

## RESEARCH ARTICLE

# Prediction of the Cancer Incidence in Nepal

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### Abstract

**Background:** The burden of cancer will increase both in males and females in Nepal. Due to the unavailability of a population based cancer registry it is difficult to precisely predict of future incidence rates. However, using hospital-based data to predict the cancer incidence in Nepal it was found that it will certainly increase both in males and females from 2013 to 2020. **Material and Methods:** For this research we used the cases from the first national cancer registry report (2003) to the cases of the most recent (2012) accumulated by all the hospital based cancer registries in Nepal. We used simple linear regression to analyze the data and thereby obtained a simple linear regression equation. **Result:** In 2020 the highest incidence rate will be for males 38.5 per 100,000 and for females, 41.4. The present study demonstrated that female cancer incidence will be higher than that in males in Nepal. **Conclusion:** This study provided evidence of future trends, which will feature an increasing rate of cancer in Nepal.

**Keywords:** Cancer- Nepal incidence- prediction

*Asian Pac J Cancer Prev*, **18 (1)**, 165-168

### Introduction

The hospital based cancer registry was established in Nepal from 2003 with the support of World Health Organization (Pun et al., 2015). Nepal is situated between India and China of which both have substantial information regarding the indicators of cancer. Unfortunately Nepal does not have enough data to measure the burden of cancer. Previous studies reported, the number of cancer cases in Nepal revealed that lung cancer was the major cancer in males while cervix uteri was the major cancer in females (Pun et al., 2015., Poudel et al., 2016). Owing to the absence of population-based cancer registry in Nepal, we had taken the cases from the hospital and denominator from Population census data (Population Monograph of Nepal, 2014).

### Materials and Methods

#### Methodology

Data which was collected by seven hospital-based cancer registries (B P Koirala Memorial Cancer hospital, Bhaktapur cancer hospital, Bir hospital, TU teaching hospital, Kanti children hospital, BP Koirala institute of health science and Maniपाल teaching hospital) of Nepal was taken in this study. We included the cancer cases together within categories as per International Classification of Disease for Oncology (ICD-10) published by World Health Organization. All cancer cases were abstracted from the medical record sections of national cancer registry forms of all hospitals. The collected

data were entered in Excel Sheet with respect to years. All double/multiple entry cases were excluded by cross checking name, sex, address and hospital registered number of each patients. We analyzed 26,064 male cases and 29,867 female cases with known age. The collected data were entered in Excel Sheet with respect to years, age and gender. The population growth rate 1.3 % from 2001 to 2011 published on population monograph of Nepal volume 1 and the Population Census of 2001 and 2011 were used to estimate the population of Nepal of 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2012 (Population Monograph of Nepal, 2014). The crude incidence rate of cancer (per 100,000) over a 10 year period was calculated for both males and females and both sexes. Statistical analysis was performed using SPSS (version 23.0) and Microsoft Excel 2010. We used simple linear regression to analyze the data and get the simple linear regression equation. According to simple linear regression equation, we have demonstrated the incidence rate of cancer in males, females and both sexes from 2013 to 2020 in Nepal.

### Results

The observed and predicted cancer incidence performed an increasing trend of cancer in Nepal every year; Female cancer incidence was higher than male cancer incidence (Table 2). The simple linear regression for male, female and both sexes were as follows.

For male,  $Y = -2,809,861 + 1,410$ ,  $R^2 = 0.944$

For female  $Y = -2,871,739 + 1,442$ ,  $R^2 = 0.919$

For both sex,  $Y = -2,805,620 + 1,409$ ,  $R^2 = 0.942$

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Figure 1. Outline Map of Nepal with the Sites of Contributing Hospitals

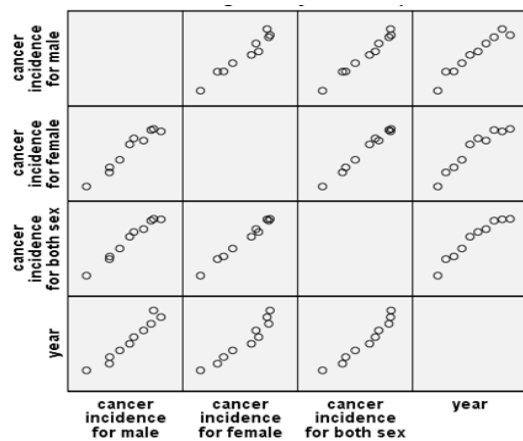


Figure 2. Relationship between the Cancer Incidence for Males and Females and Calendar Time Given in Years in Nepal

X= Year

From the scatter graph, we could see the cancer incidence rate and year followed the linear. From the analysis, the value of  $R^2$  was also very large. From this data it showed that the simple linear regression equation was the best fit for the prediction of the incidence of cancer.

### Discussion

Our study estimated the increasing rate of cancer incidence in males and females from 2013 to 2020 while comparing to former studies by Pradhanang et al., (2009) and Pun et al., (2015) which also showed the increasing number of cancer cases in males and females in 2006 and 2012 respectively. This increase could be because of several risk factors such as the use of tobacco, obesity/overweight, not enough exercise and infection (Torre et al., 2015). Due to the non-existence of community based cancer registry in Nepal, it is hard to forecast the exact figure of cancer incidence. However, a few studies had been conducted to predict the cancer cases in Nepal, which estimated that the number of cancer cases would increase in future (Sathain et al., 2010, Sathain et al., 2013). This retrospective study was the first study in the history of cancer research in Nepal to include 10 years hospital based national cancer registry data to predict the national cancer incidence. As both the cancer incidence rate and year followed the linear, it verified that simple

Table 1. Summary of Total Hospital Based Cancer Cases from 2003 to 2012 in Nepal

Years	Male	Female	Total
2003	1,488	1,763	3,251
2004	2,009	2,156	4,165
2005	2,051	2,331	4,382
2006	2,308	2,570	4,878
2007	2,758	3,276	6,034
2008	2,702	3,247	5,949
2009	2,970	3,229	6,199
2010	3,192	3,581	6,773
2011	3,295	3,793	7,088
2012	3,291	3,921	7,212
Total	26,064	29,867	55,931

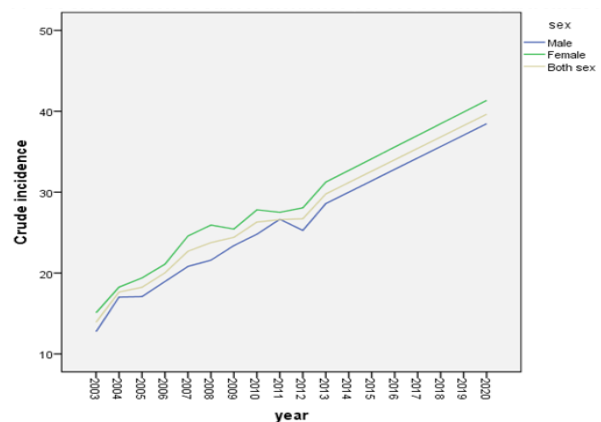


Figure 2. Prediction of Cancer Incidence Per 100,000 in Nepal from 2013 to 2020

Table 2. Observed Cancer Incidence for Males and Females from 2003 to 2012 and Estimated Incidence for the Period 2013 to 2020 in Nepal

Year	Male crude incidence	Female-Crude incidence	Both-sex-crude incidence
2003	12.8	15.1	13.9
2004	17.0	18.3	17.7
2005	17.1	19.4	18.2
2006	19.0	21.1	20.0
2007	20.8	24.6	22.7
2008	21.6	25.9	23.8
2009	23.4	25.4	24.4
2010	24.8	27.8	26.3
2011	26.7	27.5	26.6
2012	25.3	28.1	26.7
2013	28.6	31.3	29.8
2014	30.0	32.7	31.2
2015	31.4	34.1	32.6
2016	32.8	35.6	34.0
2017	34.2	37.0	35.4
2018	35.6	38.5	36.8
2019	37.1	39.9	38.2
2020	38.5	41.4	39.6

linear regression was the best fit for the cancer incidence and the year (Figure 2).

The recent studies had also reported the increasing trend of cancer in Nepal both in males and females from 2003 to 2012. This study had also presented that lung cancer was the major cancer throughout the ten years in males in Nepal (Poudel et al., 2016). Different studies had also reported that lung cancer was the major cancer in males (Pun et al., 2015) in Nepal. It was because of poor education, unmarried individuals, and Rai/Limbu/Magar ethnicity (Hashibe et al., 2010), household air pollution, and tobacco consumption (Raspanti et al., 2016), and not enough medical health education (Khatiwada et al., 2012). Due to unavailability of the National level data, the exact prevalence rate of tobacco user was not known in Nepal (Subedi et al., 2013). However, few studies had reported that the consumption of tobacco products was high in Nepal (Sreeramareddy et al., 2011; Pandey et al., 1988). A survey conducted in Nepal presented that 15% of females and 35.5% of males smoked tobacco products while 4.6% of females and 31.2% of males consumed smokeless tobacco. That report had further informed that the prevalence of smoking among Nepalese women was one of the highest in WHO south East Asia region (Brief profile on tobacco control, Nepal). Studies had reported that the estimated deaths in Nepal, because of consumption of tobacco, were nearly 15,000 per year. Tobacco attributed cancer was the main reason of death (Subedi et al., 2013). Over consumption of tobacco might be another key threat element for the growth of cancer in Nepal in future. Larynx cancer was the third most common cancers in males in Nepal (Pun et al., 2015., Poudel et al., 2016). Cancer of lung and larynx were also the leading cancer in the neighboring countries of India, Pakistan and Bangladesh. It could be because of a higher consumption of smoking and chewing of tobacco products in males of those nations. (Gaur et al., 2006; Critchley et al., 2003; Subedi et al., 2013 ). Furthermore, another study had also reported that tobacco product per consumer group was large among youths of Nepal (Subedi et al., 2013) which was the risk factor for lung cancer (Torre et al., 2015). Nepal ranked 177 among 180 countries in terms of air quality (Kathmandu Post 2016). Polluted air might be another aspect for the growth of cancer in Nepal in days to come. The incidence rate of stomach cancer which was the second common cancer in males in Nepal had also increased every year from 2003 to 2012 (Poudel et al., 2012). Dried, smoked, and salted foods were considered as higher risk factors for gastric cancer in Nepal (Sathian 2012). A national survey conducted in Nepal found that 67.5% of the total sample had consumed alcohol (WHO, 2004). It might also be an additional cause for the growth of cancer in Nepal in the future.

Cervix uteri cancer was the major cancer over the ten years in females in Nepal (Poudel et al., 2016). Due to lack of information regarding the human papillomavirus (HPV), poor purchasing capacity for HPV vaccination, the cases of cervical cancer will increase year by year (Sathian et al., 2013). Studies had also found there was a poor knowledge of breast cancer risk factors, symptoms and curability, among higher secondary school students

in Nepal (Bhandari et al., 2016) which could be another reason for the increment of cancer in Nepal in the future. In addition, cancer cases had been diagnosed more recently than in the past. However, there were only seven major cancer centers in existence in the past in Nepal. B P Koirala Memorial Cancer Hospital which is one of the leading public cancer hospitals in Nepal implemented a number of cancer awareness and education programmes over recent years. As a result, many people came forward to report cancer cases, which could be another possible cause for the growth of new cases of cancer in Nepal (BPKMCH Annual Report, 2013).

This study forecasts that the growth rate of cancer will have increased from 2013 to 2020. If the incidence of cancer will increase in such a way, it could be a serious issue in Nepal. Though this is a hospital-based research, the concerned authority and stakeholders have to focus on taking active measures to control and prevent the cancer in Nepal.

## Acknowledgements

The author would like to thank Dr Søren Nymand Lophaven , Sakrish Poudel, Dr Bal Ram Dhakal (University of Cambridge, UK), Shirish Poudel, Janaki Kharel Poudel, Dr David Hurman.

(Consultant of Aberdeen Royal Infirmary Hospital, Scotland ), Ramesh Kanta Poudel, Nirmal Duwadi (Lecture at Nepal Medical College), Bhuminda Poudel, Tulashi Devi Poudel, Shanta Poudel Tiwari, Sharan Hari Tiwari, Dev Kumar Basel, Dr Bishwa Ram Poudel ( Consultant BPKMCH), Dr Nirmal Lamichhane ( Consultant Chitwan Medical College), Divya Basel, Shikcha Sharma, Dr Bishnu Kandel, Keshav Dhungana, Dr Dong Pang, Jaya Tamang, Pratap Gurung, Suresh Adhikari, Shalik Ram Acharya, Krishna Hari Bhushal, Krishna Prasad Sapkota, Ravi lal Kharel, Bal Krishna Pandey,Rakcha Acharya, Sabita Sharma, Sadikcha Sharma, Ambika Poudel, Aayush Poudel, Bishnu Adhikari, Sumana Sharma, Bhawani Poudel, Resham Lal Sharma, Sharda Poudel and Ak Narayan Poudel for their contribution towards this research.

## References

- Bhandari PM, Thapa K, Dhakal S, et al (2016). Breast cancer literacy among higher secondary students: results from a cross-sectional study in western Nepal. *BMC Cancer*, **16**, 1-9.
- B.P.Koirala Memorial Cancer Hospital Annual Report (2013). Brief profile on tobacco control in Nepal, Government of Nepal,Ministry of Health and Population. [http://www.who.int/fctc/reporting/party\\_reports/nepal\\_2012\\_annex2\\_tobacco\\_profile.pdf](http://www.who.int/fctc/reporting/party_reports/nepal_2012_annex2_tobacco_profile.pdf) (Retrieved on 24-04-2016).
- Critchley JA, Unal B (2003). Health effects associated with smokeless tobacco: a systematic review. *Thorax*, **58**, 435-43.
- Gaur DS, Kishore S, Harsh M, et al (2006). Pattern of cancers amongst patients attending Himalayan institute of medical science, Dehradun (2006). *Indian J pathol Microbiol*, **49**, 193-8.
- Hashibe M, Siwakoti B, Wei M, et al (2010). Socioeconomic status and lung cancer risk in Nepal. *Asian Pac J Cancer*

- Prev*, **11**, 1083-8.
- Kathmandu P (2016). <http://kathmandupost.ekantipur.com/news/2016-01-29/nepals-air-pollution-among-worst.html> (Retrieved on 24-04-2016).
- Khatriwada P, Kayastha SR, Panta P, et al (2012). Understanding of tobacco and lung cancer among medical students in Kathmandu university school of medical sciences (KUSMS). *Kathmandu Univ Med J*, **10**, 60-5.
- National Cancer Registry Programme Report of Hospital Based National Cancer Registry (2003-2012).
- Pandey MR, Neupane RP, Gautam A (1988). Epidemiological study of tobacco smoking behavior among adults in a rural community of the hill region of Nepal with special reference to attitude and beliefs. *Int J Epidemiol*, **17**, 535-41.
- Population Monograph of Nepal.(2014).Government of Nepal, National Planning Commission Secretariat, Central Bureau of Statistics. (volume I, Population Dynamics).
- Poudel KK, Haug Z, Neupane PR (2016). Trend of cancer incidence in Nepal from 2003 to 2012. *Asian Pac J Cancer Prev*, **17**, 2171-5.
- Pun CB, Pradhananga KK, Siwakoti B, et al (2015). Malignant neoplasm burden in Nepal- data from the seven major cancer service hospitals for 2012. *Asian Pac J Cancer Prev*, **16**, 8659-63.
- Raspanti GA, Hashibe M, Siwakoti B, et al (2016). Household air pollution and lung cancer risk among never smokers in Nepal. *Environ Res*, **147**, 141-45.
- Sathian B (2012). Risk factors for the development of gastric cancer, and their awareness among the general public in Nepal: A necessary enquiry. *Webmedcentral*, **3**, 1-5.
- Sathian B, Fazil A, Sreedharan J, et al (2013). Statistical modelling and forecasting of cervix cancer cases in radiation oncology treatment: a hospital based study from western Nepal. *Asian Pac J Cancer Prev*, **14**, 2097-100.
- Sreeramareddy CT, Ramakrishnareddy N, Kumar HN, et al (2011). Prevalence, distribution and correlates of tobacco smoking and chewing in Nepal: a secondary data analysis of Nepal Demographic and Health survey- 2006. *Subst Abuse Treat Prev Policy*, **6**, 1-9.
- Subedi KS, Sharma P (2013). Tobacco-attributed cancer incidence is rising in Nepal due to increasing prevalence of tobacco use: a major challenging burden for Nepal. *Asian Journal of Cancer*, **12**, 89-95.
- Torre LA, Bray F, Siegel RL, et al (2015). Cancer Statistics. *Cancer J Clin*, **65**, 87-108.
- WHO global status report on alcohol (2004). [http://www.who.int/substance\\_abuse/publications/en/nepal.pdf](http://www.who.int/substance_abuse/publications/en/nepal.pdf) (Retrieved on 24-04-2016).