เบื้องหลัง: มะเร็งปอดเป็นหนึ่งในมะเร็งที่พบบ่อยที่สุดในประเทศเนปาล คิดเป็นร้อยละ 14.1 ของการตายจากผู้ป่วย มะเร็งทั้งหมด จำนวนผู้ป่วยมะเร็งปอดในประเทศเนปาลมีอัตราเพิ่มขึ้น เนื่องจากประเทศเนปาลเป็นกลุ่มประเทศกำลังพัฒนาที่จัดอยู่ ในกลุ่มด้อยทางเศรษฐกิจสังคมและการพัฒนามนุษย์ ร้อยละ 70 ของผู้ป่วยโรคมะเร็งปอดมีสาเหตุหลักมาจากการสูบบุหรี่ การศึกษา ครั้งนี้มีวัตถุประสงค์เพื่อหาความสัมพันธ์ระหว่างการสูบบุหรี่และการสูบบุหรี่จากเศษบุหรี่เหลือทิ้งกับการเกิดโรคมะเร็งปอดในหุบ เขากาฐมาณฑุ ประเทศเนปาล

ระเบียบการวิจัย: การศึกษามีกลุ่มควบคุมโดยไม่จับคู่ (Unmatched Case Control) ได้ถูกนำมาใช้เพื่อการศึกษาในครั้งนี้ โดยศึกษาในกลุ่มผู้ป่วยโรคมะเร็งปอดจำนวน 108 คน และกลุ่มควบคุมจำนวน 99 คน ในโรงพยาบาล National Hospital and Cancer Research Centre Pvt. Ltd ,Bhaktapur Cancer Hospital และในบริเวณหุบเขากาฐมาณฑุ ระหว่างเดือนกุมภาพันธ์ถึงกรกฎาคม พ.ศ. 2560 ผู้สัมภาษณ์ใช้แบบสอบถามกลุ่มทางเศรษฐกิจสังคม พฤติกรรมการสูบบุหรี่ และการรับควันบุหรี่มือสอง สถิติเชิงพรรณนาได้ ถูกนำมาใช้เพื่ออธิบายคุณลักษณะทั่วไป และใช้การวิเคราะห์การถดถอยโลจิสติกแบบย้อนหลัง เพื่อหาค่าอัตราส่วนออดส์ และช่วง ความเชื่อมั่นที่ 95% โดยคัดเลือกตัวแปรกวนจากการวิเคราะห์แบบสองตัวแปรที่มีค่า p-value < 0.2

ผลลัพธ์: จากสมการการถดถอยโลจิสติกแบบย้อนหลัง พบว่าการสูบบุหรี่เป็นปัจจัยเสี่ยงที่ของการเกิดโรคมะเร็งปอด (OR=1.91,95%C.I=1.001-3.66) และหลังหลังจากควบคุมปัจจัยกวนอื่นๆอีก 11 ตัว พบว่าการสูบบุหรี่เป็นปัจจัยเสี่ยงที่ของการเกิด โรคมะเร็งปอดเพิ่มมากขึ้น (OR=2.85,95%C.I=1.054-7.68) ในขณะที่การสูบบุหรี่จากเศษบุหรี่เหลือทิ้งแสดงถึงความสัมพันธ์กับการ เกิดโรคมะเร็งปอดเมื่อยังไม่ได้ควบคุมปัจจัยกวนอื่นๆ (OR=4.47,95%C.I=2.28-8.78) และเมื่อควบคุมปัจจัยกวน 17 ตัวพบว่ามีค่า ออดที่สูงขึ้น (OR=37.63,95%C.I=7.55-187.46).

สรุป: การสูบบุหรี่ และการสูบบุหรี่จากเศษบุหรี่เหลือทิ้งเป็นปัจจัยเสี่ยงของการเกิดมะเร็งปอด ผลจากงานวิจัยครั้งนี้จึง ชี้ให้เห็นว่าควรจะส่งเสริมการป้องกันและควบคุมการสูบบุหรี่ โดยเน้นถึงการเปลี่ยนแปลงพฤติกรรมเพื่อที่จะลดการสูบบุหรี่จากเศษ บุหรี่เหลือทิ้งในประชากรทั่วไป และลดภาวะการบุหรี่ในประชากรทั่วไปของประเทศเนปาลด้วย

สาขาวิชา   สาธารณสุขศาสตร์   ลายมือชื่อนิสิต _____

ปีการศึกษา 2559   ลายมือชื่อ อ.ที่ปรึกษาหลัก _____

DEEPSHIKHA RAJYA LAXMI RANA: Lung cancer in relation to smoking including relighting cigarette butts: Kathmandu Valley Nepal "an unmatched case control study". ADVISOR: PROF. SATHIRAKORN PONGPANICH, Ph.D., 67 pp.

Background: Lung cancer is one of the most common cancers in Nepal causing 14.1% of total death among cancers. Nepal being a developing country with poor socioeconomic and human development, the rate of lung cancer patient is in increasing trend. Tobacco smoking is one of the major risk factors causing 70% lung cancer deaths. The major objectives of the study was to find out association of cigarette smoking and relighting of cigarette butts while smoking with occurrence of lung cancer in Kathmandu Valley Nepal.

Methods: An Unmatched Case Control study was conducted among 207 participants including 108 cases and 99 controls from the study areas; National Hospital and Cancer Research Centre Pvt. Ltd , Bhaktapur Cancer Hospital and areas nearby to the hospitals in Kathmandu from April 2017 to July 2017 purposively. For data collection interviewer administered questionnaire was used having Socio-demographic, Smoking Habits and Secondary Exposure to smoke characteristics section. Descriptive statistics was done to summarize the characteristics and analytical statistics was done in which bivariate analysis of factors showing pvalue <0.2 was included in the Multivariable Logistic regression where parsimonious model with backward regression was used to calculate odds ratios (ORs) and 95% confidence intervals to find association of risk factors.

Results: In multivariate regression, cigarette smoking was a strong associated risk factor for occurrence of lung cancer (OR=1.91,95%C.I=1.001-3.66),even when adjusted with other 11 factors from the bivariate analysis (OR=2.85,95%C.I=1.054-7.68).Whereas relighting of cigarette butts while smoking showed positively strong association with occurrence of lung cancer when it was unadjusted (OR=4.47,95%C.I=2.28-8.78)as well as when adjusted for 17 factors from bivariate analysis (OR=37.63,95%C.I=7.55-187.46).

Conclusions: As per this research smoking and relighting of cigarette butts were both major associated risk factors for occurrence of lung cancer. This call for strengthening the prevention aspect of tobacco control program to focus on behavioral change for reducing relighting of cigarette butts among the general population and also reducing tobacco addiction among the general population in Nepal.

Field of Study: Public Health	Student's Signature
Academic Year: 2016	Advisor's Signature

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS

CDC:	Centers for Disease Control and Prevention
DF:	Degree of Freedom
CI:	Confidence Interval
EPA:	Environmental Protection Agency
IARC:	International Agency for Research on Cancer
NCD:	Non Communicable Diseases
NHRC:	Nepal Health Research Council
NIH:	National Institute of Health
OR:	Odds Ratios
SDG:	Sustainable Development Goal
SHS:	Second Hand Smoking
SPSS:	Statistical Package for the Social Sciences
WHO:	World Health Organization

CHAPTER I

Introduction

1.1 Background and Rationale

Cancer is the leading cause of mortality and morbidity worldwide with 14.1 million new cases of cancer and 8.2 million deaths every year. There were 32.6 million people living with cancer in 2012(WHO, 2012a). Two third of global cancer cases and deaths occur in low and middle income countries.

In Southeast Asia, the regional burden of cancer is projected to increase incidence by 41% that is, from 6.4million (2012) to 9 million (2025) and mortality from 4.3million to 6.2 million, that is mainly due to fast growing economy of these countries and also due to increase in size and ageing population of these regions. Cancer not only harms and kills a patient; it also affects the entire society and the family members causing health issues, wide economic, social and development implications. Its high curing cost that has to take care by the patient and his/her immediate family members the mental impact caused by cancer is immense to all the parties who are directly or indirectly affected.

As the burden of non-communicable disease such as cancer is in an increasing trend, World Health Organization (WHO) launched the Global Action Plan for the Prevention and Control of NCD 2013-2020 in 2013. It aims to reduce 25% premature mortality from chronic respiratory diseases, cancer, cardiovascular disease, diabetes by 2025. The United Nations in their 2030 agenda for Sustainable Development Goal (SDG) in September 2015 recognized non communicable diseases(NCD) as a major challenge for sustainable development by developing national responses by Head of state and Government for one third reduction of premature mortality by NCD - to achieve Universal Health coverage, strengthen the implementation on tobacco control , reduce harmful use of alcohol and support research and development of medicines and vaccines and also access of these for control of NCDs. Nepal has been one of active

member in the global context, taking initiations for implementation of SDG for the long term development of the country to promote healthy lives and well-being for people of all ages.

Lung cancer is the most prevalent among cancers, which accounts for 13.0% of the total and 1.8   million new cases. 58% occur in less developed country and is responsible for 19.4% of the total deaths followed by liver (9.1%), stomach (8.8%), colorectal (8.5%), breast (14.3%) and oesophagus (4.9%) cancer worldwide in 2012. Lung cancer is common in both sexes (WHO, 2012b).In population based cancer registries in neighboring countries like India, the most common reported cancer sites in male are lung then oesophagus, stomach and larynx and in females being cervical cancer, breast, ovary and oesophagus (Gajalakshmi, Swaminathan, & Shanta, 2001).
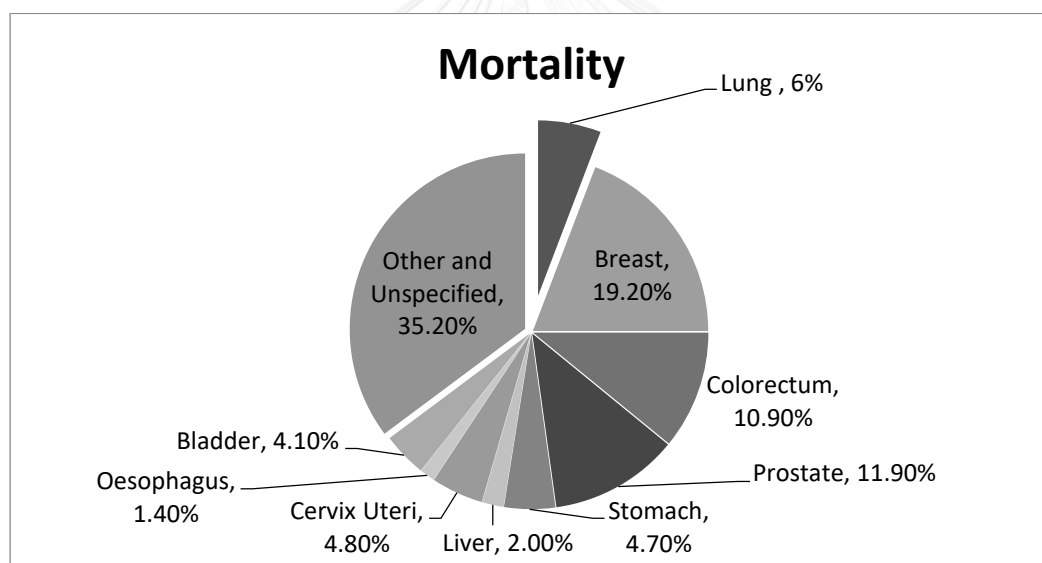
Figure 1: Estimated mortality due to cancer worldwide both sexes,(WHO, 2012b).

Nepal is a developing country with poor Socioeconomic and Human Development. Though, Nepal has actively been a part of attaining SDG among non-communicable diseases, lung cancer still accounts for 17.0% and 14.3% mortality in male and female patients with cancer.(IARC, 2014)

Cancer is a term used for rapid creation of abnormal cells that grow beyond their usual boundaries, which invade adjoining parts of the body and spread to other organs (metastasis) (WHO). Lung, Prostate, stomach, colorectal and liver cancers are the most

common type in male, whereas breast, colorectal, lung, uterine cervix and stomach cancers in females. The changes are due to interaction between physical carcinogens (UV and ionizing radiation), chemical carcinogens (components of tobacco smoke, Alfa toxin, arsenic and biological carcinogens (viruses, bacteria's and parasites). Ageing increases the risk of cancer.

Factors responsible for causing lung cancer

1. Smoking

Smoking is the process of inhaling smoke through any medium that might contain nicotine or any other chemical. Cigarette smoking is the process of inhalation of the gases and hydrocarbon vapors generated by slowly burning tobacco in cigarettes. There are over 4,000 chemicals in tobacco smoke and at least 69 of those chemicals are known to cause cancer. Cigarette smoking has become one of the main risk factors for causing lung cancer, nearly 80-90% of lung cancers is caused by cigarette smoking. People who have the habit of smoking are 15-30 times more susceptible to cancer than people who are nonsmokers. The amount and years of cigarette smoked increases the risk of lung cancer. According to Doll and Hill in 1950, cigarette smokers have been defined as someone that smokes at least a cigarette per day for at least a year (Doll & Hill, 1950). According to Harrison's Principal of Internal Medicine the primary cause of lung cancer worldwide is tobacco smoking out of which 60% occurs in never smokers i.e. smoked <100 cigarettes per lifetime) /former smokers (smoked ≥100 cigarettes per lifetime or quit ≥1 year), many of whom quit decades ago. (Horn, Pao, & Johnson, 2012)

2.Second Hand Smoke

Second hand smoke contains the same carcinogens but at different concentrations (Besaratinia & Pfeifer, 2008). Exposure of SHS in the world is 40% among children ,33% in nonsmoker males and 35% in nonsmoker female highest in Europe then Western Pacific and then group B Southeast Asia. (Jaakkola, Oberg, Woodward, Peruga, & Pruss-Ustun, 2011)

3.Radon

Radon is a naturally occurring radioactive gas that is being trapped in the house and has become the second leading cause of lung cancer. According to U.S Environmental Protection Agency (EPA), Radon is leading cause of lung cancer to 20,000 people each year.

4.Family or Personal History of Lung Cancer.

5.Other substances: Asbestos, Arsenic, Silica, Diesel exhaust and chromium.

6.Radiation Therapy to Chest: Cancer patients receiving radiation to the chest have a high risk of developing lung cancer.

Cancer mortality can be reduced to 30% by modifying and avoiding key risk factors i.e. tobacco. Approximately, tobacco causes around 20% of global cancer deaths and 70% of global lung cancer deaths. Promotional campaign and awareness programs, early detection, diagnosis and effective treatment, including palliative care and pain relief helps to increase the cancer survival rate and reduce the suffering.

Tobacco smoking is the biggest health problem in the world at present .About 6 million people lose their lives as a result of tobacco out of which 5 million are due to smoking tobacco (WHO, 2016). Out of 7 billion people in the world 1.1 billion smoke tobacco everyday (WHO, 2015c). Smoking tobacco is the main cause of lung cancer. People smoking cigarette are 15-30 times more susceptible to get lung cancer.(Centers for Disease Control and Prevention (CDC)).
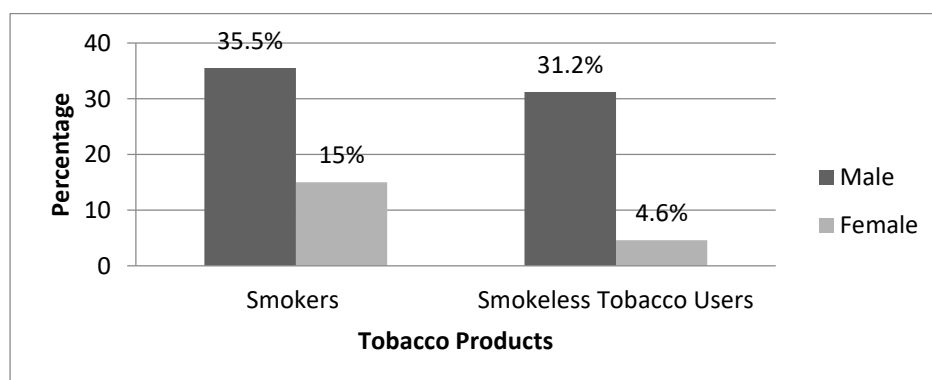
Figure 2: Prevalence of tobacco use among men and women age 15–64 years, Nepal, 2007.

Nepal Demographic Health Survey 2007 reveals 35. 5% of male in Nepal and 15 % female smoke cigarette and 31.2% of male and 4.6% of female are the smokeless tobacco users.

Evidences have shown that " relighting is the method when once smoked cigarette, smoked and extinguished is again relit again and smoked, which is also known as "dimping" in Manchester area and can be practiced till it is finally discarded". An earlier study has shown that smokers who relight cigarette have higher risk of developing lung cancer (Dark, O'Connor, Pemberton, & Russell, 1963) Most of the research done so far has focused on the effect of smoking on lung cancer, but the effect of the relighting of cigarette butts on lung cancer has not been investigated in detail. This study examines the relationship between relighting of cigarette with lung cancer in Nepal, where relighting is most prevalent because of poor resources and its improper disposal. The findings of this study may help in designing long term behavioral intervention programs and policies to minimize the impact of the relighting of cigarette to lung cancer.

1.2 Research Objective

The core objective of conducting this research work is:

1.   To find out whether there is a relationship between smoking of relit cigarette butts and occurrence of lung cancer in male/female in Kathmandu Valley, Nepal.

2.   To find out the relationship between smoking and occurrence of Lung Cancer in male/female in Kathmandu Valley, Nepal.

1.3 Research Question

- Is there a relation between relighting cigarette butts while smoking and occurrence of lung cancer among male/female in Kathmandu Valley, Nepal?

- Is there a relation between smoking and the occurrence of lung cancer among male/female in Kathmandu Valley?

1.4 Research Hypothesis

<u>Hypothesis 1:</u>

H0: There is no relationship between relighting cigarette butts while smoking in male/female and occurrence of lung cancer.

Ha: There is a relationship between relighting cigarette butts while smoking in male/female and occurrence of lung cancer.

Hypothesis 2:

H0: There is no relationship between smoking and occurrence of lung cancer among male/female.

Ha: There is a relationship between smoking and occurrence of lung cancer among male/female.

1.5 Conceptual Framework

Independent Variable   **Dependent Variables**

Socio-Demographic Characteristics
- Age
- Sex
- Occupation
- Religion
- Marital Status
- Ethnicity
- Educational Status
- Economic Status
- Family History of Cancer   → Cases: with Lung Cancer

Smoking History
- Smoking
- Started Age   → Controls: without Lung Cancer
- Number of Cigarettes per day
- Filter present or not
- Type of Cigarette
- Relighting of cigarette butts
- Duration of smoking
- Ever quit smoking

Exposure to second hand smoke
- Exposure of Smoke at home
- Exposure of smoke at workplace
- Type of fuel used for cooking
- Cooking Location at Household

Figure 3:Conceptual Framework.

1.6 Operational Definitions

- **Age:** Current age of the participant in completed years.

- **Sex:** Categorized as a male or female with respect to their reproductive functions

- **Religion:** Belief or faith on particular god or gods of the participant.

- **Marital Status:** Current status of the participant whether he/she is single, married, divorced or widowed/ widower.

- **Occupation:** Current or past profession or job of the participant.

- **Ethnicity:** The social group with which the participant shares a distinctive likes, religion, culture or language.

- **Educational status:** Highest level of schooling that the participant has either completed or running.

- **Smoking:** It is the process of inhaling hydrocarbon vapors generated by slowly burning tobacco in cigarettes. And checked whether the participant ever or never smoked. Few terminologies related to the smoking habit:

➢ Started age: Age at which the participant first started smoking even a single puff.

➢ Number of cigarettes per day: Approximate number of cigarette smoked by the participant per day.

➢ Type of Cigarette: Place of manufacture, which could be either locally made or imported foreign cigarette.

➢ Filter: Porous device for removing impurities or solid particles from a liquid or gas passed through it. The cigarette smoked had a filter or not.

➢ Relighting Butt Ends: Method of smoking in which the participant extinguishes a cigarette at a certain stage and again relights the same cigarette and smokes it which is practiced over and over till the butt is discarded.

- **Economic Status**: The average amount of money earned per month by the participant at present or past while he/she was working.

- **Family History of Cancer:** If any immediate parents, sibling, cousin or relative have any history/evidence of cancer.

Chapter II

Literature Review

2.1 Non Communicable Diseases as Global Burden

In the past communicable diseases were the main causes of death around the world thus limiting the life expectancy by uncontrolled epidemics .However after World War II with achievements in medical research like vaccines , antibiotics and improvement in living condition, non-communicable diseases have become major burden on industrialized countries .Although at first considered as a disease of only the rich but now the entire world has been facing the burden of NCD's especially in the developing countries including both the rich and the poor. NCD's has been predicted to account for 80% of the total burden around the world by 2020.

Table 1:Evolution of NCDs in developing countries (Boutayeb & Boutayeb, 2005).

	Non-Communicable Diseases	Communicable Diseases + Maternal + Perinatal + Nutritional	Injuries	total
1990	18.7 (47%)	16.6 (42%)	4.2 (11%)	39.5 (100%)
2000	25.0 (56%)	14.6 (33%)	5.0 (11%)	45.0 (100%)
2020	36.6 (69%)	09.0 (17%)	7.4 (14%)	53.0 (100%)

Globally, the accelerated epidemic of NCDs is mainly related to population ageing and risk factors distribution changes .At present in the world there are nearly 600 million people aged 60 years and over which has been estimated to double by 2025 and expected to reach 2 billion by 2050.As there is an increase in age there is a decline in mortality causing challenges for social and health policy planners both in developed and developing countries to support older people to remain healthy and to ensure a good quality of life in their later years.(WHO, 2003).

WHO 2015 states non communicable diseases are responsible for 28 million deaths especially in the low income and middle income countries mainly due to increase in aging population and also because half of the population are below poverty line and have limited access to health care. Among these cancer accounts for 8.2 million deaths (WHO, 2015b). The main reasons for high prevalence of NCD in South Asia are extreme poverty, sedentary lifestyle and inadequate health. In low-income and middle-income countries, there was an increase in lung cancer death by 30% in a gap of 10 years from 1990 to 2000 , which reflects the emergence of tobacco epidemic in these countries (WHO, 2003)The prevalence of risk factor were among different socio-demographic groups in rural India in which commonest risk factor was smoking (Ghaffar, Reddy, & Singhi, 2004).When compared to White Caucasians ,South Asians have less health seeking behavior and awareness due to language barriers and atypical presentation delayed diagnosis and other sociocultural and religious factors. These lead to poorer prevention and poor and delayed treatment and rehabilitation.(Misra & Khurana, 2011).

Nepal being a low income country faces double burden of disease due to NCD's with cancer being the top 4 NCD's .The main contributing risk factors of NCDS of Nepal is tobacco smoking (30%,2011), alcohol (2.2%,2010),high blood pressure(24.2,2011) and obesity (1.4%,2008)(Vaidya, Shakya, & Krettek, 2010).

2.2 General overview
2.2.1 Cancer
Cancer is one of the leading non-communicable diseases causing high morbidity and mortality worldwide, especially in low and middle income countries.(WHO, 2014)

It is predicted that there will be a rising incidence of cancer to 15million and deaths to 12 million in 2020 of which most of the burden of cancer will occur in developing countries which are mainly due to larger epidemiological transitions in lesser developed countries. The rapidly aging population, urbanization, tobacco, dietary pattern, alcohol and infectious agents are the major contributing factors in this global increasing trend. In developing countries lung cancer, breast cancer, stomach cancer, colorectal cancer, stomach cancer and liver cancers are the most frequently occurring

cancer. (Kanavos, 2006). Annually, there are more than 3,500 cases of cancer in Nepal out of which 21% of all cancers are in women. (Pradhananga, Baral, & Shrestha, 2009)In India it was found that cancer was intimately associated with customs, habits and other exogenous factors hence these cancers can be control by adequate public health measures and proper education(Paymaster, 1964).

2.2.2 Lung Cancer

One of the most commonly occurring cancers around the world is lung cancer with an estimate of 1.8 million cases out of which 58% occurs in less developed countries. It is seem to be more common in males about 1.2 million that is 16.7% of the total lung cancer cases than females (WHO, 2012b).

Lung cancer has become one of the leading cause of cancer death in the past 100 years not only in developed countries but now in developing countries and as estimated by WHO there will be a continuous rise in cancer deaths due to rise in cigarette smoking especially in Asia. Despite efforts to restrain smoking worldwide there are approximately 1.1 billion smokers as of which by 2025 if the trend continuous it is estimated to reach 1.9 billion. (Boisclair, 2003).As per studies done there will be an expected increase to 3.5million cases per year, especially in developing countries women that smoke may increase their smoking in comparison to men thus expect increase of 80% rise in lung cancer cases per year by 2025 (Stanley & Stjernswärd, 1989).Thus in developed countries there is an increase in number of lung cancer deaths mostly due to aging population and due to evolving tobacco epidemic in lesser developed countries (Didkowska, Wojciechowska, Mańczuk, & Łobaszewski, 2016).

In India, as there is increase in smoking trend among male because of which in past decade lung cancer has become the most common cancer among males in most of the hospitals rather than oropharynx cancer which was supposedly the most common cancer (Behera & Balamugesh, 2004). In a study done in Pakistan by Lugman.M. et.al (Luqman et al., 2014) in 2014 tobacco smoking was the number one leading cause of lung cancer in Pakistani population others causes were pesticide, exposure to red meat, exposure to diesel exhaust and preventive factors being active living, no smoking, no alcohol, healthy lifestyle and consumption of healthy green vegetables and fruits. In a

study done in Xuan Wei, China lung cancer in women were strongly associated with domestic use of smoky coal rather than tobacco (Mumford et al., 1987).

Bronchogenic carcinoma lies in the top 5 most common cancers according to statistics from 5 major hospitals in Nepal(Joshi, 2003). As per WHO 2014, there were 1,310 and 2,332 reported cases of lung cancer in male and female respectively. Mortality due to lung cancer reached 2,235 that is 1.41% of total deaths.(WHO, 2014).A study which was conducted using both cancer registry data from 2003 and 2013 as well as hospital registry data showed lung cancer to be the commonest in male(Poudel, Huang, Neupane, & Steel).Another study done showed tobacco related cancer constitute 48% of all cancer among male and 285 among female of which lung cancer being most common in male(22.2%) and in female (20%).(Binu et al., 2007) Other study also shows that, lung cancer to be major cancer in males like study done by (Binu et al., 2007),(Pradhananga et al., 2009) ,(Poudel, Huang, & Neupane, 2016) factors related ethnicity like Rai / Limbu / Magar and lower education(Hashibe et al., 2011), not enough health education (Khatiwada et al., 2013) and tobacco consumption and household air pollution.(Raspanti et al., 2016; Raspanti et al., 2015).

2.2.3 Tobacco Smoking
The use of tobacco is the leading risk factor of lung cancer causing 70% lung cancer deaths worldwide.(WHO, 2015a).Among the total population under study in China, 68% were smokers leading to a quarter of the most adult male cancers (Chen et al., 2015).

Apart from lung cancer positive associations between tobacco smoking and other cancer such as cancers of urinary bladder, oral cancer, pharynx, larynx, oesophagus, renal pelvis and pancreas have been established by international experts working group in 1985 (Sasco, Secretan, & Straif, 2004). Cigarette smoking has been found to be the primary risk factor especially in male .A study done showing a combined analysis of 11 case control studies showed a linear increase of occurrence of bladder cancer with increase in duration of smoking. There was an intermediate decrease of risk of occurrence of bladder cancer by over 60% among those who have given up smoking for the last 25 years and over 30% among those who have left smoking for 1 to 4 years.(Brennan et al., 2000).Other study concluded that current cigarette smokers had

a threefold higher risk than nonsmokers for occurrence of bladder cancer (Zeegers, Tan, Dorant, & van den Brandt, 2000). In a study done in Alexandria ,Egypt there was a strong association of cigarette smoking and bladder cancer accounting for 75% of the bladder cancer cases in male.(Bedwani et al., 1997).

Tobacco causes nearly 5 million deaths worldwide every year. 2.41 million Deaths in developing countries and 2.43 million in developed countries. By 2030, the toll is projected to increase to 10 million (Thankappan & Thresia, 2007). It's even known that predominance of smoking in male may be due to greater restriction on the behavior of women in many situations due to different sex roles and greater of scarce resources to men than women. (Waldron et al., 1988)

In Nepal there is slight predominance of smoking in male than in female who tend to smoke more frequently and for a much longer duration than females (57.5% in males and 42.5% in female)(R Chawla et al., 2010).

Table 2: WHO Report on the Global Tobacco Epidemic, 2015.
Prevalence of tobacco use

Tobacco use data from the latest survey results as at 31 December 2014

Smoking prevalence (%)	Youth tobacco use		Adult tobacco smoking		Adult cigarette smoking	
	Current tobacco use	Current cigarette smoking	Current	Daily	Current	Daily
Male	24.6	5.5	27.0	22.2	...	20.0
Female	16.4	0.8	10.3	9.6	...	7.1
Both sexes	20.4	3.1	...	...	...	...

Youth: Global Youth Tobacco Survey, 2011; National, ages 13-15
Adult: NCD Risk Factors STEPS Survey Nepal, 2012-13; National, ages 15-69

From the above data daily adult cigarette smoking (.i.e. nearly one cigarette smoked every day or nearly every day over a period of a month or more) is higher in male i.e.20% whereas in female it is only 7.1%.Tobacco smoking includes bidi (raw tobacco rolled in a leaf), hukka and hashish (usually mixed with raw tobacco and smoked) accounts for 22.2% of daily smoking prevalence of smoking among adults. A study done in Japan as well as in Nepal shows that there is an increased risk of lung cancer with use of local cigarettes,(Raspanti et al., 2015; Wakai et al., 1997).

With increase in average amount of cigarette smoked per day there is an increase in risk of lung cancer which is shown in many studies (Raspanti et al., 2015; Wakai et al., 1997; Wu-Williams et al., 1990).

In one of the studies done in the mountainous region of Nepal there is higher prevalence of female smokers than male smokers(71.6%) (Pandey, Neupane, & GAUTAM, 1988).There is an increasing trend of smoking with increase in age .i.e. above 64 years and decrease in trend with increased level of education. In rural Nepal, smoking acts as a recreational pursuit among the people of the community. This attitude acts as a serious problem in devising effective policy to reduce such norms. (Pandey, M. R., Neupane, R. P., & Gautam, A. (1988). Interest in quitting depends on level of education as well as extent of knowledge about harmful effects of smoking. In a study where Nepal Demographic and Health Survey 2006 secondary data analysis showed that individuals who were less educated were 6.57 times more likely to smoke than individuals with higher level education. It also concluded that individuals who were separated, divorced or widowed were 1.54% more likely to use any form of tobacco than single or married individuals. (Sreeramareddy, Ramakrishnareddy, Harsha Kumar, Sathian, & Arokiasamy, 2011).

Tobacco smoking addiction is not only an adversity of adulthood; it is also a disease of childhood. In many countries the mean age of use of tobacco is below 15 years (Cinciripini, Hecht, Henningfield, Manley, & Kramer, 1997). In later age groups, former smokers who quit smoking benefit more from those who are current smokers. Those who quit smoking before the age of 50 years of age show a reduction of 50% in mortality due to all causes of death in following 16 years of life .It is even shown that there is a reduction in risk by time of quitting ,previous exposure to tobacco level and abstinence duration of smoking(Cinciripini et al., 1997). Secondary exposure to smoke at workplace is highly influenced by type of workplace and smoking policy. Smokers tend to consume less number of cigarettes per day as well as consider quitting or quit if there is a strong smoking ban in the workplace than places with no or weak smoking policies. (Ross C Brownson, David P Hopkins, & Melanie A Wakefield, 2002).

2.2.4 Relighting of cigarettes butts

Past studies have shown that there is no safe level of smoking but it is also known that the way of smoking also determines the harmfulness of smoking .For example the depth of smoke inhaled and the covering the micro perforations around light cigarettes also increases the harmfulness of smoking (Hunecke, Haustein, Grischkat, & Böhler, 2007).

The way people smoke and whether they smoke is important through public health perspective. People deserve to know that certain ways of smoking are more harmful than other, by being aware of how smoking can be less and more harmful brings in change in behavioral habits of people. They either quit smoking or reduce smoking knowing that it can never be safe altogether. (Cunningham, Faulkner, Selby, & Cordingley, 2006).

Relighting of cigarette butts which a variation of normal method is of smoking in which a cigarette is once extinguished at a certain stage and later again relit and is smoked again and practiced again and again till it's discarded. This practice is also known in Manchester area as "dimping".This method of relighting have shown the higher chances of lung cancer in smokers than those who do not relight (Dark et al., 1963). Other studies have shown that not only relighting cause lung cancer it also increases the rate approximately of about 15% for occurrence of other lung diseases like chronic bronchitis (J Rimington, 1974). Smokers who were more dependent on smoking practiced relighting than who were nonsmokers. The other factors related to relighting in some studies showed that smokers to be mainly female, unemployed, Low income homes and less education and on number of cigarette smoked per day. (Cunningham et al., 2006). In a unpublished study conducted in Nepal showed that, out of 28% of the respondents who relit the cigarette ends, 48% developed the cancer compared to those who never relight cigarette butt ends (Acharya, 2015).

2.2.5 Second Hand Exposure to Smoke

Among the 6 million people who are killed by tobacco each year 0.6 million are nonsmokers who are exposed to second hand smoke. Second hand smoke are smoke that fills restaurants, offices and household especially enclosed spaces where people

burn cigarettes, bidis, water pipes and also due to indoor cooking. Half of the children around the world breathe polluted air by tobacco in public places. 28% of the deaths in 2004 were children due to second hand smoke. In adults, it is responsible for coronary heart disease, respiratory diseases and even lung cancer.(WHO, 2016). There are more than 50 chemicals that cause cancer in tobacco smoke .A study shows that individuals first exposed at the age before 25 years to second hand some have higher chances of lung cancer compared to those who are exposed to SHS after the age of 25 years.(Asomaning et al., 2008). In a study done in China showed that household exposure to second hand smoke where high and that high percentage of smokers smoked in front of respondents. In 2004, second hand smoking as estimated to cause 21,400 lung cancer cases worldwide and has attributed to cause 1.0% of worldwide mortality.(Öberg, Jaakkola, Woodward, Peruga, & Prüss-Ustün, 2011).

A study showed positive association between domestic smoke and chronic chest infections which is more prevalent in women because they are more likely to be exposed to domestic smoke in hill region of Nepal (Pandey, 1984). Women in rural and urban regions in Nepal spend large proportions of their lives at indoors thus leading to high respirable dust concentrations leading to high chances of exposure likely to produce respiratory illness. (Kurmi, Semple, Steiner, Henderson, & Ayres, 2008). Lack of ventilation and poor design of stoves with absence of hoods which take out smoke from indoor exacerbate the adverse health effects caused by indoor smoke. Biomass fuel which is commonly used in developing countries which are usually wood, coal, animal dung, charcoal and crop residue exert high levels of noncombustible products which are usually harmful for health of individuals who constantly get exposed to it. According to WHO guideline, particulate matter of smoke with inhalable material greater than 10μm is referred to as PM10 which as a guideline 24h mean of PM10 is set as 50μg/m3 .But in most developing countries it exceeds 2000μg/m3. (Fullerton, Bruce et al. 2008).In a study done in Nepal, showed women were more exposed to indoor smoke especially in rural regions as they were more exposed to indoor smoke while cooking. The average PM10 (particulate matter) in kitchen using biomass fuel was 3 times higher than those using LPG(Liquefied petroleum gas) , kerosene, electricity and bio gas (Shrestha & Shrestha, 2005).In nonsmoking women ,long term exposure to smoke due to cooking may lead to

adenocarcinoma of lung.(Hernandez-Garduno, Brauer, Perez-Neria, & Vedal, 2004),(Behera & Balamugesh, 2004). Secondary exposure to smoke at workplace is highly influenced by type of workplace and smoking policy .Smokers tend to consume less number of cigarettes per day as well as consider quitting or quit if there is a strong smoking ban in the workplace than places with no or weak smoking policies (R. C. Brownson, D. P. Hopkins, & M. A. Wakefield, 2002).

2.2.6 Family History (Genetic)

 In assessment of family history, individuals showing positive history of cancer have been represented as a higher risk group for occurrence of cancer. Those individuals with a first degree relative with lung cancer showed 1.51 fold increase risk of lung cancer (Coté et al., 2012).There have been evidences in recent decade that genetic basis of cancer has increases thus making it important in epidemiological study for assessment of familial cancer aggregation (Love, Evans, & Josten, 1985; Wünsch-Filho, Boffetta, Colin, & Moncau, 2002).Study done by Love et al, the history of family cancer among 1st degree relatives in primary site was 83.3% in reported cases. The risk of lung cancer further increases with increase of lung cancer among number of family members. Other studies suggest that positive association of family history and lung cancer may be due to similar environmental factors like smoking, secondary exposure to smoking ,household exposure to smoke and also inherited genetic susceptibility (Osann, 1991),(Samet, Humble, & Pathak, 1986).Those families of cases with cancer having two or more than two members showing a multigenerational pattern had a higher risk of occurrence of multiple tumors.one of the most common sites in male and females being lung cancer (OR:1.96/1.8) respectively(McDuffie, 1991).

CHAPTER III

RESEARCH METHODOLOGY

This chapter represents the research methodological framework that was used for collection of the data and analyzing them to solve the research gap and answer the research questions. The overall methods available to obtain data is presented and explained before selecting the appropriate ones.

3.1 Research Design

Research design serves as the master framework for the study that guides the data collection and analysis stage of the research work. The research design applied to the study comprises of two distinct design considerations; descriptive and analytical research design. These two design considerations were applied effectively to meet the design objectives. To learn the profile of the respondent, presentation and description of the data collection and to describe the characteristics of the subject descriptive research design was undertaken. On the other hand, Analytical research design was employed to identify the nature of the relationship between dependent (presence of lung cancer) and the independent variable (various factors responsible for causing lung cancer).

This study, the unmatched case control study was conducted to ascertain the relationship between the presence of lung cancer and cigarette smoking habit and relighting of cigarette butts while smoking in Kathmandu ,Nepal. This design of study is being conducted as a case control study that is particularly suitable for relatively rare disease with long induction period such as cancer.

3.2 Study Area

For the collection of demographic and the research specific data, two hospitals were chosen as the study area, namely National Hospital and Cancer Research Centre Pvt. Ltd situated at Kathmandu and Bhaktapur Cancer Hospital situated in Bhaktapur, Nepal for the cases who were diagnosed with lung cancer, whereas controls were non lung cancer patients who were either participants visiting the hospital and from areas nearby.
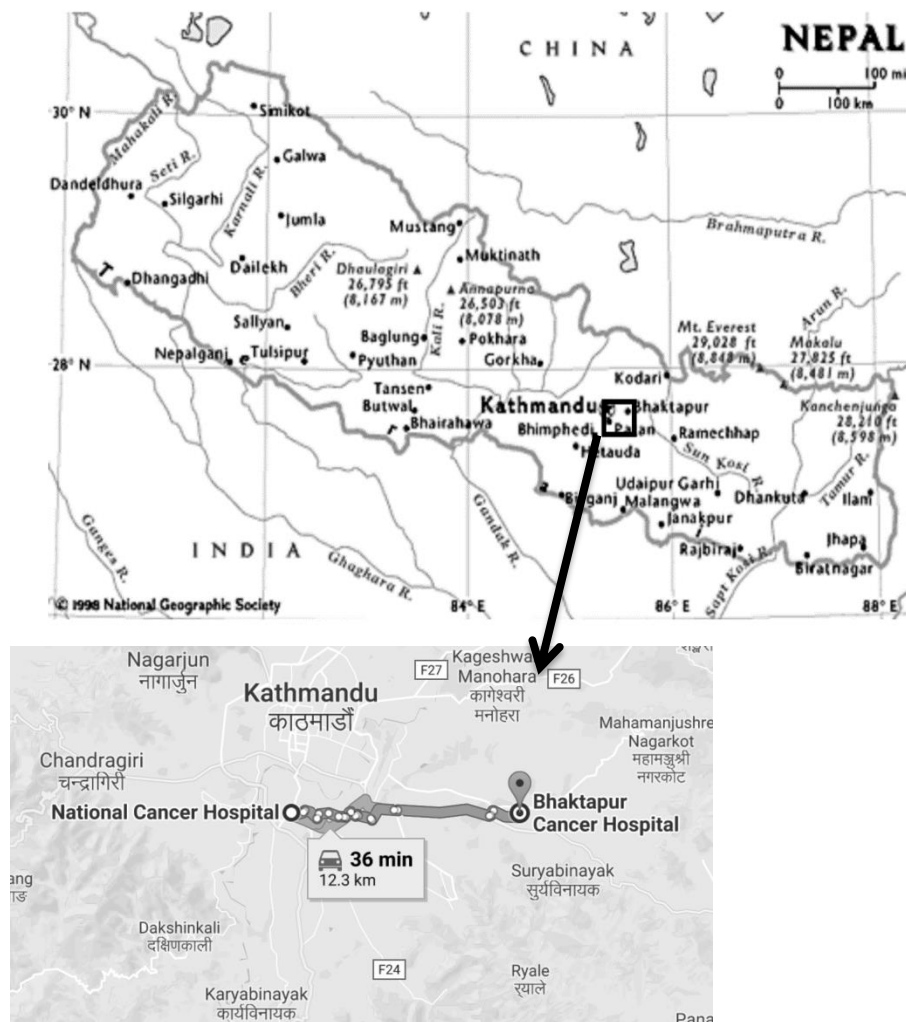
Figure 4 Map of Nepal

The study population included the cases and controls. The cases were those people who were visiting these two hospitals: National Hospital and Cancer Research Centre Pvt. Ltd and Bhaktapur Cancer Hospital as a patient suffering from lung cancer. For

Controls, participants were those people visiting and from areas nearby of these two study areas during the study period and ones not suffering from lung cancer.

Cases: Participants diagnosed with lung cancer.

Control: Participants who were not suffering from lung cancer.

3.4 Study Period

Every research activity has the time constraint. The study period for this research work was approximately from April 2017 to July 2017.

3.5 Inclusion and exclusion criteria's

Cases

Eligible cases were patients with lung cancer with or without a previous history of malignancy receiving treatment at the hospitals. They may or may not have the history of the relighting of cigarette butts while smoking. Cases have been identified from the registry from both the hospitals at the outpatient department (OPD) and also willingness to participate was taken into consideration.

Controls

Controls were the residents of Kathmandu and Bhaktapur visiting this two study areas and areas nearby during data collection period.

- Severely ill patients were excluded from both the cases and controls.

3.6 Sample Size Calculation

As there is no any supporting evidence of total number (population) of patient suffering from lung cancer because of exposure of second hand smoke or smoking relighted cigarette butts in Kathmandu valley and in Nepal. This has restricted us to use the numerical calculation method to find out the total sample size that needs to be considered to conduct the research. Instead, we have used non probability sampling and convenience technique for the selection of the study area and sample size.

We have used sample size higher than the sample size taken by the previous researchers.

Open epi was used to calculate the sample size.

Kelsey et al., Methods in Observational Epidemiology 2nd Edition,

Fleiss, Statistical Methods for Rates and Proportions.

CC = continuity correction

Results are rounded up to the nearest integer.

The sample size formula for the method described in Kelsey et. al. is:

$$n_1 = \frac{\left(Z_{\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 \overline{pq}\,(r+1)}{r(p_1 - p_2)^2}$$

And $n_2 = r\, n_1$

n_1 = number of cases

n_2 = number of controls

$Z_{\frac{\alpha}{2}}$ = Standard normal device for two tailed test based on alpha level(relates to the confidence interval level.

Z_β = Standard normal deviate for one tailed test based on beta level(related to the power level)

r = ratio of control to cases

p_1 = propotion of cases with exposure and $q_1 = 1 - p_1$

p_2 = propotion of controls with exposure and $q_2 = 1 - p_2$

$\bar{p} = \frac{p_1 + rp_2}{r+1}$ and

$\bar{q} = 1 - \bar{p}$

The sample size formula *without* the correction factor by Fleiss is:

$$n_1 = \frac{[Z_{\alpha/2}\sqrt{(r+1)\overline{pq}} + Z_{1-\beta}\sqrt{rp_1q_1 + p_2q_2}\ ]^2}{r(p_1 + p_2)^2}$$

$$n_2 = rn_1$$

For the Fleiss method with the correction factor, take the sample size from the uncorrected sample formula and place into the following formula:

$$n_{2\alpha} = \frac{n_1}{4} \left[1 + \sqrt{1 + \frac{2(r+1)}{n_1 r(p_2 - p_1)}} \right.$$

$$n_{2\alpha} = r n_{1\alpha}$$

When the input is provided as an odds ratio (OR) rather than the proportion of cases exposed, the proportion of cases exposed is calculated as:

$$p_1 = \frac{p_2 OR}{1 + p_2 OR - 1)}$$

Sample Size for Unmatched Case-Control Study for Smoking			

For,

	Two Sided Confidence Level (1-alpha)			95
	Power(% chance of detecting)			80
	Ratio Of Controls to Cases			1
	Hypothetical Proportion of controls with exposure			40
	Hypothetical Proportion of cases with exposure			70
	Least extreme Odds Ratio to be detected			3.5

	Kelsey	Fleiss	Fleiss with CC
Sample Size -Cases	44	42	49
Sample Size -Controls	44	42	49
Total Sample Size	88	84	**98**

Assume 2-sided confidence = 95% and power = 80%.

1-to-1 case-control ratio has been assumed.

For smoking, Assume 40% and 70% smoking in controls and cases, respectively.

Sample Size for Unmatched Case-Control Study for Relighting

For,

Two Sided Confidence Level (1-alpha)		95
Power(% chance of detecting)		80
Ratio Of Controls to Cases		1
Hypothetical Proportion of controls with exposure		15
Hypothetical Proportion of cases with exposure		35
Least extreme Odds Ratio to be detected		3.05

	Kelsey	Fleiss	Fleiss with CC
Sample Size -Cases	74	73	83
Sample Size -Controls	74	73	83
TotalSample Size	148	146	**166**

For relighting, Assume 15% and 35% relighting in controls and cases, respectively. From the above sample size calculation, the higher sample size has been taken into consideration for conducting this research work. 20% has been added for missing and refusal .The total sample size considered for this study was 207, which have included 108 cases and 99 controls (Acharya, 2015).

3.7 Sampling Technique:
The cases and controls were selected purposive sampling from the hospitals as well as areas nearby due to limited data collection time.

3.8 Measurement Tool
For the collection of the primary responses from both cases and controls, a well-planned questionnaire was used that contained three sections:

Section 1: Demographic Section to find the characteristics of the participants.

Section 2: Smoking History of both cases and controls to find the answers to the research questions

Section 3: Second Hand Exposure to smoke.

For making data collection more reliable and efficient, each and every question was asked by the researcher and clarified before giving responses by the subject. This eliminated the probability of missing and inappropriate responses.

3.9 Reliability and Validity Testing

To check the validity of the data before proceeding ahead Pilot testing was conducted with 20 samples, including 10 from the controls and 10 from cases.

The Cronbach's alpha coefficient technique was used to check the reliability of the data collected. On performing the reliability testing, Cronbach alpha coefficient value was 0.777, and considered as the high level of internal consistency for our scale.

3.10 Data Collection

As this research work is for academic purpose, a proper process has been adopted for data collection. Before proceeding for data collection, questionnaire was prepared and approved. Sampling size was determined and spot finding was made to collect the responses from the cases and controls of lung cancer patient or non-lung cancer participants from Kathmandu and Bhaktapur based busiest hospitals, National Hospital and Cancer Research Centre Pvt. Ltd , Bhaktapur Cancer Hospital and areas nearby respectively.

The overall Data collection procedure had the following stages:

- First Approval was taken from both the hospitals: National Hospital and Cancer Research Centre Pvt. Ltd and Bhaktapur Cancer Hospital.

- After approval of proposal from College of Public Health Sciences, Chulalongkorn University then approval was taken from the ethical committee of the Nepal Health Research Council, Kathmandu, Nepal.

- Data were collected from the both the hospitals and participants were invited for the interview .Controls were randomly selected from people visiting the hospital along with patients and from the nearby areas of the hospital.

• Before asking any research question, the objectives and benefits of the study have been explained to the participants and were requested to participate in the research work and written consent was taken from them.

• Responses have been collected only from the subject who wanted to be the part of the research work.

• The researcher was helped by two qualified nurses to collect the data from both the hospitals.

• The participants were interviewed "face to face" by the researcher and the nurses and clarified for any confusion (interviewer administered).

3.11 Data Analysis

MS Excel and Statistical Package for the Social Sciences (SPSS) version 16.0 applications were used to organize and analyses the collected data to answer the research questions respectively.

The analysis has been carried out in two parts:

3.11.1 Descriptive statistics: Descriptive statistics has been used to determine the characteristics of the respondents and develop the graph, charts, tables and find out the mean, mode, frequency, percentage and Standard Deviation.

3.11.2 Analytical Statistics: Inferential analysis has been done to answer the research questions. Chi-square test, Independent Sample T-test and Multivariable Logistic regression model was used to calculate odds ratios (ORs) and 95% confident intervals. The main exposure variable was smoking status, with 3 levels: non-smoker, a smoker who does not relight and a smoker who relights the cigarette butts while smoking. This was enabling characterization and comparison of the impacts on lung cancer risk of smoking with and without relighting. The coefficients in logistic regression indicate the change in the logic for each unit change in the independent variable. This may not be intuitive and coefficients from the regression model will be presented as odds ratios. All risk factors with $p<0.20$ on bivariate analysis were considered for inclusion in the multivariable logistic model. All risk factors with $P<0.05$ were considered significant.

3.12 Ethical Consideration

The proposal has been approved by College of Public Health Sciences and Chulalongkorn University and the ethical approval was taken from Ethical Committee of Nepal Health Research Council, Kathmandu, Nepal (NHRC,Reference no.1880).

Every participant was briefly explained about the research before proceeding to any question and responses were collected only from the participant who wanted to be the part of the research work. Written consent has been taken from both the cases and controls before the interview. The response collected from the subject has been used only for academic purpose and the personal and research specific information provided has been kept confidential.

3.13 Limitations:

Every research is performed under certain boundary with various limitations or constraints. Some of the limitations of this study are given below:

- Lung cancer patients may be severely ill and are unable to answer questions.
- There may be recall bias as it is a case control study.
- Within the given time frame, in depth analysis may not be possible to carry out.
- Sample size is limited to only two hospitals
- Data efficiency is based on the quality responses.
- Besides the independent variable considered, there could be other factors responsible for causing lung cancer.

CHAPTER IV

RESULTS

In this chapter, we performed a primary analysis of lung cancer in relation to the smoking including relighting the cigarette butts. The primary data analysis has been classified into two parts; the first part is more focused towards determining the characteristics of the subjects. The second part is focused on determining the association between the dependent and independent variable and figure out the answers of the research questions.

4.1 Descriptive and Bivariate Analysis:

The primary purpose of collecting the data is to find out some insight about the characteristics of the participants in the research. To conduct this study, total 207 samples were taken of which 108 were the cases and 99 were the controls. Data analysis began with finding out the frequency, percentage, and mean, median of the independent variable and developing the charts and graphs which provided us the basic characteristics of the respondent. This provides simple summaries about the sample and the measures.
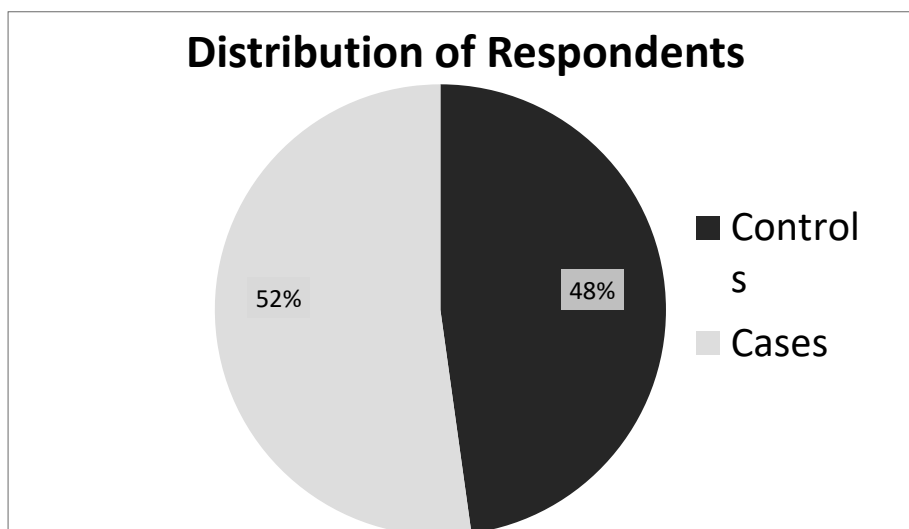
Figure 5: Distribution of the Respondents.

Among 207 samples collected, 52 % of the respondents were cases diagnosed with lung cancer because of direct consumption of the cigarette or could be from the second hand exposure to smoke. Remaining were the controls, non-lung cancer participants visiting the two study area during the study period.
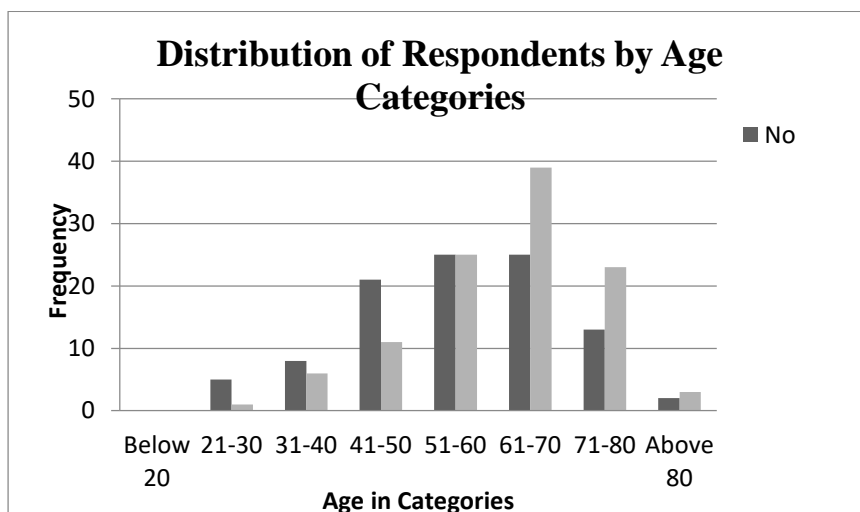
Figure 6: Distribution by Age Groups of cases and controls.

This bar diagram shows that participants, cases and controls are left skewed. Where most participants were from the age group 61 to 70. Among 108 cases considered for the study, more than 80% of the respondents suffering from lung cancer were from the age group 51 to 80, which is followed by age group 41 to 50. This indicates that age has the direct relationship with lung cancer.

Table 3: Descriptive analysis of cases by the age of respondents

	Mean	Maximum	Minimum	Standard Deviation
Age	61.56	83	26	12.326

The age of the respondents suffering from lung cancers ranges from 26 to 83, where 26 was the minimum and 83 maximum. The mean age of the participants in this study was 62 years with the standard deviation of 12.
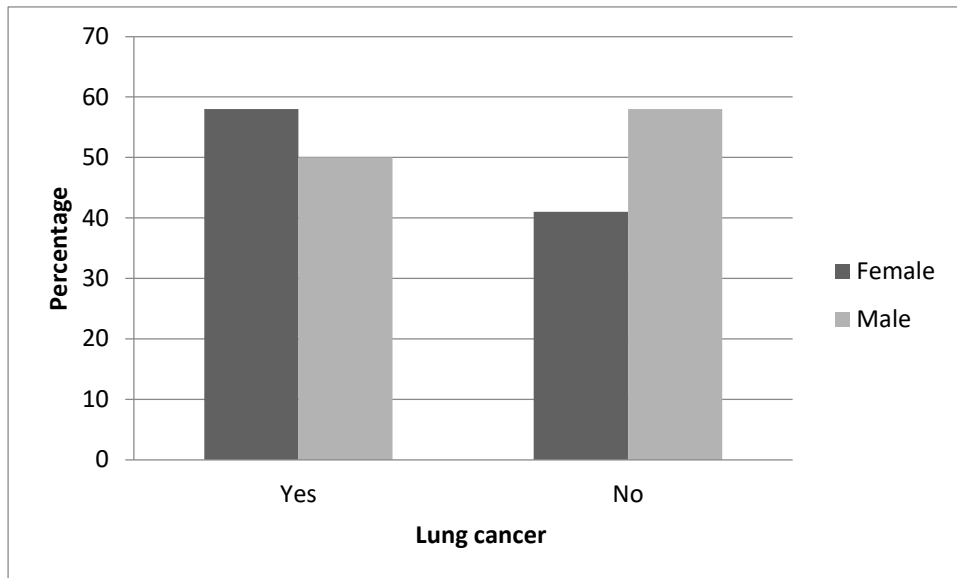
Figure 7: Distribution of respondents on the basis of Gender (n=207).

Nearly 54% of the female and 46% male respondents were diagnosed with lung cancer. This indicates that female population visiting the two study areas were suffering from lung cancer by direct consumption of cigarette or by other secondary factors.

Table 4: Socio Demographic Characteristics of Cases and Controls with Bivariate Analysis

Variable	Lung Cancer (N=108)		Non Lung Cancer(N=99)		P Value	OR	95%CI	
	N	%	N	%			LL	UL
Gender								
Female[ref]	58	53.7	41	41.4	0.095[1]	-		
Male	50	46.3	58	58.6		0.61	0.35	1.06
Age								
Mean ±SD	62 ±12		57 ±14		0.011[2]	1.03	1.01	
								1.05
Range	57		70					
Religion								
Others [ref]	14	13	13	13.1	0.567[1]	-		
Hindu	94	87	86	87		1.02	0.45	2.28
Marital Status								
Married [ref]	103	95.3	95	96	1.00[1]	-		
Others	5	4.7	4	4		1.15	0.30	4.42
Occupation								
Service [ref]	28	25.9	35	35.4	<0.001[1]	-		
Business	16	14.8	34	34.3		0.59	0.27	1.28
Housewife	48	44.4	18	18.2		3.33	1.60	6.95
Unemployed	16	14.8	12	12.1		1.67	0.70	4.09
Ethnicity								
Newar	26	24.1	9	9.1	<0.001[11]	0.88	0.34	2.31
Brahmin	3	2.8	57	57.6		0.02	0.04	0.06
Chettri	33	30.6	19	19.2		0.53	0.23	1.20
Others [ref]	46	42.6	14	14.1		-		

Education Level

Illiterate	62	57.4	35	35.4	0.001[1]	4.13	1.71	10.01
Literate	13	12	24	24.2		1.26	0.45	3.55
Primary/Secondary	24	22.2	19	19.2		2.95	1.10	7.90
Higher Level [ref]	9	8.3	21	21.2		-		

Monthly Income

<10,000	37	34.3	16	16.2	0.006[1]	3.36	1.51	7.48
10,000-20,000	30	27.8	23	23.2		1.90	0.88	2.09
21,000-30000	19	17.6	28	28.3		0.90	0.45	2.19
>30,000 [ref]	22	20.4	32	32.3		-		

[ref] = reference variable, (--)[1] =Chi Square P Value ,(--)[2]=Independent T Test PValue

From table number 4.3: Among lung cancer patients there were more males (58.6%) whereas those without lung cancer were more females (53.7%)(pvalue=0.095,OR=0.61,95%CI=0.35-1.06).The respondents who had lung cancer had a mean (±SD) age of 59.43(±13.12) (pvalue=0.011,OR=1.03, 95%C.I=1.01-1.05).87% of the participants were the Hindu and remaining were other which included Muslim, Buddhist and others (pvalue=0.567,OR=1.02, 95%CI=0.45-2.28). For both; cases and controls, almost 96 % of the subjects considered for this study were married and rest were unmarried, widowed and divorced (pvalue=1.00,OR=1.15, 95%CI=0.30-4.42). For controls, 35.4 % of participants were involved in service sector and 34.3% on business sectors, whereas 18.2% were housewives whereas for cases 44.4%were housewives (OR=3.33,95%C.I=1.60-6.95), 25.9% where in service, 14.8% in business(OR=0.59,C.I=0.27-1.28) and unemployed (OR=1.67,C.I=0.70-4.09).Most of the controls included the ethic group Brahmins compromising 57.6% then Chettri 19.2%,Newar 9.1% and others compromising of Rai, Lama, Sherpa, Tamang, Gurung, Thakali, Dalit, Magar, Madhesi, Limbu where 14.1% whereas in cases there were more others (42.6%) and less Brahmins(2.8%) (pvalue=<0.001,OR=1.6, 95%CI=1.23-2.12).Most of the cases and controls were illiterate (57.4% and 35.4% respectively) and in cases least were

those with higher education(9%) and in controls with primary and secondary education (19.2%) (pvalue=<0.001,OR=0.70, 95%CI=0.54-0.89). This indicates that lung cancer has the inverse relation with the education level. (OR=0.66, 95%C.I=0.51-0.84).

Most of the lung cancer patients had a monthly income less than 10,000 (34.5%) whereas those without lung cancer had a monthly income greater than 30,000 (32%) (pvalue=0.006,OR=0.99, 95%C.I=0.45-2.19).

Table 5:Relationship between smoking and lung cancer:

	Lung Cancer(n=108)		Non Lung Cancer(n=99)	
	N	%	N	%
Non Relighting Smokers	26	24.1	45	45.5
Relighting Smokers	62	57.4	24	24.2
Non-Smokers	20	18.5	30	30.3

Among 99 control participants who were not suffering from lung cancer, 30.3% were the nonsmokers, 45.5% were the smokers who do not relit the cigarette butts while smoking and remaining 24.2% relit the cigarette butts while smoking. However, among the 108 cases considered for the research activity, 18.5% were the nonsmokers suffering from lung cancer where exposure to second hand smoke could play the major role for causing lung cancer, 24.1% were smokers who did not relit cigarette butts while smoking and 57.4% relit cigarette butts while smoking.

Table 6: Characteristics of Smoking of Respondents along with Bivariate Analysis

Variable	Lung Cancer		Non Lung cancer		P	OR	95%CI for EXP(B)	
	N(88	%	N(69	%			LL	UL
Smoke Cigarette								
No [ref]	20	18.5	30	30.3	0.048[1]	-		
Yes	88	81.5	69	69.7		1.91	1.00	3.66
Type Of Cigarette								
Local	84	95.5	54	78.3	.001[1]	5.83	1.84	18.51
Foreign[ref]	4	4.5	15	21.7				
Relit Butts								
No [ref]	26	29.5	45	65.2	<.001[1]	-		
Yes	62	70.5	24	34.8		4.47	2.28	8.78
Quit Smoking								
No [ref]	5	5.7	25	36.2	<.001[1]	-		
Yes	83	94.3	44	63.8		9.43	3.38	26.35
Average Cigarette/day								
<10 [ref]	6	7.3	27	40.9	<.001[1]	-		
10-20	34	41.5	32	48.5		4.78	1.75	13.1
>20	42	51.2	7	10.6		27	8.20	89
Filter								
No	27	30.7	6	8.7	.001[1]	4.65	1.79	12.04
Yes [ref]	61	69.3	63	91.3		-		
Total years of smoking								
Mean ±SD	40±15		34±17		0.02[2]	1.03	1.00	1.07
Range	73		82					

Age Started Cigarette

Mean ±SD	14±6	21±6	<.001 [2]	0.83	0.77	0.89
Range	43	27				

[ref] = reference variable. (--)[1] =Chi Square P Value ,(--)[2]=Independent T Test P Value.

Most of the respondents either used to smoke in the past or still have the habit of smoking ,the cases who were either ever smokers and current smokers compromised of 81.5% and the controls compromised of 69.7% which was significant (P value=0.048) (OR1.91, 95%CI=1.00-3.66). Among which 94.3% cases have quit smoking and 63.8% of the controls have quit smoking (P value= <0.001,OR=9.43, 95%CI= 3.38-26.35). Most of the cases who smoke prefer local cigarette (95.5%) over the foreign ones (4.5%) as well as in controls most prefer local (78.3%) than foreign cigarettes (21.7%) and was significant (p value=0.001,OR=5.833, 95%CI=1.84-18.51). Majority of the cases were relighters of cigarettes (70.5%) whereas in controls only 34.8% relighters of cigarettes which was also significant with a p value of <0.001 (OR=4.71, 95%CI=2.28-8.78).Those with lung cancer 51.2% smoked >20 cigarettes per day in average whereas in those without lung cancer 40.9% smoked less than 10 cigarettes per day in average.(P value=<0.001,OR=5.28, 95%C.I=2.89-9.48).69.3%of the cases smoked cigarettes with filter whereas 30.7% did not use filtered cigarettes(OR=4.65, 95%C.I=1.79-12.042)

The total year of smoking was higher in lung participants having lung cancer than those without lung cancer.i.e.40±15 and 34±17 respectively (p value= 0.02, OR=1.03, 95%C.I=1.00-1.05).Lung cancer patients started smoking cigarette at a younger age (14±6) than those without lung cancer (21±6) (p value =<0.001,OR=0.83, 95%C.I=0.77-0.89).

Table 7:Characteristics of Secondary Exposures of Cases and Controls with Bivariate Analysis

Variable	Lung cancer (N=108)		Non Lung CancerN=99		PValue	OR	95%CI	
	N	%	N	%			LL	UL
SHS Exposure at Home								
No [ref]	30	27.8	47	47.5	.003[1]	-		
Yes	78	72.2	52	52.5		2.35	1.2	4.85
SHS Exposure at Workplace								
No [ref]	62	57.4	43	43.4	.031[1]	-		
Yes	46	42.6	56	56.6		0.57	0.39	0.99
Type of Fuel								
Clean [ref]	54	50	79	79.8	<.001[1]	-		
Unclean	54	50	20	20.2		3.95	2.13	7.33
Location of cooking								
In The house	104	96.3	84	84.8	.004[1]	4.64	1.49	14.51
Elsewhere [ref]	4	3.7	15	15.2		-		
Family H/O Cancer								
No [ref]	69	63.9	96	97	<.001[1]	-		
Yes	39	36.1	3	3		18.09	5.37	60.92

[ref] = reference variable. (--)[1] =Chi Square P Value ,(--)[2]=Independent T Test P Value.

Beside the direct factors causing lung cancer, there could be other indirect or secondary factors responsible for causing lung cancer. In both cases and controls, more than 50% participants have exposure to second hand smoke at home with a significant P value of 0.003 (OR=2.35, 95%CI=1.2-4.85). However, exposure to second hand smoke in the workplace was 56% for control and 42.6% for cases which

was also significant (Pvalue=0.031,OR=0.57, 95%CI=0.33-0.99).96.3% of the participants who cook food in the house are also suffering from lung cancer and was significant (P value=0.004,OR=0.215, 95%CI=0.069-0.67).The type of fuel use for cooking also was significant factor for causing lung cancer (P Value =<0.001) among which use of unclean fuel including Natural gas, Kerosene, Coal or lignite, Charcoal, Wood, etc where higher in lung cancer patients (50%) than non-lung cancer participants (20.2%) (OR=3.95, 95%C.I =2.13-7.33). However for the cases, 64% of the participants have no history of lung cancer in their family and 36.1% have family history of cancer in their immediate family. (P value=<0.001, OR=18.08, 95%CI=5.37-60.92).

4.2:Analytic Analysis:

Table 8:Characteristics of Relationship between Smoking and Lung Cancer (N=207).

Variables	Lung Cancer				
		No		Yes	
	Total	N	%	N	%
Non Smokers	50	30	30.30	20	18.50
Smokers	157	69	69.70	88	81.50

Among 157 participants, 81.5% were smokers and 18.5% nonsmokers were suffering from lung cancer whereas among those not suffering from lung cancer 69.7% were smokers and 30.3% were nonsmokers.

Table 9 :Association between smoking and occurrence of lung cancer by Multivariate logistic Regression (n=207)

Variables	Lung Cancer					
	Unadjusted OR Model1			Adjusted OR Model2		
	OR	95%CI		OR	95%C.I	
		LL	UL		LL	UL
Smoke Cigarette						
Yes	1.91	1.00	3.66	2.85	1.05	7.68
No [ref]				-		
Age of participant				1.03	1.00	1.07
SHS Exposure at Workplace						
Yes				0.18	0.08	0.41
No [ref]				-		
Location of Cooking						
In the House				9.76	2.30	41.43
Elsewhere [ref]				-		
Type of fuel used						
Unclean				5.35	2.42	11.82
Clean [ref]				-		
Family H/O Cancer						
Yes				23.72	5.71	98.53
No [ref]				-		
Occupation						
Service [ref]				-		
Business				1.98	0.57	6.87
Housewife				1.52	0.42	5.46
Unemployed				6.99	1.96	24.99

[ref] has been assigned for reference variable

Model Summary:

Nagelkerke R Square: 0.527

Hosmer and Lemeshow Test : Chi-Square = 13.432,df=8 ,Sig = 0.098.

To find out the association of smoking with lung cancer 2 models were made. Model 1 compromised of association of smoking of cigarette with lung cancer and Model 2 compromised of logistic regression in which other confounding variables were included so to control their influence on occurrence of lung cancer and thus to obtain an OR that is adjusted for the influence of confounders.

All the variables that were significantly associated with Lung cancer in the bivariate analysis were included in the multivariate analysis. In addition to that, variables with $p \leq 0.2$ in the bivariate analysis were included as predictors. The variables that satisfied these criteria were: age of the respondents, gender of the respondents, occupation, education level, ever smokers, ethnicity, month income, type of fuel used while cooking, location of cooking at home, family history of cancer in their immediate family, exposure to second hand smoke at workplace and exposure to second hand smoke at home.(total 12).

Interpretation of Model 1:

Model 1: It showed that Smoking of Cigarettes caused 1.9 times more risk for occurrence of lung cancer (OR=1.91, 95%CI=1.00-3.66) and was positively associated when OR was not adjusted for the influence of other confounders.

Model 2: Here the OR was adjusted for influence of other confounders which included 12 variables which had a P Value <0.2 in the bivariate analysis. Here parsimonious model was applied with which backward regression was done.(i.e.: the nonsignificant variables after running multiple regression multiple times where manually removed and the end results consisted of those variable which were significantly associated with risk for occurrence of lung cancer.This showed that smoking when adjusted for OR with other confounders still caused 2.8 times risk for occurrence of lung cancer and was positively associated(OR=2.85. 95%CI =1.05-

7.68). Other factors like age of the respondent (OR=1.03,95%C.I=1.003-1.07) and Family history of cancer (OR=23.74, 95%C.I=5.71-98.53) showed high risk for occurrence of lung cancer and were both positively associated. Whereas Secondhand smoke exposure at workplace also negatively associated with occurrence of lung cancer (OR=0.18, 95%C.I=0.08-0.41).Location of cooking in the house also showed 9.76 times more risk for occurrence of lung cancer and was positively associated (OR=9.76, 95%C.I=2.3-41.43).Type of fuel used for cooking like unclean fuel like Natural Gas, kerosene, coal or lignite, charcoal, wood, etc. showed 5.35 times more risk compared to clean fuel like electricity and LPG and was positively associated (OR=5.35, 95%C.I=2.42-11.82).Those who were unemployed were 6.99 times risk for occurrence of lung cancer (OR=6.99, 95%C.I=1.96-24.99) than the ones in service ,business and housewife and was positively associated.

The following regression shows that smoking of cigarette as risk factor for occurrence of lung cancer even when OR is adjusted with other actors which acts as confounders for occurrence of lung cancer. As per model summary, the model was a good fit.

4.2.2 A relation between relighting and the occurrence of lung cancer.

Table 10:Characteristics of relation between lung cancer and relighting cigarette butts among smokers (n=157)

Variable	Lung cancer (n=157)				
		Yes		No	
	n	N	%	N	%
Non relighting smokers	71	26	29.5	45	65.2
Relighting smokers	86	62	70.5	24	34.8

Total 157 Participants who were smokers where considered. Among which 70.5% participants where either current smoker of ex-smokers who used to relit cigarette butt ends and was suffering from lung cancer whereas 34.8% were smokers who relit cigarette butt ends were not suffering from lung cancer.

Table 11: Association between Relighting of Cigarette Butt ends and occurrence of Lung Cancer by Multivariate logistic Regression (n=157):

Variables	Lung Cancer					
	Unadjusted OR **Model 1**			**Adjusted OR** **Model 2**		
	95%C.I.			**95% C.I.**		
	OR	**Lower**	**Upper**	**OR**	**Lower**	**Upper**
Relight Cigarette Butts						
Yes	4.47	2.28	8.79	37.69	7.56	187.46
No [ref]				-		
Average Cigarette/day						
<10cigs/day [ref]				-		
10-20cigs/day				6.67	1.44	30.93
>20cigs/day				63.72	8.70	466.76
Cigarette Filter						
No				24.25	3.81	154.53
Yes [ref]				--		
Age of participant				1.05	0.10	1.11
Occupation Service [ref]						
Business				0.64	0.12	3.44
Housewife				4.32	0.83	22.41
Unemployed				0.80	0.12	5.26
Family History of Cancer						
Yes				26.38	2.48	280.38
No [ref]				-		
Location Of Cooking						
In the House				24.80	3.48	176.82
Elsewhere [ref]				-		

SHS Exposure at Work			
Yes	0.21	0.05	0.81
No ref	-		

ref has been assigned for Reference Variable

Model Summary:

 Nagelkerke R Square: 0.769

 Hosmer and Lemeshow Test : Chi-Square = 11.553,df= 8 ,Sig = 0.172

In Table 4.10 again 2 models where made one unadjusted model and other adjusted with all the independent variables related with relighting of cigarettes causing risk in occurrence of lung cancer.

Model1: In this model the OR of relighting of cigarette butts was unadjusted to find association of risk of lung cancer. This model showed significantly positive association of relighting of cigarette butts with 4.47 times more risk for occurrence of lung cancer (p value=0.00,OR=4.47, 95%C.I=2.28-8.78) .

Model 2: Here the OR of relighting of cigarette butts was adjusted with other 17 variables which were significant in bivariate analysis which were as follows: age, gender, occupation, ethnicity, education, monthly income , exposure to second hand smoke at home and workplace, mode of cooking, location of cooking at home, family history of cancer among immediate family, Type of cigarette, average cigarette smoked ,filter present or not in cigarette, age at which smoking was started, duration of smoking.

Here again parsimonious model was used with backward regression which showed that relighting still was positively associated causing 37.63 times more risk of occurrence of lung cancer and was significant.(p value=.000,OR=37.63, 95%CI=7.55-187.46).The likelihood of occurrence of lung cancer increased with increase in average cigarette per day as per the above table if average cig/day>21 (p value =0.000,OR=63.72 and 95%C.I=8.70-466.77). Absence of filter in cigarette while smoking causes 24.25 times more risk than presence of filter for occurrence of lung cancer and was positively associated (p value=0.001,OR=24.25,

95%C.I=3.81-154.55).With increase in age of the respondent there is significant increase in likelihood of occurrence of lung cancer which was positively associated(p value=0.007,OR=1.05, 95%C.I=0.70-1.11).Those who had history of family cancer in their immediate family had a significantly higher risk for occurrence of lung cancer and was positively associated (p value=0.007,OR=26.38, 95%C.I=2.48-280.38).Location of cooking in the house was positively associated and had 24.80 times higher risk than if the cook location being elsewhere for likelihood of lung cancer (p value=0.001,OR=24.80, 95%C.I=3.48-176.82).Second hand Exposure at workplace is significantly negatively associated with lung cancer (P=0.024,OR=0.21, 95%C.I=0.05-0.81). As per occupation of respondents housewives (OR=4.32, 95%C.I=0.83-22.41) were positively associated and had a higher risk than those in business (OR=0.64,95%C.I=0.12-3.44) and unemployed (OR=0.80,95%C.I=0.12-5.26) who were negatively associated.

The following regression shows that relighting cigarette as positively associated risk factor for occurrence of lung cancer even when OR is adjusted with other actors which acts as confounders for occurrence of lung cancer. As per model summary, the model was a good fit.

CHAPTER V

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The main objective of this thesis was to identify the degree of association between lung cancer and smoking and relighting of cigarette butts while smoking. After reviewing the extensive literature, several independent variables associated with the research work included; Age, Sex, Occupation, Religion, Marital Status, Ethnicity, Educational Status, Economic Status, Family History of Cancer as the Socio-demographics factors and Smoking habit, Started age, Number of Cigarettes per day, Presence of filter in cigarettes, Relighting of cigarette butts, Duration of smoking, Tried to quit smoking and second hand exposure to smoke at workplace and at home,type of fuel used for cooking and location of cooking were those related to second hand exposure to smoke were the research specific independent variables.

This Chapter is divided into following five sections:

5.1 General Discussion on characteristics of study population

5.2 General Discussion of key findings of the study

5.3 Benefits from the study

5.4 Conclusions

5.5 Recommendations

5.1 General Discussion on characteristics of study population

In conducting this research work, total 207 samples were taken of which 52 % of the respondents were the cases suffering from lung cancer because of smoking or from the other secondary factors and remaining were the controls. The maximum number of participants during the study period was from the age group 41-80 for the controls and 51-80 for the cases, with 83 being maximum and 26 being the minimum for the cases.Gender wise female populations were suffering the most from lung cancer visiting the two study areas during the study period. In a study done in Nepal also showed lung cancer to be more prevalent among female may be because of high prevalence of smoking among female than other developing countries.(Binu et al.,

2007),(Wu-Williams et al., 1990),(Osann, 1991).But in other studied have shown lung cancer to be more prevalent among male ((Bhurgri et al., 2000),(Boyle & Maisonneuve, 1995; Poudel et al.; Pradhananga et al., 2009),(Rachit Chawla et al., 1789). 87% Hindu and 96% married populations were the most participants who took part in the research activity. Also the 95.4% of married populations were suffering from lung cancer compared to other marital status of the respondents. Other study showed unmarried were suffering from lung cancer than married.(Hashibe et al., 2011).Other than the specified ethnic group like : Rai, Lama, Sherpa, Magar , etc were the 42.6% participants were suffering from lung cancer as other study done also showed these ethnicity to suffer more from lung cancer may be due to low socioeconomic conditions. (Hashibe et al., 2011). More than 57% of the respondents suffering from lung cancer were Illiterate similar to other studies done in Nepal (Hashibe et al., 2011).As per monthly income those having lung cancer most of them were from lower income group 34.3% and those without lung cancer most were from higher income group more than 30,000 i. e 32.3%.

Among 81.5 % of the smokers suffering from lung cancer as per WHO tobacco is a leading cause of cancer causing 70% of lung cancer deaths worldwide(WHO, 2015a).Those suffering from lung cancer started smoking at a younger age (mean=14±15) than those without lung cancer (21±6).Other studies done by J. Rimington showed higher incidence of lung cancer among smokers.(Rimington, 1971). 95.5% lung cancer patients consumed local cigarette as in a study done in Japan also showed high incidence of lung cancer among those who consumed local cigarette (Wakai et al., 1997) and also a study done in Nepal showed increase risk in lung cancer among those who consumed local cigarette (Raspanti et al., 2015).51.2% who smoked more than 20 average amount of cigarettes had lung cancer compared to those without lung cancer only 10 % smoked more than 20 cigarettes per day. With increase in average amount of cigarette smoked per day there is an increase in risk of lung cancer which is also evident in many studies (Raspanti et al., 2015; Wakai et al., 1997; Wu-Williams et al., 1990).Lung cancer patients mostly smoked unfiltered cigarettes (69.3%) than filtered(30.7)than those without lung cancer used mostly filtered(91.3%).This is also shown in other studies that those who consume unfiltered

cigarette are at a higher risk for having lung cancer (Raspanti et al., 2015; Wakai et al., 1997).63.8% of the respondents without cancer quit smokin at an earlier age as shown in previous studies there is reduction in risk by time of quitting , previous exposure to tobacco level and abstinence duration of smoking (Cinciripini et al., 1997; Parsons, Daley, Begh, & Aveyard, 2010; Wakai et al., 1997). 94 % of the respondents suffering from lung cancer quit smoking at the age of 58 years.70.5% of the populations who have relit the cigarette butts end while smoking are suffering from lung cancer as per other studies relighting increases risk of lung cancer (J. Rimington, 1974).

Beside the smoking factor, secondary factors are also equally responsible for causing lung cancer(Raspanti et al., 2016),(Binu et al., 2007; Pradhananga et al., 2009). 72.2% of participants were exposure to second hand smoke at home and were suffering from the lung cancer. However, 42.6% of participants suffering from lung cancer were exposure to second hand smoke in the workplace. Cooking mode was also another prime factor of causing lung cancer .96.30% of participants who cook food inside the house were suffering from lung cancer. Although the use of clean fuel like LPG and electricity and unclean fuel like wood, coal, biomass fuel, charcoal were equal in lung cancer patients (50% each) the use of clean fuels were higher among the ones not suffering from lung cancer. In a study done in Nepal and other countries also showed that long term exposure to cooking leads to lung cancer which is especially high among biomass fuel users than those who use LPG and electricity.(Hernandez-Garduno et al., 2004),(Behera & Balamugesh, 2004),(Shrestha & Shrestha, 2005). However, 36.10% of the participants who were suffering from the lung cancer have the family history of lung cancer as in other studies showed increase in risk of lung cancer among those who had a history of cancer in their family (Coté et al., 2012).

5.2 General Discussion of key findings of the study
The findings can be broadly classified into two parts; one is finding out the characteristics of the participants and other is finding out the association and strength

of the association between dependent and independent variables. Characteristics of the participants have been classified on previous heading and this section is more focused on determining the answers of the research questions.

- Discussion on association of smoking and occurrence of lung cancer :

There is positive association of tobacco smoking and risk of occurrence of lung cancer when not adjusted with factors such as age, gender, ethnicity, socioeconomic, education and second hand exposure to smoke (OR=1.91, 95%C.I=1.001-3.66). When there is involvement of other significant factors such age of the respondents, gender of the respondents, occupation, education level, ethnicity, month income, type of fuel used while cooking, location of cooking at home, family history of cancer in their immediate family, exposure to second hand smoke at workplace and exposure to second hand smoke at home smoking still smoking was associated risk factor for occurrence of lung cancer (OR=2.85, 95%C.I=1.054-7.68),such as in other studies when smoking when adjusted with other confounders still was positively associated with lung cancer (Wakai et al., 1997). In a study done in Nepal showed increase in age increases the risk of occurrence of lung cancer (Raspanti et al., 2015)In this study also every increase in age there is 1.03 times likelihood of occurrence of lung cancer showing a positive association (OR=1.03, 95%C.I=1.00-1.07) when adjusted as well as when it was unadjusted it showed 1.029 times risk for occurrence of lung cancer (OR=1.03, 95%C.I=1.01-1.05).Family history of cancer among immediate family members also showed positive association with occurrence of lung cancer (OR=23.72, 95%C.I=5.75-98.53) with adjustment with other factors as well as without adjustment (OR=18.09, 95%C.I=5.37-60.92). Other studies also showed 1.51 fold increase in risk of lung cancer among those who had history of cancer in their family (Osann, 1991).Those respondents who cooked inside the house had 9.76 times risk for occurrence of lung cancer when adjusted (OR=9.76, 95%C.I=2.30-41.43) with other confounders and also in bivariate analysis between location of cooking and lung cancer showed 4.643 times risk (OR=4.64, 95%C.I=1.49-14.51) which showed positive association. In Nepal most of the household cook inside the house causing more exposure to second hand smoke.(Raspanti et al., 2016) thus increasing the risk for occurrence of lung cancer (Binu et al., 2007; Pradhananga et

al., 2009)as per finding in our study. Other factors like fuel used for cooking such as natural gas , kerosene, coal, wood, animal dung, charcoal also showed 3.95 times risk when adjusted with other factors as when unadjusted its 5.35 times risk for occurrence of lung cancer both showing positive association in this study .Another study done in China also showed association of fuel used for cooking like coal, wood, etc. with occurrence of lung cancer (Mumford et al., 1987) and another in Nepal also showed increased risk(Rachit Chawla et al., 1789).Respondents who were unemployed has 6.99 times risk and was positively associated with occurrence with lung cancer when adjusted (OR=6.99, 95%C.I=1.96-24.99) for other factors than when it was not adjusted (OR=1.67, 95%C.I=0.70-4.10).

- Discussion on association of relighting of cigarette butts while smoking and occurrence of lung cancer :

Relighting of cigarette butt while smoking was positively associated with occurrence of lung cancer when it was unadjusted (OR=4.47, 95%C.I=2.28-8.78) as well as when it was adjusted with factors which were significant in the bivariate analysis for occurrence of lung cancer (OR=37.63, 95%C.I=7.55-187.46). A study done in Manchester also showed habit of relighting caused an increment of lung cancer hazard (Dark et al., 1963).This may be because smokers who relight tend to smoke till the cigarette butt is short thus consuming a little more tobacco and considerably more tar. Thus this habit of possible relighting of compressed tobacco tends to produce more harmful substances which may be lead to damage of lungs (J. Rimington, 1974).The analysis also shows that the incremental effect of risk of lung cancer has an association with the average number of cigarette smoked daily over a period of time as per another study done by Dark ,O'Connor et al.(Dark et al., 1963).Those who smoked greater than 20 cigarettes per day when adjusted with other factors had 63.716 times increased risk (OR=63.72, 95%C.I=8.70-466.77) than unadjusted which caused 27 times risk (OR=27, 95%C.I=8.19-89)for occurrence of lung cancer as also shown in other studies (Raspanti et al., 2015),(Wu-Williams et al., 1990),(Wakai et al., 1997). Those who smoked cigarette without filter had 4.65 times risk for occurrence of lung cancer (OR=4.65, 95%C.I=1.79-12.04) but when

adjusted with other risk factors it caused 24.25 fold risk for occurrence of lung cancer which was positively associated(p value=0.001,OR=24.25, 95%C.I=3.81-154.55)as per other studies(Wakai et al., 1997). Even family history of cancer among immediate family shows positive association as a risk factor for occurrence of lung cancer when unadjusted 18.09 times risk (OR=18.09, 95%C.I=5.37-60.92)and when adjusted with other factors caused 26.38 times risk (OR=26.38, 95%C.I=2.48-280.38) like in other studies (Osann, 1991). In this study also every increase in age there is 1.05 times likelihood of occurrence of lung cancer (OR=1.05, 95%C.I=0.10-1.11) when adjusted as well as when it was unadjusted it showed 1.03 times risk for occurrence of lung cancer (OR=1.03, 95%C.I=1.006-1.05) which was both positively associated.Those respondents who cooked inside the house had 24.80 times positively associated risk for occurrence of lung cancer when adjusted (OR=24.80, 95%C.I=3.48-176.82) with other confounders and also in bivariate analysis between location of cooking and lung cancer showed 4.64 times risk (OR=4.64, 95%C.I=1.49-14.51).As per other studies also there is an increased risk if cooking is done inside the house causing more exposure to second hand smoke especially practiced in Nepal. (Raspanti et al., 2016) (Binu et al., 2007; Pradhananga et al., 2009).In this study when occupation is unadjusted housewives have 3.33 times positively associated risk for occurrence of lung cancer (OR=3.33, 95%C.I=1.60-6.95) whereas when adjusted with other factors including smoking habits the risk increases to 4.32 fold (OR=4.32, 95%C.I=0.83-22.41).Other studies have also shown that women who are more exposed to second hand some are at a greater risk for having lung cancer (Pandey, 1984).

5.3 Benefits from the study

The findings of any well planned and effectively executed research may directly or indirectly contribute to various individuals, public health authorities and stakeholders.

- The findings of the study can be useful in educating people about behavioral habits associated with smoking such as relighting of cigarette butts which causes more risk of occurrence of lung cancer.

- The finding of this study can be used by the stakeholders like public health authorities, health personnel, governing and monitoring bodies to know about the various direct and indirect factors responsible for causing lung cancer.

- Findings can help different direct and indirect stakeholders to develop the various awareness programs and policies about lung cancers to make people more conscious about their health.

- Finding can help make general public much aware about exposure to second hand smoke and its risk for occurrence of lung cancer.

- Another segment of the stakeholders who may be benefited in the future to conduct the research are the future researcher. This research can work as the benchmark to conduct the future research. There are some limitations which needs to be addressed in the future by the researcher.

5.4 Conclusions

An unmatched case control study was conducted among 207 participants, which included 99 controls and 108 cases from study areas; National Cancer Hospital and Research Centre Pvt. Ltd situated at Kathmandu and Bhaktapur Cancer Hospital situated in Bhaktapur, Nepal and areas nearby to these hospitals. For response collection, structured questionnaire was used which was supervised by the researcher herself. Collected data were managed in excel and data analysis has been done in SPSS version 16.0. Descriptive statistics were done to summarize the characteristics of the participants and analytical statistics were conducted to find the association and the degree of association between the dependent and independent variable.

From this study we can conclude that nearly 81%of smokers suffered from lung cancer. Smoking when directly associated with lung cancer causes 1.91 times risk for occurrence of lung cancer. Even when it there is involvement of other factors which may act as confounders in occurrence of lung cancer it still causes 2.85 times risk. There are also other major factors like family history of cancer, location of cooking

in the household, type of fuel used while cooking and occupation were positively associated with occurrence of lung cancer but negatively associated with second hand exposure at workplace.

Whereas when only smokers where assessed it showed that even smoking habits acted as major risk factors and showed positive association with occurrence of lung cancer like relighting of cigarette butts while smoking, average number of cigarettes smoked per day and presence and absence of filter in cigarettes. Other factors like location of cook in in the house, family history of cancer, second hand exposure at workplace and occupation also showed positive association. Relighting showed 37.69 times risk for occurrence of lung cancer and was positively associated even when there was involvement of other factors which acted as confounders.

As per our research question, smoking and relighting of cigarette butts were both were major positively associated risk factors for occurrence of lung cancer. This call for strengthening the prevention aspect of tobacco control program to focus on behavioral change for reducing relighting of cigarette butts among the general population and also reducing tobacco addiction among the general population in Nepal.

5.5 Recommendations.:

The following points can be recommended from the findings of this study:

1. The government should set policies regarding population based counseling in communities by developing health programs to make people more aware of lung cancer who currently smoke and are of low socioeconomic groups.

2. The government should give health education regarding smoking habits targeted to younger age groups to bring behavioral changes and also to make them aware of consequences of smoking and lung cancer.

3. The government should strengthen the prevention aspect of tobacco control program by also focusing on behavioral changes of relighting cigarette butts while smoking, using filtered cigarettes and decreasing the average number of cigarettes per day in the general population.

4. Health education should be given to females regarding smoking and secondary exposure to smoke because as they are the most vulnerable ones to get exposed at home.

5. Strategies can be made to decrease household hair pollution in addition to tobacco control.

6. Organization and workplaces can make rules regarding workplace bans of smoking so that there will be no exposure to second hand smoking.

7. Individuals who smoke should avoid smoking and ones who continue smoking should avoid habits of relighting and decrease to average amount of cigarette smoking so that there is less chance of occurrence of lung cancer.

8. Further studies are needed with a larger population which includes extensive research on chemicals present in cigarette, other secondary factors like radon exposure and genetic predisposition.

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APPENDIX

Appendix A: Questionnaire

Date of interview:

1. What is your name?

2. What is your Age?: (in completed years):……………..years.

3. Sex: a. Male   b. Female

4. What is your religion?:

   a. Hindu   b. Buddhist   c. Muslim   d. Christian   e. Others

5. Marital Status : (please choose only one):

a. Married   b. Unmarried   c. Divorced   d. Widowed

6. What is your Occupation (please choose only one)?

a. Service   b. Business   c. housewife   d. unemployed

7. Address (Where do you live?)

8. What is your Ethnicity (please choose only one)?

a. Newar   b. Brahmin   c. Chettri   d. Rai   e. Lama   f. Sherpa

g. Tamang   h. Gurung   i. Limbu   j. Thakali   k. others……………….

9. Educational Status:

a. Illiterate   b. literate   c. Primary   d. Secondary   e. Higher secondary

f. SLC   g. +2   h. Bachelor and above   i. Master   j. PHD

10. Did you or do you Smoke cigarette: Yes: No:

i. At what age did you start? …………………..years

ii. How many cigarettes per day on average   a.<10sticks/day   b.10-20   c.21-30 d.31-40/day   e >41/day

iii. What type of Cigarettes do you smoke: a. Local   b. Foreign

iv. Does the cigarette you smoke have filter: a. Yes   b. No

v. Have you ever relighted cigarette butt ends while smoking: a. Yes   b.No

vi. For about how many total years have you smoked? …………..years

vii. Have you ever quit smoking?:   a. Yes   b. No

vii. When did you stop smoking?   a. Days   b. Months   c. Years

11. Exposure to secondhand smoke :

1. Does anyone in your household smoke at home?   a. Yes   b. No

2. Does anyone in your work smoke ?   a.Yes   b.No

12. What kind of fuel does your household mainly use for cooking? (Please choose only one)

a. Electricity   b. LPG   c. Natural Gas   d. Biogas   e. Kerosene   d. Coal or lignite

e. Charcoal   f. Wood   g. Straw or shrubs or grass   h. Agricultural crops

i. Animal Dung   j. Others

13. Is food for your household usually cooked in the house or somewhere else? (Please choose only one):

a. In the house   b. Elsewhere

14. Economic Status: About how much is your household income per month in total?

a. <10,000   b.10,001-20,000   c.20,001-30,000   e>30,000

15. Does anyone in your family have a history of cancer like mother, father , sibling, grandparents, uncle and aunt who are directly related to you?

a. Yes   b. No

16. How was your disease diagnosed by (more than one can be chosen from the clinical records):

a. Sputum   b. FNAC   c. Bronchial Biopsy   d. Bronchial Brushing

e. Bronchial washing

17. Confirmed Histopathological Diagnosis:

Appendix B: Cost Calculation

Item	Cost in Baht	Budget required in			
		1st Month	2nd Month	3rd Month	4th & 5th Month
Training and pretest of questionnaire	**1,000**	1,000			
Data collection	**7,000**	2,000	3,000	2,000	
Data entry and processing	**2,000**				2,000
Stationary questionnaire, pen,.etc	**4,000**	2,000	1,000	1,000	
Travel costs	**40000**	500	500	13000	26000
Accommodations and other expenses	**3,000**	500	500	500	500
TOTAL COST OF THE RESEARCH	**57,000**	6,100	5,100	4,100	28500

Appendix C: Time Schedule

Different Activities	Aug 16	Sept 16	Oct 16	Nov 16	Dec 16	Jan 17	Feb 17	Mar 17	Apr 17	May 17	Jun 17	July 17
Literature Review	■	■										
Writing Thesis Proposal			■	■	■							
Validity Testing of Questionnaire					■							
Field testing of Questionnaire						■						
Thesis Proposal Exam							■					
Thesis proposal Submission								■				
Ethical Consideration by NHRC								■	■			
Data Collection									■	■		
Data Analysis											■	
Thesis writing											■	
Thesis examination												■
Thesis Submission												■

Appendix D: Consent Form

This informed consent form is for research for thesis titled - Lung cancer in relation to smoking including relighting cigarette butts: Kathmandu Valley, Nepal: An unmatched case control study.I, Dr. Deepshikha Rajya Laxmi Rana currently acquiring my MPH Degree at College of Public Health Sciences, Chulalongkorn University, Thailand. This research is being carried out because lung cancer is one of the most common cancers in our region. This research focuses on lung cancer and its relationship with smoking and relighting of cigarette butts. The information provided in the questionnaire will be kept confidential. Your participation in the research is entirely voluntary. It is your choice whether to participate or not .If you choose not to participate all the services you receive at the Centre will continue and nothing will change. Also that the information provided will not be used against you in anyway. But if you choose to participate the information you will be provided will help us find whether relighting of cigarette butts and smoking causes cases and this information can help us in planning in bringing behavioral changes in habits regarding smoking so there is less likely chance of occurrence of lung cancer. You will not be provided incentive as such or there may be no direct benefit but any information gained will be provided to you for future interventions.

The study will be conducted by the interviewer who will be ask questions which will take no more than 10 mins. If you have any questions regarding the research you can ask them now or later. If you wish to ask later, you may contact me Dr. Deepshikha Rajya Laxmi Rana (mobile no. 9841283306).

This proposal has been reviewed by the ethical committee, Nepal Health Research Council, which is a committee whose task it is to make sure that research participant are protected from harm.

If you agree on the following and wish to participate willingly please sign the following below giving your approval.

....Name of the participant

Appendix D: Approval Letters

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

Ref. No.: 1880
05 May 2017

Dr. Deepshikha Rajya Laxmi Rana

Principal Investigator
College of Public Health Sciences
Chulalongkorn University, Thailand

Subject: Approval of research proposal entitled Lung Cancer in relation to smoking including relighting cigarette butts: Kathmandu Valley, Nepal : An unmatched case control study

Dear Dr. Rana,
It is my pleasure to inform you that the above-mentioned proposal submitted on **24 March 2017** (**Reg.no. 83/2017**) please use this Reg. No. during further correspondence) has been approved by NHRC Ethical Review Board on **27 April 2017**.
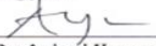
As per NHRC rules and regulations, the investigator has to strictly follow the protocol stipulated in the proposal. Any change in objective(s), problem statement, research question or hypothesis, methodology, implementation procedure, data management and budget that may be necessary in course of the implementation of the research proposal can only be made so and implemented after prior approval from this council. Thus, it is compulsory to submit the detail of such changes intended or desired with justification prior to actual change in the protocol before the expiration date of this approval. Expiration date of this study is **July 2017.**

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

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

As per your research proposal, the research amount is **NRs.1,88000.00** and accordingly the processing fee amount to **NRs.10,000.00**. It is acknowledged that the above-mentioned processing fee has been received at NHRC.

If you have any queries, please feel free to contact the Ethical Review M & E section of NHRC.

Thanking you,

Prof. Dr. Anjani Kumar Jha
Executive Chairman

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Website: http://www.nhrc.org.np, E-mail: nhrc@nhrc.org.np

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4, 5th Floor, Institute Building 2, Soi Chulalongkorn 62, Phyathai Road, Bangkok 10330, THAILAND
Tel. (662) 218 8152-53 Fax. (662) 253 2395, 255 2177, 218 8149
E-mail: cphs@chula.ac.th   Website:www.cphs.chula.ac.th

No. 0512.38/ 0161

17 February 2017

TO WHOM IT MAY CONCERN

This is to certify that Ms. Deepshikha Rajya Laxmi Rana, Student's Identification No. 5978807353 is currently a student of Master of Public Health Program in Public Health at the College of Public Health Sciences, Chulalongkorn University for academic year of 2016 starting on June 2016. She had been successfully passed her proposal examination on the topic of "Lung Cancer in Relation to Smoking Including Relighting Cigarette Butts: Kathmandu Valley, Nepal: An Unmatched Case Control Study" on 9 February 2017. She will submit her research project for ethical review at the Government of Nepal (Nepal Health Research Council) from April – July 2017.

This is for your information and further appropriate actions.

Sincerely yours,

Associate Prof. Ratana Somrongthong, Ph.D.
Deputy Dean
For Dean, College of Public Health Sciences

Nepal Cancer Relief Society
BHAKTAPUR CANCER HOSPITAL
in collaboration with
Government of Nepal
Rotary International and Local Community of Bhaktapur

Estd: 2051 B.S. (1995 A.D.)

Ref No.

March 27, 2017

The Medical Oncology Department
Bhaktapur Cancer Hospital

Re: **Regarding Data collection**

This is to kindly request you that **Ms. Deepshikha Rajya Laxmi Rana** from Chulalongkorn University, Thailand has been given permission to do Data collection on topic *Lung Cancer in Relation to Smoking Including Relighting Cigarette Butts: Kathmandu Valley, Nepal: An Unmatched Case control Study* to your department as per her request.

So, it is kindly request to help & guide her as per needful.

2063/92/98
27/03/2017
....

Raja Ram Tajale
Hospital Administrator

Cc:
➤ Reception

National Hospital & Cancer Research Center (P.) LTD.

NEPAL

Ref No: 126 / 073/074   Date: 19th February,2017

To,

Dr.Deepshikha Rajya Laxmi Rana,
College of Public Health Sciences,
Chulalongkorn University.

Subject: Permission For Research Data Collection

This letter is provided for Dr.Deepshikha Rajya Laxmi Rana, a master's degree student in Public Health Science, Chulalongkorn University for the permission of her request to collect research data for thesis.Thesis entitled Lung Cancer in Relation to Smoking Including Relighting Cigarette Butts:Kathmandu Valley,Nepal."An Unmatched Case Control Study.

Yours Sincerely,

Prof. Shyam Krishna Joshi
Managing Director

VITA

Dr.Deepshikha Rajya Laxmi Rana was born on 31st of January 1984 in Kathmandu,Nepal. She received her Bachelor of Medicine, Bachelor of Surgery (MBBS) Degree from R.G KAR Medical College and Hospital, Calcutta University, Kolkata, India in 2006 .She is a registered doctor in Nepal Medical Council. After graduation she worked as a Medical Officer in different hospitals in Kathmandu,Nepal. She pursued her career In Master's in Public Health Sciences at College of Public Health Sciences,Chulalongkorn University in 2016 and completed the program in 2017.