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The burden of tobacco in Nepal: a systematic analysis from the Global Burden of Disease Study 1990-2017

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The burden of tobacco in Nepal: a systematic analysis from the Global Burden of Disease Study 1990-2017

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Article Summary

Strengths and limitations of this study

- This study is one of the first studies in Nepal to extracts Global Burden of Disease Study data to present mortality and disability attributable to tobacco in Nepal.
- It shows more than one-third increase in mortality and 3% increase in disability adjusted life years attributable to different form of tobacco use.
- It analyses the secondary data of Global Burden of Disease Study and hence has all the limitations pertaining to the data.

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ABSTRACT

Background: Tobacco consumption has been a major public health issue worldwide because of its associated high morbidity and mortality. This study attempts to systematically review the data extracted from the global burden disease study and set out to assess the age-sex-specific mortality and disability attributable to different forms of tobacco from 1990 to 2017, for Nepal.

Methods: The Institute for Health Metrics and Evaluation's Global Burden of Disease database was used for the extraction of data related to age-sex-specific mortality and disability-adjusted life years (DALYs), then was quantitatively analyzed to show the trends and patterns in age-sex-specific deaths and DALYs attributable to tobacco use from different diseases from the year 1990 to 2017 in Nepal.

Results: In between 1990 and 2015, the prevalence of tobacco smoking significantly decreased by 15% in male, 11% in female, and 13% in both. By 2017, the total deaths attributable to tobacco use, including any form, increased by 39% in both gender and DALYs attributable to tobacco use, including any form, in all ages increased by 11% males but decreased by 9% in females, with tobacco

smoking having the most contribution. An increasing rate of deaths and DALYs attributable to tobacco was noted with an increase in age. Non-communicable diseases were responsible for most deaths and disabilities attributable to tobacco use.

Conclusion: There was a more than one-third increase in mortality and a 3% increase in DALY, though the smoking prevalence is in decreasing trend. There is a huge increase in deaths and DALYs due to chewing tobacco. A strong implementation plan is needed to control all forms of tobacco including second-hand exposure.

Keywords: tobacco; global burden of diseases; Nepal; DALY.

INTRODUCTION

To date, tobacco remains a major public health issue worldwide because of its associated high morbidity and mortality rate. Any forms of tobacco use are harmful to health and kill millions of people every year.[1] Tobacco is commonly used in either smoking or smokeless form, both are highly addictive forms. There is no safety margin for exposure to second-hand smoke or tobacco smoking and second-hand smoke exposure is equally harmful to health. The use of tobacco products or exposure to second-hand smoke has been implicated to many health issues like cardiovascular diseases, respiratory diseases, cancers, non-communicable diseases (NCD), and many more.[2,3]

According to the World Health Organization (WHO), about 1.3 billion people in the world used tobacco products among which more than one billion people were smokers.[4] Almost over 80% of the smokers reside in low- and middle-income countries. The prevalence rates of tobacco use differ widely among different geographical regions, and the number of male smokers compared with female smokers is higher in all regions. The last two decades have seen a decreasing trend towards the consumption of tobacco in all age groups. In 2000, almost one-third of the world's population (33.3%) aged 15 and more used some form of tobacco products, 50% in males and 16.7% in female. While in 2015, the prevalence of tobacco use dropped to nearly a quarter of the world's population (24.9%), 40.3% in

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males and 9.5% in females.[1] Despite the decreasing prevalence of tobacco use globally, the absolute number of male smokers is growing continuously in South-East Asian, African, and Eastern Mediterranean regions. The South-East Asian region has the highest prevalence of tobacco use (31% in 2015) compared with other regions, 49.4% in males and 12.9% in females.[1] According to recent findings from STEPS survey 2019 in Nepal, around 29% of adults (48% male and 12% female) within the age group 15-69 years used any form of tobacco, either smoking or smokeless.[5] In recent times, people have shown a growing preference for smokeless tobacco over smoking in South-East Asia including Nepal.[6–8] In Nepal, the use of smokeless tobacco is much more common than tobacco smoking and is more prevalent among males (33%) compared with females (5%).[5]

Despite decreasing prevalence, the number of deaths due to tobacco use continues to rise. Tobacco kills more than 8 million people every year. Among them, about 7 million people die from direct tobacco use while the deaths of about 1.2 million people result from second-hand smoke exposure.[4] In 2015, smoking alone was responsible for 11.5% and 6% of global deaths and DALYs respectively.[9] Deaths of about 65,000 children per year can be attributed to exposure from second-hand smoke.[10] The recent estimates show around US$ 1.4 trillion of total economic loss results globally from tobacco use which is equivalent to 1.8% of the world's annual GDP.[11] About 40% of this cost occurred in developing countries. In Nepal, around 27 thousand deaths occur annually from tobacco use, which comprises about 14.9% of all deaths.[12]

Given such a significant negative impact of tobacco on public health, navigation of the outcomes of tobacco use in a low-income country like Nepal is of the essence. The issue of tobacco usage has received considerable attention. In response, Nepal implemented the WHO Framework Convention on Tobacco Control (WHO FCTC) in 2006[13] and passed Tobacco Control and Regulatory Bill in 2011 by the Parliament[5]**.** So far, however, there has been little discussion about trends and patterns of tobacco use and its outcomes in Nepal. Such approaches have an unsatisfactory description of the burden of tobacco in the Nepalese population. This study tries to systematically evaluate the trends in mortality and DALYs attributable to smoking, tobacco use, chewing tobacco, and second-hand smoking by sex in Nepal from 1990 to 2017. For this, we explored the leading cause of mortality and DALYs attributable to tobacco in the same period. Thus, this study attempts to systematically review the data extracted from the global burden disease study 2017 and set out to assess the

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age-sex-specific mortality and disability attributable to different forms of tobacco from 1990 to 2017, for Nepal. Therefore, the findings of this study will make a major contribution to research by providing important insights into evidence for an effective tobacco control program in Nepal.

METHODS

Data sources and extraction

The global burden of disease study 2017 was a comprehensive epidemiological study that reported the trends and patterns in morbidity and mortality in 195 countries from major injuries, diseases, and risk factors to health at the global, regional and national level. The study design, metrics, and analysis are published elsewhere.[14] The Institute for Health Metrics and Evaluation (IHME)'s Global Burden of Disease (GBD) database was used for the extraction of data related to age-sex-specific mortality and disability-adjusted life years (DALYs) of all causes and other major public health issues of Nepal like cardiovascular diseases, diabetes and kidney disease, all neoplasms, NCD, and tuberculosis from the year 1990 to 2017.[15]

Patient and public involvement statement

This study used the data freely available from The Institute for Health Metrics and Evaluation (IHME)'s Global Burden of Disease (GBD) database. Patients were not involved in the design, recruitment, or conduct of the study. Results of this study will be made publicly available through publication.

Definition of terminology

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Disability-adjusted life year (DALY): According to the World Health Organization (WHO, 2012), DALY is "the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability".[16]

Age-standardized mortality rate (ASMR): According to the World Health Organization (WHO, 2015), ASMR is "a weighted average of the age-specific mortality rates per 100,000 persons, where the weights are the proportions of persons in the corresponding age groups of the WHO standard population".[17]

The term tobacco includes tobacco use in all forms including smoking and smokeless form.

Statistical analysis and interpretation

The extracted data from IHME was imported into Microsoft Excel, then was quantitatively analyzed and presented in the graphical, tabular forms and histograms to show the trends and patterns in age-sex-specific mortality and DALYs in Nepal. Statistical significance of p-value less than 0.05 was considered.

RESULTS

Here we report the GBD study results for Nepal on the prevalence of tobacco use, mortality, and burden caused by different forms of tobacco, smoking, and smokeless tobacco, between 1990 and 2017.

In 1990, the prevalence of tobacco smoking at all ages was 32.5% (27.2%-38%) for both sexes. It was 41.8% (37.2%-46.6%) for male and 23.5% (17.5%-29.8%) for female. In 2015, the prevalence of tobacco smoking decreased to 19.7% (16.4%-23.4%) in both sexes at all ages, with male 27.4% (23.9%-31.4%) and female 12.7% (9.6%-16%) [Figure 1].

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Figure 1: Prevalence of smoking from the year 1990 to 2015 for Nepal

Deaths and DALYs

In absolute terms, the attributable deaths at all ages to tobacco use, including all forms, increased (38.99%) in the general population (both male and female) from 19372 (95% UI 16060-23310) in 1990 to 26926 (95% UI 22826-31135) in 2017 [Table 1]. While DALYs for all ages due to tobacco use increased (10.52%) in males from 403665 (95% UI 319794-512870) in 1990 to 446132 (95% UI 364622-524648) in 2017, it decreased (8.78%) in females from 280977 (95% UI 205487-373384) in 1990 to 256300 (95% UI 205569-316573) in 2017 [Table 2]. Similarly, the attributable deaths and DALYs at all ages due to tobacco smoking or chewing tobacco showed increasing trends while that due to second-hand smoking showed falling trends for both sexes. Over the same time period, the age-standardized deaths and DALYs to tobacco use, tobacco smoking, chewing tobacco, secondhand smoking showed falling trend for both sexes.

Table 1. All-Age Deaths in number and Age Standardized Deaths for different diseases in different forms of tobacco and their percentage change in Nepal, 1990-2017

Subcategory	All-Age Deaths, No. in Thousands (95% UI)			Age-Standardized Deaths, in Rates per 100,000(95%UI)		
	1990	2017	change, %	1990	2017	Change, %
All causes						
Tobacco						
Male	11763.49 (9612.18-14237.80)	17372.20 (14056.39-20307.12)	47.68	258.31 (210.40-311.96)	192.61 (157.59-222.97)	-25.44
Female	7608.83 (5827.14-9679.57)	9553.55 (7463.66-12031.65)	25.56	173.77 (132.36-221.72)	97.55 (76.10-122.53)	-43.86
Both	19372.32 (16059.91-23310.44)	26925.75 (22826.17-31135.35)	38.99	216.59 (183.28-258.18)	144.95 (120.86-163.38)	-34.46
Smoking						
Male	9858.89 (8016.19-12138.96)	15573.83 (12511.70-18320.09)	57.97	233.81 (188.33-287.71)	173.70 (140.69-202.11)	-25.71
Female	5619.71 (4163.78-7373.09)	7984.05 (6026.50-10280.06)	42.07	145.70 (107.91-191.96)	82.34 (62.37-105.36)	-43.49
Both	15478.60 (12838.83-18675.51)	23557.88 (19798.77-27400.07)	52.20	190.28 (157.79-229.81)	124.98 (104.95-145.25)	-34.32
Chewing tobacco	324.53 (221.95-453.10)	595.13 (412.87-782.12)	83.38	6.27 (4.33-8.66)	5.88 (4.11-7.71)	-6.16
Male	142.83 (98.54-201.01)	268.19 (194.01-356.27)	87.76	3.50 (2.47-4.87)	2.61 (1.89-3.45)	-25.46
Female	467.36 (351.24-609.37)	863.32 (664.09-1073.70)	84.72	4.94 (3.79-6.31)	4.18 (3.24-5.21)	-15.49

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Both						
Secondhand smoking						
Male	2023.02 (1223.08-3116.32)	1966.04 (1388.69-2649.68)	-2.82	29.06 (19.32-41.14)	2[illegible]46 (15.18-28.93)	-26.17
Female	2133.57 (1257.73-3283.64)	1717.76 (1179.09-2388.87)	-19.49	32.52 (20.82-48.22)	1[illegible]96 (11.54-23.68)	-47.84
Both	4156.59 (2503.94-6381.37)	3683.80 (2641.33-4882.95)	-11.37	30.79 (20.61-43.63)	1[illegible]07 (13.58-25.41)	-38.06
Cardiovascular diseases						
Tobacco						
Male	3791.45 (2966.34-4752.99)	7184.91 (5484.11-8728.33)	89.50	79.77 (62.88-100.16)	7[illegible] (55.43-87.12)	-9.56
Female	1939.91 (1409.64-2638.17)	2759.22 (2031.88-3598.37)	42.23	44.72 (32.51-60.62)	2[illegible] (28.65-33.50)	-42.84
Both	5731.36 (4645.29-7010.77)	9944.13 (7888.43-12157.90)	73.50	62.60 (50.60-76.99)	4[illegible] (37.76-58.00)	-23.99
Smoking						
Male	3453.41 (2688.03-4375.06)	6398.37 (4808.50-7886.57)	85.28	72.05 (56.17-91.65)	6[illegible] (48.14-78.29)	-11.43
Female	1631.37 (1150.06-2269.44)	2305.75 (1631.12-3096.08)	41.34	37.58 (26.31-52.83)	2[illegible] (25.00-28.47)	-43.37
Both	5084.78 (4033.28-6349.49)	8704.12 (6785.50-10755.96)	71.18	55.18 (43.64-69.61)	4[illegible] (32.17-50.97)	-24.94
Secondhand smoking						
Male	470.29 (335.36-642.16)	1019.62 (716.19-1367.19)	116.81	10.33 (7.50-13.98)	[illegible] (7.71-13.79)	2.12
Female	392.38 (279.69-543.01)	552.72 (399.72-738.60)	40.86	8.93 (6.42-12.28)	[illegible] (5.13-6.88)	-42.30
Both	862.67 (645.37-1136.15)	1572.35 (1155.62-2052.89)	82.27	9.63 (7.30-12.52)	[illegible] (5.71-9.91)	-20.28
Diabetes and kidney diseases						
Tobacco						
Male	89.86 (46.50-132.87)	341.19 (212.30-499.97)	279.71	2.40 (1.24-3.52)	[illegible] (2.52-5.88)	68.81
Female	83.46 (40.03-146.03)	320.67 (180.70-493.02)	284.24	2.25 (1.08-3.91)	[illegible] (1.88-5.12)	49.56
Both	173.31 (104.61-250.63)	661.86 (423.10-933.46)	281.89	2.32 (1.40-3.39)	[illegible] (2.34-5.22)	58.71
Smoking						
Male	60.05 (31.00-92.21)	215.64 (125.04-325.16)	259.10	1.52 (0.79-2.35)	[illegible] (1.44-3.68)	63.05
Female	38.47 (16.74-70.51)	135.17 (71.15-222.16)	251.37	0.99 (0.44-1.80)	[illegible] (0.72-2.29)	39.87
Both	98.52 (56.73-144.71)	350.81 (205.70-514.87)	256.08	1.26 (0.73-1.84)	[illegible] (1.09-2.82)	50.83
Secondhand smoking						
Male	35.40 (12.48-60.40)	143.98 (52.67-241.44)	306.69	1.02 (0.37-1.76)	[illegible] (0.65-2.96)	73.70
Female	49.68 (16.07-97.51)	199.24 (74.84-338.96)	301.03	1.38 (0.47-2.58)	[illegible] (0.79-3.57)	53.42
Both	85.08 (30.02-145.39)	343.22 (128.33-559.19)	303.39	1.20 (0.44-2.01)	[illegible] (0.74-3.16)	63.59
All Neoplasms						
Tobacco						
Male	1458.30 (1139.03-1890.08)	2795.38 (2190.73-3628.29)	91.69	30.95 (24.06-39.91)	28.96 (22.83-37.32)	-6.44
Female	850.81 (606.63-1144.57)	1355.16 (979.14-1773.62)	59.28	19.39 (13.78-25.56)	12.94 (9.36-16.79)	-33.27

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Both	2309.11 (1829.24-2855.31)	4150.54 (3336.01-5024.85)	79.75	25.33 (20.13-31.34)	21.51 (16.50-24.68)	-19.00
Smoking						
Male	1250.10 (975.25-1649.62)	2401.44 (1848.26-3151.69)	92.10	27.08 (21.06-35.75)	22.14 (19.63-32.65)	-7.15
Female	720.15 (488.16-1000.56)	1097.67 (750.55-1488.11)	52.42	16.42 (11.15-22.30)	14.55 (7.22-14.28)	-35.75
Both	1970.25 (1545.76-2475.89)	3499.11 (2734.84-4290.12)	77.60	21.87 (17.21-27.66)	17.43 (13.68-21.32)	-20.30
Chewing tobacco	324.53 (221.95-453.10)	595.13 (412.87-782.12)	83.38	6.27 (4.33-8.66)	5.88 (4.11-7.71)	-6.16
Male	142.83 (98.54-201.01)	268.19 (194.01-356.27)	87.76	3.50 (2.47-4.87)	2.61 (1.89-3.45)	-25.46
Female	467.36 (351.24-609.37)	863.32 (664.09-1073.70)	84.72	4.94 (3.79-6.31)	4.18 (3.24-5.21)	-15.49
Both						
Secondhand smoking						
Male	21.07 (8.88-41.47)	41.08 (18.62-77.70)	95.01	0.45 (0.19-0.91)	0.42 (0.19-0.78)	-7.22
Female	34.30 (13.82-61.95)	71.29 (29.95-123.53)	107.84	0.71 (0.28-1.28)	0.61 (0.26-1.08)	-12.63
Both	55.37 (28.26-90.91)	112.37 (57.13-183.26)	102.96	0.58 (0.30-0.97)	0.49 (0.27-0.87)	-9.13
Non-communicable diseases						
Tobacco						
Male	9084.74 (7213.20-11113.09)	15843.57 (12712.23-18568.33)	74.40	218.16 (173.73-265.37)	173.88 (142.88-204.64)	-19.38
Female	5405.68 (4000.45-7169.95)	8479.47 (6562.76-10786.52)	56.86	142.34 (104.66-187.72)	88.99 (76.91-110.32)	-38.88
Both	14490.42 (12108.44-17315.76)	24323.04 (20523.48-28032.74)	67.86	180.75 (151.51-216.69)	128.54 (108.71-148.12)	-28.88
Smoking						
Male	8360.61 (6594.62-10279.50)	14278.19 (11397.99-16901.41)	70.78	201.54 (159.38-247.44)	159.02 (128.76-185.87)	-21.10
Female	4650.42 (3337.03-6281.82)	7178.97 (5429.79-9244.20)	54.37	123.38 (88.81-165.96)	71.07 (55.75-95.36)	-39.97
Both	13011.04 (10706.22-15734.95)	21457.17 (17836.70-25205.32)	64.92	162.93 (134.84-196.44)	114.74 (94.11-132.80)	-30.19
Chewing tobacco	324.53 (221.95-453.10)	595.13 (412.87-782.12)	83.38	6.27 (4.33-8.66)	5.88 (4.11-7.71)	-6.16
Male	142.83 (98.54-201.01)	268.19 (194.01-356.27)	87.76	3.50 (2.47-4.87)	2.61 (1.89-3.45)	-25.46
Female	467.36 (351.24-609.37)	863.32 (664.09-1073.70)	84.72	4.94 (3.79-6.31)	4.18 (3.24-5.21)	-15.49
Both						
Secondhand smoking						
Male	826.51 (544.18-1157.79)	1707.58 (1204.09-2298.64)	106.60	20.73 (13.44-29.41)	18.10 (13.45-25.79)	-7.84
Female	885.80 (562.91-1315.63)	1428.84 (955.94-2015.36)	61.31	23.01 (14.20-34.45)	14.46 (9.48-20.35)	-37.17
Both	1712.31 (1160.43-2406.58)	3136.42 (2218.91-4183.96)	83.17	21.88 (14.28-30.81)	16.64 (11.75-22.37)	-23.92
Tuberculosis						
Tobacco						
Male	1065.82 (611.69-1723.30)	533.34 (298.43-827.30)	-49.96	20.61 (11.78-33.64)	5.29 (2.98-8.12)	-74.34
Female	667.34 (210.36-1288.01)	267.93 (114.47-461.56)	-59.85	13.55 (4.08-27.10)	2.43 (1.04-4.25)	-82.06
Both	1733.16 (962.41-2696.31)	801.27 (445.52-1198.40)	-53.77	17.14 (9.42-27.10)	3.78 (2.13-5.69)	-77.94
Smoking						

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Male	1065.82 (611.69-1723.30)	533.34 (298.43-827.30)	-49.96	20.61 (11.78-33.64)	5.29 (2.98-8.12)	-74.34
Female	667.34 (210.36-1288.01)	267.93 (114.47-461.56)	-59.85	13.55 (4.08-27.10)	2.43 (1.04-4.25)	-82.06
Both	1733.16 (962.41-2696.31)	801.27 (445.52-1198.40)	-53.77	17.14 (9.42-27.10)	3.78 (2.13-5.69)	-77.94

Table 2. All-Age DALYs and Age Standardized DALYs for different diseases in different forms of tobacco and their percentage change in Nepal, 1990-2017

	All-Age DALYs, No. in Thousands (95% UI)			Age Standardized DALYs, Rate per 100,000 (95%UI)		
Subcategory	**1990**	**2017**	**change, %**	**1990**	**2017**	**Change, %**
All causes						
Tobacco						
Male	403665.07 (319794.17-512869.65)	446131.58 (364621.77-524648.21)	10.52	6479.90 (5370.92-7761.64)	4[illegible].77 (3503.41-4989.62)	-34.06
Female	280977.20 (205487.39-373383.63)	256300.53 (205568.71-316572.58)	-8.78	4417.82 (3434.48-5521.70)	2[illegible].71 (1807.00-2790.11)	-48.85
Both	684642.27 (538331.13-875950.09)	702432.11 (593052.53-812425.42)	2.60	5474.76 (4575.91-6509.77)	3[illegible].40 (2731.40-3706.93)	-41.25
Smoking						
Male	280385.51 (227328.27-345198.66)	387323.13 (314734.78-458240.78)	38.14	5460.34 (4494.44-6658.41)	376[illegible].43 (3080.63-4416.59)	-31.13
Female	153618.50 (116802.49-200154.70)	201074.00 (155098.74-253269.80)	30.89	3280.63 (2506.14-4233.47)	181[illegible].83 (1404.38-2286.84)	-44.71
Both	434004.01 (360694.99-523145.50)	588397.13 (487193.19-690655.02)	35.57	4397.13 (3669.32-5255.62)	273[illegible].68 (2284.27-3196.91)	-37.72
Chewing tobacco	9802.97 (6587.60-13907.45)	15546.94 (10681.34-20552.20)	58.59	168.65 (114.63-236.68)	1[illegible].37 (97.27-186.23)	-16.18
Male	3558.17 (2385.54-5110.57)	6011.17 (4233.98-8176.42)	68.94	73.41 (50.23-103.75)	[illegible].22 (37.00-70.13)	-28.87
Female	13361.13 (9934.89-17759.87)	21558.11 (16005.69-27194.58)	61.35	122.55 (91.82-159.88)	[illegible].91 (71.42-119.17)	-22.55
Both						
Secondhand smoking						
Male	125282.54 (64552.81-208075.08)	61759.15 (44109.97-84284.35)	-50.70	1086.43 (673.97-1635.96)	5[illegible].55 (390.79-739.73)	-49.42
Female	130921.51 (68925.95-212905.05)	58748.28 (40421.33-80159.30)	-55.13	1224.70 (741.83-1844.80)	4[illegible].98 (332.88-653.52)	-60.73
Both	256204.06 (133797.03-415607.64)	120507.43 (86416.83-162640.49)	-52.96	1154.42 (715.21-1723.62)	5[illegible].66 (368.38-681.62)	-55.51
Cardiovascular diseases						
Tobacco						
Male	106045.53 (82267.08-133672.18)	178781.72 (135047.16-220860.34)	68.59	1936.27 (1511.95-2423.60)	164[illegible].74 (1249.24-2025.45)	-14.90
Female	51596.75 (37925.85-69499.33)	68559.09 (51346.16-88568.29)	32.87	1031.71 (759.76-1395.12)	5[illegible].31 (436.90-754.23)	-43.46
Both	157642.28 (126776.05-193554.33)	247340.82 (194740.00-303138.58)	56.90	1496.61 (1211.38-1833.80)	108[illegible].61 (864.04-1335.54)	-27.06
Smoking						
Male	96619.66 (74256.90-122738.75)	159276.84 (119281.99-198937.41)	64.85	1764.47 (1368.64-2229.23)	146[illegible].62 (1100.22-1816.26)	-16.88
Female	42772.31 (30386.44-59660.41)	56949.09 (41194.34-75687.19)	33.14	866.98 (622.05-1191.46)	4[illegible].20 (350.81-645.50)	-43.81
Both	139391.98 (110502.77-173724.72)	216225.93 (167097.28-267200.96)	55.12	1328.36 (1051.46-1644.91)	95[illegible].25 (741.81-1176.85)	-28.09

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Secondhand smoking						
Male	13262.84 (9357.97-18103.45)	25748.76 (17829.80-34584.44)	94.14	239.06 (170.65-325.81)	247.07 (164.09-318.59)	-0.83
Female	11177.24 (7815.41-15454.67)	14258.69 (10012.59-19091.91)	27.57	209.45 (149.20-289.64)	117.97 (83.21-157.40)	-43.68
Both	24440.09 (18131.54-32553.33)	40007.45 (28671.94-52101.01)	63.70	224.55 (167.63-294.69)	174.52 (127.17-225.73)	-22.28
Diabetes						
Tobacco						
Male	6537.41 (4043.63-9355.31)	16371.62 (10553.78-22939.55)	150.43	122.02 (76.26-170.75)	155.45 (100.86-216.42)	27.40
Female	5137.20 (2824.43-7939.95)	13300.29 (7444.24-19447.89)	158.90	100.14 (56.08-152.06)	114.21 (65.15-166.66)	14.05
Both	11674.62 (7240.42-16558.61)	29671.92 (18547.14-41567.02)	154.16	111.38 (69.92-157.69)	133.85 (84.28-188.70)	20.17
Smoking						
Male	4392.28 (2637.49-6322.29)	10215.58 (6340.69-14596.02)	132.58	81.42 (48.91-117.42)	96.71 (60.36-139.06)	18.78
Female	2188.41 (1197.36-3496.51)	5142.53 (2903.20-7975.01)	134.99	44.00 (23.92-69.99)	45.15 (25.44-69.43)	2.61
Both	6580.70 (4055.51-9682.42)	15358.11 (9426.86-22203.75)	133.38	63.12 (39.32-92.22)	89.58 (42.63-100.74)	10.23
Secondhand smoking						
Male	2525.21 (955.13-4178.18)	7028.35 (2625.10-11459.51)	178.33	47.87 (18.20-78.84)	67.04 (24.88-109.93)	40.04
Female	3218.62 (1162.47-5459.71)	8689.48 (3316.27-13987.41)	169.98	61.56 (22.44-103.23)	78.72 (28.41-119.04)	19.75
Both	5743.83 (2138.89-9608.90)	15717.82 (5916.86-24952.45)	173.65	54.62 (20.91-90.45)	76.65 (26.68-113.48)	29.34
All Neoplasms						
Tobacco						
Male	38763.61 (30206.76-49414.72)	63597.51 (48418.72-82150.39)	64.06	719.64 (561.48-925.16)	599.10 (461.65-774.18)	-16.75
Female	22919.15 (16055.39-31167.33)	30615.38 (22087.11-40608.53)	33.58	449.04 (319.58-604.71)	264.74 (191.97-350.53)	-41.04
Both	61682.77 (48392.88-76293.78)	94212.89 (74227.14-114859.20)	52.74	588.97 (467.75-728.93)	424.87 (338.03-516.50)	-27.86
Smoking						
Male	32126.79 (24809.85-42129.01)	52760.17 (39959.53-69669.29)	64.22	608.89 (473.84-798.63)	501.77 (383.81-659.25)	-17.59
Female	19297.97 (12618.21-27388.48)	24084.51 (16609.46-32930.07)	24.80	379.46 (255.47-531.95)	210.28 (145.63-284.73)	-44.59
Both	51424.76 (40202.22-65087.14)	76844.68 (59707.14-94791.62)	49.43	498.15 (390.94-629.30)	349.81 (272.49-429.49)	-29.78
Chewing tobacco	9802.97 (6587.60-13907.45)	15546.94 (10681.34-20552.20)	58.59	168.65 (114.63-236.68)	141.37 (97.27-186.23)	-16.18
Male	3558.17 (2385.54-5110.57)	6011.17 (4233.98-8176.42)	68.94	73.41 (50.23-103.75)	52.22 (37.00-70.13)	-28.87
Female	13361.13 (9934.89-17759.87)	21558.11 (16005.69-27194.58)	61.35	122.55 (91.82-159.88)	94.91 (71.42-119.17)	-22.55
Both						
Secondhand smoking						
Male	551.75 (228.76-1067.50)	939.60 (427.81-1780.49)	70.29	10.32 (4.34-20.07)	8.81 (3.99-16.65)	-14.62
Female	1071.97 (442.54-1953.02)	2081.06 (870.79-3602.03)	94.13	19.02 (7.78-34.41)	16.60 (6.95-28.67)	-12.76
Both	1623.73 (810.67-2684.85)	3020.66 (1546.52-4853.92)	86.03	14.61 (7.44-23.91)	12.97 (6.68-20.93)	-11.21
Non-communicable diseases						

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Tobacco						
Male	258037.36 (208400.97-311823.54)	399996.94 (325615.15-473155.30)	55.02	5073.68 (4093.17-6082.55)	3863.03 (3172.91-4519.86)	-23.76
Female	149766.37 (113912.16-195422.04)	222238.88 (176225.32-276201.22)	48.39	3221.12 (2456.18-4144.06)	1981.52 (1586.27-2466.11)	-38.39
Both	407803.74 (341565.27-482686.51)	622235.82 (521551.91-724024.44)	52.58	4171.13 (3497.48-4911.28)	2888.23 (2423.63-3338.29)	-30.95
Smoking						
Male	235498.35 (188051.06-288093.77)	356411.43 (288822.06-421623.66)	51.34	4660.11 (3736.64-5631.05)	3463.52 (2818.29-4056.89)	-25.74
Female	125863.59 (93741.89-167530.95)	183252.98 (141279.02-232004.89)	45.60	2750.38 (2049.71-3589.87)	1651.40 (1277.75-2100.42)	-39.85
Both	361361.93 (297489.31-433996.59)	539664.42 (445211.65-635293.86)	49.34	3729.23 (3088.40-4466.96)	2511.85 (2093.96-2941.53)	-32.62
Chewing tobacco	9802.97 (6587.60-13907.45)	15546.94 (10681.34-20552.20)	58.59	168.65 (114.63-236.68)	141.37 (97.27-186.23)	-16.18
Male	3558.17 (2385.54-5110.57)	6011.17 (4233.98-8176.42)	68.94	73.41 (50.23-103.75)	52.22 (37.00-70.13)	-28.87
Female	13361.13 (9934.89-17759.87)	21558.11 (16005.69-27194.58)	61.35	122.55 (91.82-159.88)	94.91 (71.42-119.17)	-22.55
Both						
Secondhand smoking						
Male	24185.68 (16369.38-33055.50)	46057.83 (32953.64-60548.19)	90.43	472.79 (313.93-651.81)	440.77 (311.91-580.57)	-6.99
Female	27170.66 (17935.98-39583.53)	42147.61 (28847.28-57043.88)	55.12	551.53 (358.70-804.61)	361.85 (243.59-491.64)	-34.39
Both	51356.35 (35980.77-71788.94)	88205.44 (62908.63-115112.33)	71.75	511.51 (349.86-717.58)	400.22 (283.70-522.97)	-21.95
Tuberculosis						
Tobacco						
Male	34317.44 (19894.39-54836.53)	15474.57 (8686.80-23623.93)	-54.91	581.11 (338.60-930.65)	140.92 (80.10-214.54)	-75.75
Female	21064.12 (7035.82-39071.66)	7511.65 (3425.62-12761.83)	-64.34	374.51 (122.68-703.54)	62.02 (28.35-105.50)	-83.44
Both	55381.56 (31368.85-84009.28)	22986.22 (12814.67-33890.22)	-58.49	480.01 (273.37-734.23)	89.52 (55.66-146.98)	-79.27
Smoking						
Male	34317.44 (19894.39-54836.53)	15474.57 (8686.80-23623.93)	-54.91	581.11 (338.60-930.65)	140.92 (80.10-214.54)	-75.75
Female	21064.12 (7035.82-39071.66)	7511.65 (3425.62-12761.83)	-64.34	374.51 (122.68-703.54)	62.02 (28.35-105.50)	-83.44
Both	55381.56 (31368.85-84009.28)	22986.22 (12814.67-33890.22)	-58.49	480.01 (273.37-734.23)	89.52 (55.66-146.98)	-79.27

Figure 2 demonstrates a clear trend of the increasing rate of deaths and DALYs attributable to tobacco with an increase in age. From figure 3, it is apparent that NCDs are responsible for most deaths and disability attributable to tobacco use.

Cardiovascular diseases

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The attributable deaths from cardiovascular diseases at all ages due to tobacco increased (73.5%) from 5734 (95% UI 4645-7011) in 1990 to 9944 (95% UI 7888-12158) in 2017 in both sexes, with more deaths occurring from tobacco smoking. The DALY for all ages from cardiovascular diseases due to tobacco use increased (56.9%) from 157642 (95% UI 126776-193555) in 1990 to 247341 (95% UI 194740-303139) in 2017 in both sexes, with tobacco smoking the major cause of disability. Over the same time period, all ages deaths and DALYs from cardiovascular diseases showed rising trends in both sexes due to tobacco smoking and second-hand smoking. The age-standardized deaths from cardiovascular diseases showed falling trends in both sexes due to tobacco use (of all types), tobacco smoking, and in females due to second-hand smoking, while age-standardized deaths showed increasing trends in males from second-hand smoking. The age-standardized DALYs from cardiovascular diseases showed falling trends in both sexes due to tobacco use, tobacco smoking, and second-hand smoking.

Diabetes and kidney diseases

The attributable deaths at all ages from diabetes and kidney diseases due to tobacco increased (281.89%) from 173 (95% UI 105-251) in 1990 to 662 (95% UI 423-933) in 2017 in both sexes, with almost similar deaths occurring from tobacco smoking and second-hand smoking. The DALYs for all ages from diabetes and kidney diseases due to tobacco use increased (154.16%) from 11675 (95% UI 7240-16559) in 1990 to 29672 (95% UI 18547-41567) in 2017 in both sexes, with a disability resulting from smoking and second-hand smoking in similar manner. Over the same period, all age deaths and DALYs from diabetes and kidney diseases showed rising trends in both sexes due to tobacco smoking and second-hand smoking. Similarly, age-standardized deaths and DALYs from diabetes and kidney diseases showed rising trends in both sexes due to tobacco use, tobacco smoking, and second-hand smoking.

Neoplasms

The attributable deaths at all age deaths from all neoplasms due to tobacco increased (79.75%) from 2309 (95% UI 1829-2855) in 1990 to 4151 (95% UI 3336-5025) in 2017 in both sexes, with deaths occurring mostly from tobacco smoking. The DALYs for all ages from neoplasms due to tobacco increased (605.13%) from 61683 (95% UI 48393-76294) in 1990 to 94213 (95% UI 74227-114859) in 2017

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in both sexes, with a disability resulting mainly from tobacco smoking. Over the same period, all age deaths and all age DALYs from all neoplasms showed rising trends in both sexes due to tobacco smoking, chewing tobacco, and secondhand smoking. While, age-standardized deaths and age-standardized DALYs from all neoplasms showed falling trends in both sexes due to tobacco use, tobacco smoking, chewing tobacco, and secondhand smoking.

Non-communicable diseases

The attributable deaths at all ages from NCD due to tobacco use increased (86.94%) from 14490 (95% UI 12108-17316) in 1990 to 24323 (95% UI 20523-28033) in 2017 in both sexes, with deaths occurring mostly from tobacco smoking. The DALYs for all age from noncommunicable due to tobacco use increased (52.58%) from 407804 (95% UI 341565-482687) In 1990 to 622236 (95% UI 521552-724025) in 2017 in both sexes, with disability mostly resulting from smoking. Over the same period, all age deaths and all age DALYs from NCDs showed rising trends in both sexes due to tobacco smoking, second-hand smoking, and chewing tobaccowhile the age-standardized deaths and DALYs from NCDs showed falling trends in both sexes due to tobacco use, tobacco smoking, chewing tobacco, and second-hand smoking.

Tuberculosis

The attributable deaths at all ages from tuberculosis due to tobacco use decreased (53.77%) from 1733 (95% UI 962-2696) in 1990 to 801 (95% UI 446-1198) in 2017 in both sexes, with deaths occurring mostly from tobacco smoking. The DALYs for all age from noncommunicable due to tobacco use decreased (58.49%) from 55382 (95% UI 31369-84009) In 1990 to 22986 (95% UI 12815-33890) in 2017 in both sexes, with disability mostly resulting from smoking. Similarly, all age and age-standardized deaths and DALYs from tuberculosis showed falling trends in both sexes from tobacco use and tobacco smoking.

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Figure 2: Age-wise deaths (A) and DALYs (B) rates in all causes in both sexes attributable to tobacco, including all types, in 2017

Figure 3: All-age deaths (A) and DALYs (B) from different diseases attributable to tobacco use (including all types) in Nepal in 2017

DISCUSSION

Prevalence and patterns of tobacco use

The GBD study results indicate that throughout the time between 1990 and 2015, the prevalence of daily tobacco smoking in all ages significantly decreased by 15% in male (42% in 1990 and 27% in 2015), by 11% in female (24% in 1990 and 13% in 2015) and by 13% in the general population (33% in 1990 and 20% in 2015). On the other hand, the STEPS survey conducted in Nepal in 2019 showed no significant decrease in the prevalence of the overall use of tobacco in 2019 compared with 2013.[5] One reason for the decrease in the prevalence of daily tobacco use could be Nepal's implementation of WHO FCTC in 2006[13] and Tobacco Control and Regulatory Bill in 2011[5], which regulate the law of tobacco use in Nepal. In reviewing previous literature, it is evident that gender, geographical and socio-economic variation do play a role in observed difference in the pattern of tobacco use. In Nepal, the use of tobacco products is practiced extensively in the elderly population, males, people with lower education levels, rural areas, mountainous areas than in plain areas, and Far- and Mid-western regions than in Eastern, Central, and Western regions.[18] In addition to that, in Nepal, people in mountainous areas tend to smoke more while, people in plain areas tend to chew tobacco more.[18,19] Elderly people have different beliefs around tobacco use, like continuing tobacco does no harm, and stopping tobacco does not improve health status.[20] People who are less educated might have a lower level of awareness of the harmful hazards of tobacco use. However, in recent times, males of the young

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age group have high tobacco consumption.[6] A similar pattern of variation in tobacco use was noticed in the Southeast Asian population. The higher prevalence of smoking in males was observed in Asian countries like Malaysia, Philippines, Singapore, Vietnam, Indonesia, Maldives, and Bangladesh.[21,22] In these countries, gender seems to be an important determinant of the initiation of the smoking habit and for perpetuating it. Social norms and the prohibition of tobacco use can be one of the factors responsible for the lower prevalence of tobacco use in the female population in Southeast Asian countries.[23] Smokeless form of tobacco was common in countries like India, Nepal, Bangladesh, Maldives, and Cambodia.[22] Increasing age, poverty, and poor education were associated with higher consumption of tobacco in these countries.

Deaths and DALYs attributable to tobacco

Tobacco use was the second most common risk factor for deaths and the third most common risk factor for total DALY in Nepal in 2017.[24] In numbers, 14.73% (95% UI 12.52-16.58) of total deaths and 7.8% (95% UI 6.68-9.06) of total DALYs were attributed to tobacco use in 2017.[24] In between 1990 and 2017, the total deaths attributable to tobacco use, including any form, in all ages increased by 39% in the general population (both males and females) and DALYs attributable to tobacco use, including any form, in all ages increased by 11% males but decreased by 9% in females, with tobacco smoking having the most contribution. Also, in 2017 most of the tobacco attributable deaths were due to cardiovascular disease, diabetes, neoplasm, and kidney disease. Between 1990 and 2017 tobacco attributable disease occupied a larger proportion of cause of death in Nepal. In contrary to an overall decrease in the prevalence of tobacco use in both males and females in recent decades, the total deaths and DALYs were higher in 2017 compared with 1990. One plausible explanation for this pattern could the population growth in Nepal, 29 million in 2019 compared with 18.9 million in 1990.[25] The rising number of tobacco consumers despite the overall decrease in the prevalence of tobacco use can be attributed to population growth compared with 1990. Furthermore, the elderly population tends to have smoked for more decades considering they started consuming tobacco from an early age. Thus, they tend to have the highest exposure to tobacco which can support a fact that the mortality attributable to tobacco becomes evident usually after the two to three decades of tobacco use.[26] This evidence also explains the reason

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why there are increasing deaths and disabilities with an increase in age.[Fig. 2] Consequently, the deaths attributed to tobacco use may continue to rise in the long run despite the decrease in the prevalence of tobacco use.

Trends of different forms of tobacco

Smoking

In 2017, smoking was the second most common leading cause for death and third for risk attributable DALY in Nepal. Despite the decrease in the prevalence of smoking from 1990-2017, there was a considerable increase in the death and DALY attributed to tobacco.

Smokeless tobacco

It was evident from the results that, age-standardized rates of death and disability due to smokeless tobacco is in decreasing pattern, however, the absolute number of deaths and disabilities due to smokeless tobacco is in increasing pattern. In recent years in the Southeast Asia region, including Nepal, there is a clear increase in preference to using of smokeless tobacco over tobacco smoking, with a higher prevalence of smokeless tobacco in males.[6–8,27] Smokeless tobacco is associated with a higher risk of getting cancer[28] and cardiovascular risk factors like hypertension, metabolic syndrome, and cardiovascular events like acute coronary syndrome[29] than non-tobacco users, although less than tobacco smoking. The increased prevalence of smokeless tobacco in the Nepalese population and the potential increase in the risk of cancer associated with it might be the reason for the increase in disability rate from all neoplasms due to chewing tobacco. According to a study in Nepal, most of the consumers of smokeless tobacco are unaware of its harmful health hazards.[30] Studies have shown that smokers tend to perceive smokeless tobacco less harmful than smoking.[31] This belief might exist among smokers in Nepal and the extent of such beliefs needs to be explored in detail. The production of smokeless tobacco products is unhindered in Nepal and the increased import of smokeless form neighboring country, India made the products easily accessible all over the country.[30] And, owing to the government's lower taxation imposed on smokeless products compared with smoking tobacco products, smokeless tobacco products have an added affordability.[6] Tobacco products such as bidis and smokeless tobacco are perceived as "hard to tax" due to their more informal nature. Thus, all these factors with more emphasis of tobacco control policy on tobacco smoking over smokeless tobacco

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with lack of awareness towards the hazards of smokeless tobacco products seems to be the cause for shifting the preference of consumers from smoking to smokeless tobacco.

Second-hand smoking

The results indicate that the age-standardized rates of death among males due to cardiovascular diseases, age-standardized deaths and disability due to diabetes and kidney diseases in both sexes, attributable to second-hand smoking are the increasing pattern. At the global level, around 40% of children, 33% of male non-smokers, and 35% of female non-smokers are estimated to have been exposed to second-hand smoke regularly, with Southeast Asia and Western Pacific region accountable for 50% of the globe's total burden from second-hand smoke exposure.[32] Most of the deaths attributable to second-hand smoke occurred from ischaemic heart disease in adults and lower respiratory tract infections in children, women having the greatest burden among all. Most DALY lost secondary to second-hand smoke exposure occurred due to lower respiratory tract infections and ischemic heart diseases, children being the most affected ones.[32] In Nepal, public transports and restaurants are the major areas of second-hand smoke exposure in public places, while home and workplaces are indoor areas of second-hand smoke exposure.[5]

Policy related to tobacco in Nepal:

In response to the global tobacco epidemic, WHO launched a global public health treaty in 2003 named WHO framework convention on tobacco control (WHO FCTC).[33] Nepal signed the WHO FCTC in 2003 with the ratification of the treaty in 2006.[13] In 2008, to efficiently implement the FCTC, WHO launched the MPOWER policy to lower the tobacco demand in individual countries,[34] which was adopted by Nepal. The Parliament of Nepal passed the Tobacco Control and Regulatory Bill in 2011 incorporating the provisions of WHO FCTC which is currently the primary law that governs tobacco use. This act regulates the use of tobacco in public workplaces and public transport, advertisement and promotion of any kind of tobacco products, and packaging and labelling of tobacco products. However, the question that arises is how effective the law is, and how effective we have been in protecting people from tobacco use,

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tobacco-related deaths, and disability. The decreasing trends in the prevalence of tobacco use and age-standardized deaths and DALYs attributable to tobacco suggest that tobacco control has been effective so far. Nepal received a Bloomberg Philanthropies Award for Global Tobacco Control in 2015 for its work in control and reduction of tobacco products use by warning people about the hazards of tobacco use.[35] The tobacco act has emphasized more on packaging and promotion to abate the consumption of tobacco products. In the STEPS survey conducted in 2019, 75.7% of adults noticed health warnings on tobacco packages and 44.8% of current users thought of quitting because of such warning. However, the tobacco act is limited by lack of knowledge on the implementation of regulations in public places and around the educational hubs. Though the control of tobacco use in Nepal appears well in the last few decades, the progress seems static in recent times. The STEPs survey conducted in Nepal in 2019 showed only a mild drop in the prevalence of former smokers or former smokeless tobacco users in comparison to 2013.[5] Tobacco control, not only contributes to improving the health of its consumers but also is very important for the economic development. On average, the average amount of money spent per year on cigarettes is around 11% of GDP per capita.[5]

Limitations of study

There are a few limitations to the study. First, we took the data from the Global Burden of Disease database. Hence, the limitations pertaining to the data elsewhere in the literature also apply to our study. Second, the prevalence of smoking could have been underestimated as the GBD data only takes into account the prevalence of daily smoking and lacked the data for the prevalence of smokeless tobacco and second-hand exposure. This could have resulted in an underestimation of overall prevalence.

CONCLUSIONS

This study is one of the first studies in Nepal to show the effect of using tobacco on mortality and DALY. Despite the prevalence of tobacco smoking decreasing in the time between 1990 and 2015, there was a more than one-third increase in mortality and a 3% increase in DALY. Most deaths and disabilities attributable to tobacco use were NCDs. There is a huge increase in deaths and DALY due to

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chewing tobacco from 1990 to 2017. Despite Nepal's government commitment to the FCTC, there is still much that needs to be done for effective control of tobacco use in Nepal. Awareness and control strategies should focus on all forms of tobacco including second-hand exposure.

Conflict of interest

The authors declared that they have no conflict of interest.

Contributorship statement

Gambhir Shrestha: Conceptualization, Methodology, Software, Formal analysis, Supervision, Writing-Original draft preparation.

Prabin Phuyal: Software, Formal analysis, Visualization, Writing-Original draft preparation.

Rabin Gautam: Conceptualization, Methodology, Software, Formal analysis, Writing-Original draft preparation.

Rashmi Mulmi: Conceptualization, Visualization, Writing-Reviewing and Editing.

Pranil Man Singh Pradhan: Methodology, Visualization, Writing-Reviewing and Editing.

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Data sharing statement

The data used in this study is freely available from The Institute for Health Metrics and Evaluation (IHME)'s Global Burden of Disease (GBD) database.

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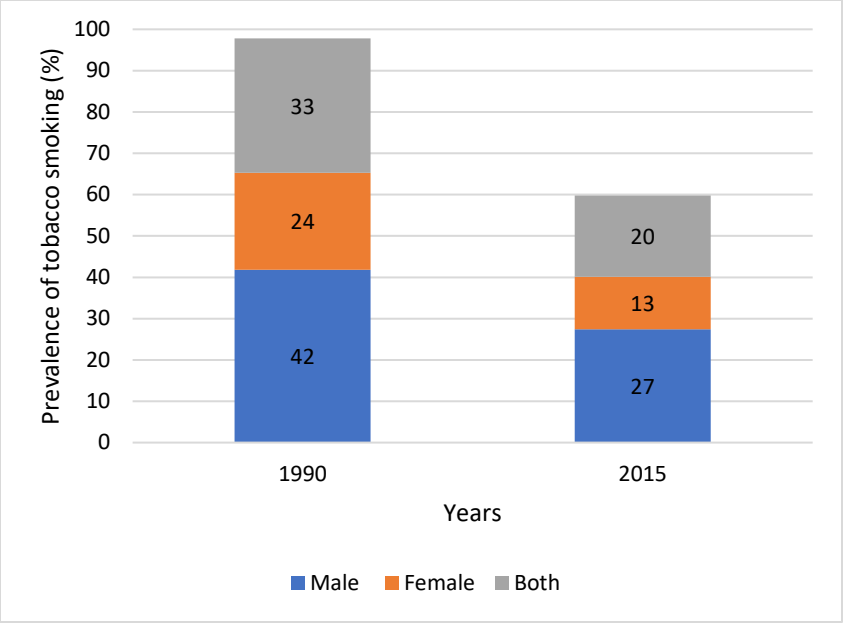

Figure 1: Prevalence of smoking from the year 1990 to 2015 for Nepal

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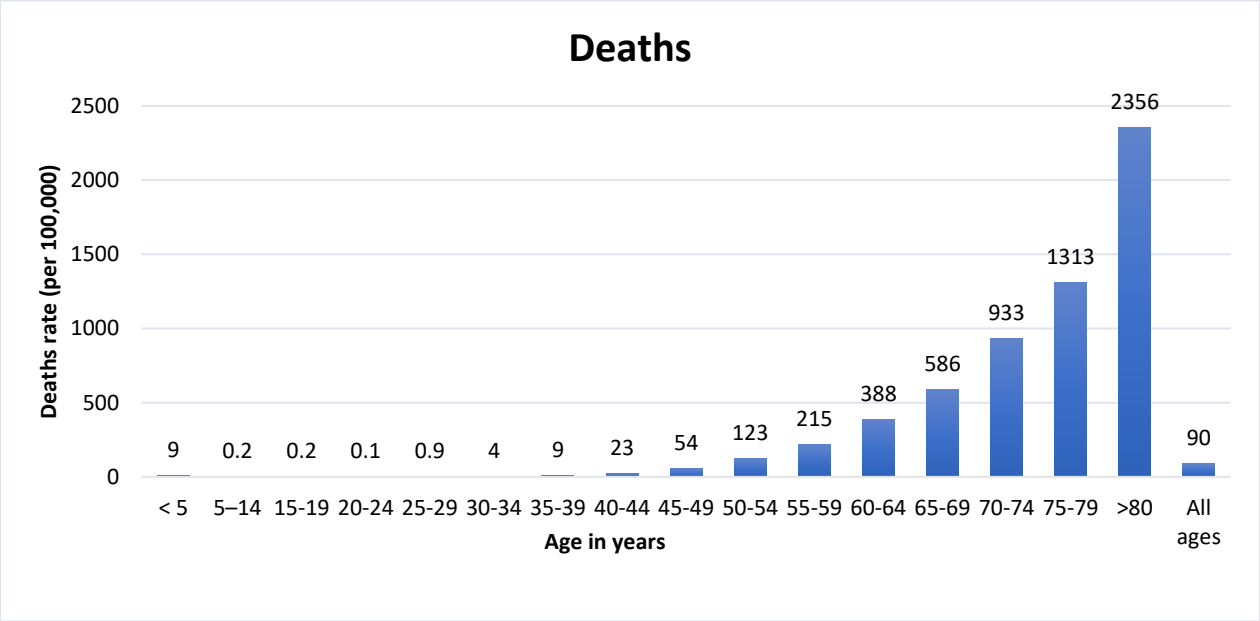
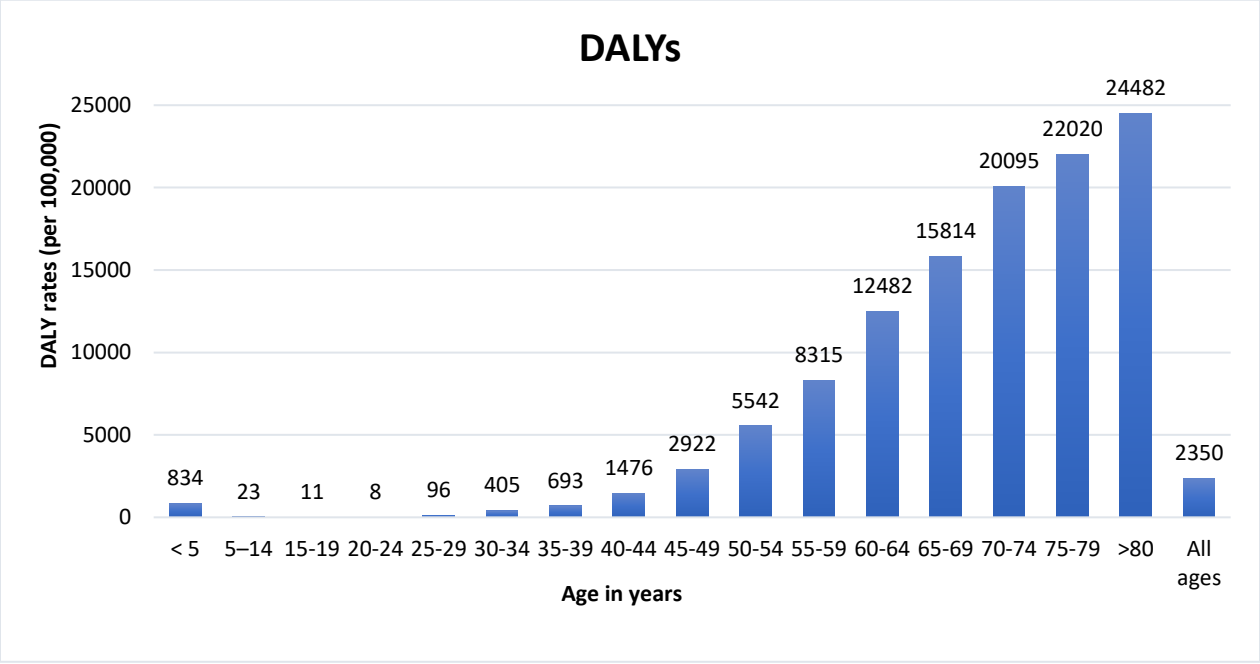


A



B

Figure 2: Age-wise deaths (A) and DALYs (B) rates in all causes in both sexes attributable to tobacco, including all types, in 2017

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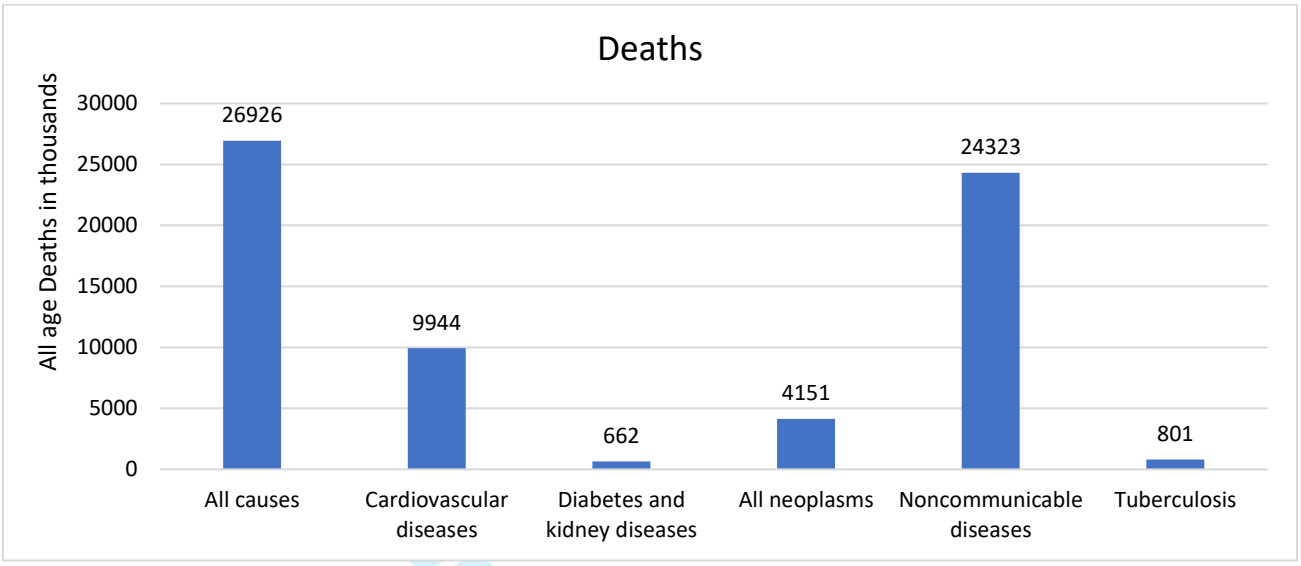

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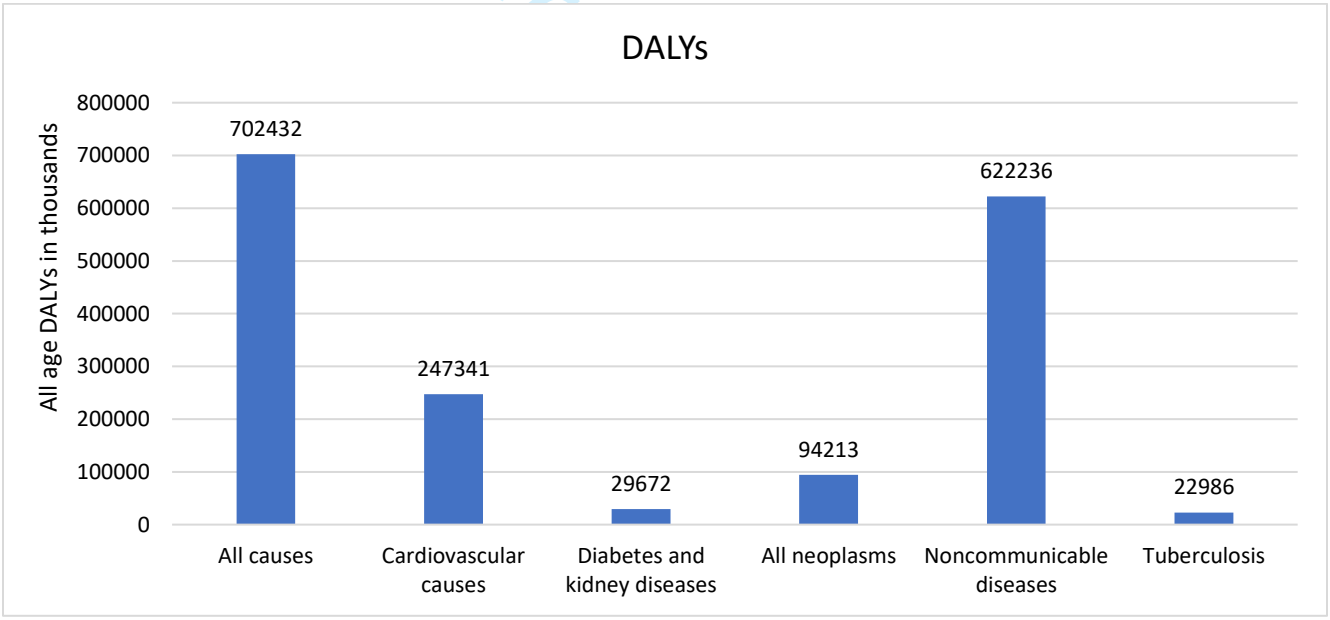

B

Figure 3: All-age deaths (A) and DALYs (B) from different diseases attributable to tobacco use (including all types) in Nepal in 2017

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Depression among Inmates in a Regional Prison of Eastern Nepal: A Cross-Sectional Study

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Please insert check where included or N/A where not applicable
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	√
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	√
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	√
Objectives	3	State specific objectives, including any prespecified hypotheses	√
Methods			
Study design	4	Present key elements of study design early in the paper	√
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	√
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	**NA**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	√
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	√
Bias	9	Describe any efforts to address potential sources of bias	√
Study size	10	Explain how the study size was arrived at	√
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	√
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	√
		(*b*) Describe any methods used to examine subgroups and interactions	√
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	√
		(b) Give reasons for non-participation at each stage	**NA**
		(c) Consider use of a flow diagram	**-**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	√

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		(b) Indicate number of participants with missing data for each variable of interest	√
Outcome data	15*	Report numbers of outcome events or summary measures	√
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	√
		(*b*) Report category boundaries when continuous variables were categorized	-
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	√
Discussion			
Key results	18	Summarise key results with reference to study objectives	√
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	√
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	√
Generalisability	21	Discuss the generalisability (external validity) of the study results	√
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	√

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BMJ Open

The burden of tobacco in Nepal: a systematic analysis from the Global Burden of Disease Study 1990-2017

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Primary Subject Heading:	Public health
Secondary Subject Heading:	Epidemiology, Smoking and tobacco
Keywords:	EPIDEMIOLOGY, Epidemiology < ONCOLOGY, PREVENTIVE MEDICINE

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The burden of tobacco in Nepal: a systematic analysis from the Global Burden of Disease Study 1990-2017

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Abstract

Objective: This study attempts to systematically review the data extracted from the global burden disease study and set out to assess the age-sex-specific mortality and disability attributable to different forms of tobacco from 1990 to 2017, for Nepal.

Design: This cross-sectional study extracted data from the Institute for Health Metrics and Evaluation's Global Burden of Disease database, then was quantitatively analyzed to show the trends and patterns of prevalence of tobacco use, deaths and DALYs attributable to tobacco use from different diseases from the year 1990 to 2017 in Nepal.

Setting: Nepal.

Results: In between 1990 and 2015, the age-standardized prevalence of daily tobacco smoking decreased by 33% in males, 48% in females, and 28% in both. By 2017, the age-standardized mortality rate and DALYs attributable to tobacco use, including any form, decreased by 34% and 41% respectively, with tobacco smoking having the most contribution. However, the absolute number of deaths and DALYs increased by 39% and 3% respectively. An increasing rate of deaths and DALYs attributable to tobacco was noted with an increase in age. Non-communicable diseases were responsible for most deaths and disabilities attributable to tobacco use.

Conclusion: The prevalence of smoking along with the age-standardized mortality rate and DALYs shows a decreasing trend. However, attention should be made to implement a strong plan to control all forms of tobacco including second-hand exposure.

Keywords: tobacco; global burden of diseases; Nepal; DALY.

Strengths and limitations of this study

- This study is one of the first studies in Nepal to extracts Global Burden of Disease Study data to present nationally representative data on mortality and disability attributable to tobacco by age, sex, and disease.

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- This study informs the policymakers on further strategies to control tobacco use including second-hand smoking.
- This study analyses the secondary data of the Global Burden of Disease Study and hence it has all the limitations pertaining to the data.
- The prevalence of smoking could have been underestimated as the Global Burden of Disease data mainly takes into account the prevalence of daily smoking and lacked the data for the prevalence of smokeless tobacco and second-hand exposure.

INTRODUCTION

To date, tobacco remains a major public health issue worldwide because of its associated high morbidity and mortality rate. Any forms of tobacco use are harmful to health and kill millions of people every year.[1] The use of tobacco products in any form either smoking or smokeless or exposure to second-hand smoke has been implicated in many health issues like cardiovascular diseases, respiratory diseases, cancers, non-communicable diseases (NCD), and many more.[2,3] There is no safety margin for exposure to second-hand smoke or tobacco smoking and second-hand smoke exposure is equally harmful to health.

According to the World Health Organization (WHO), about 1.3 billion people in the world used tobacco products among which more than one billion people were smokers.[4] Almost 80% of smokers reside in low- and middle-income countries. The last two decades have seen a decreasing trend towards the consumption of tobacco in all age groups. In 2000, almost one-third of the world's population (33.3%) aged 15 and more used some form of tobacco products, 50% in males and 16.7% in females. While in 2015, the prevalence of tobacco use dropped to nearly a quarter of the world's population (24.9%), 40.3% in males and 9.5% in females.[1] Despite the decreasing prevalence of tobacco use globally, the absolute number of male smokers is growing continuously in South-East Asian, African, and Eastern Mediterranean regions. The South-East Asian region has the highest prevalence of tobacco use (31% in 2015) compared with other regions, 49.4% in males and 12.9% in females.[1] According to recent findings from STEPS survey 2019 in Nepal, around 29% of adults (48% male and 12% female) within the age group 15-69 years used any form of tobacco.[5] In recent times, people have shown a

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growing preference for smokeless tobacco over smoking in South-East Asia including Nepal.[6–8] In Nepal, the use of smokeless tobacco is much more common than tobacco smoking and is more prevalent among males (33%) compared with females (5%).[5]

Despite decreasing prevalence, the number of deaths due to tobacco use continues to rise. Tobacco kills more than 8 million people every year. Among them, about 7 million people die from direct tobacco use while the deaths of about 1 million people result from second-hand smoke exposure.[4] In 2015, smoking alone was responsible for 11.5% and 6% of global death and disability-adjusted life years (DALYs) respectively.[9] Deaths of about 65,000 children per year can be attributed to exposure to second-hand smoke.[4] The recent estimates show around US$ 1.4 trillion of total economic loss results globally from tobacco use which is equivalent to 1.8% of the world's annual GDP.[10] About 40% of this cost occurred in developing countries. In Nepal, around 27 thousand deaths occur annually from tobacco use, which comprises about 14.9% of all deaths.[11]

Given such a significant negative impact of tobacco on public health, navigation of the outcomes of tobacco use in a low-income country like Nepal is of the essence. The issue of tobacco usage has received considerable attention. In response, Nepal implemented the WHO Framework Convention on Tobacco Control in 2006[12] and passed Tobacco Control and Regulatory Bill in 2011 by Parliament[5]. So far, however, there has been little discussion about trends and patterns of tobacco use and its outcomes in Nepal. Such approaches have an unsatisfactory description of the burden of tobacco in the Nepalese population. This study systematically reviews the data extracted from the global burden disease study 2017 and sets out to assess the trends in prevalence, mortality, and disability attributable to different forms of tobacco in Nepal from 1990 to 2017. Therefore, the findings of this study will make a major contribution informing the policymakers and public health professionals by providing important insights into evidence for an effective tobacco control program in Nepal.

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METHODS

Data sources and study settings

The global burden of disease (GBD) study 2017 was a comprehensive epidemiological study that reported the trends and patterns in morbidity and mortality in 195 countries from major injuries, diseases, and risk factors to health at the global, regional and national level. The study design, metrics, and analysis are published elsewhere.[13] The Institute for Health Metrics and Evaluation (IHME) coordinated the GBD study 2017 and used the data from several published and unpublished literature, survey and surveillance data, hospital and clinics data to estimates the deaths and disability attributable to 84 risk factors for 195 countries by age and sex.[13,14]

The Nepal GBD 2017 study utilized data from over 90,000 sources covering the years between 1990 and 2017. These data sources included in Nepal's burden of disease estimates mainly data from the 1971–2011 Nepal Population and Housing Census, disease registries such as the Kidney Disease Data Centre maintained by the International Society of Nephropathy, epidemiological surveillance such as the WHO Disease Observatory, periodic and ad hoc large household surveys such as Nepal Demographic Health Surveys, Multiple Indicator Cluster Surveys (MICS), and Nepal STEPS Non-Communicable Risk Factor Surveys, Nepal Global Youth Tobacco Survey, Nepal Behavioral Surveillance Survey, Nepal Hospital Inpatient Discharges Record, Health Management Information System (HMIS), published scientific literature, reports, and administrative records.[15]

The GBD database was used for the extraction of data related to mortality and DALYs of all causes and other major public health issues of Nepal like cardiovascular diseases, NCDs, diabetes, and kidney disease, all neoplasms including benign and malignant, and tuberculosis from the year 1990 to 2017.[16]

Patient and public involvement statement

This study used the data freely available from The Institute for Health Metrics and Evaluation (IHME)'s GBD database. Patients were not involved in the design, recruitment, or conduct of the study. Results of this study will be made publicly available through publication.

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Definition of terminology

Years of life lost (YLLs) are calculated by multiplying the number of deaths at each age by a standard life expectancy at that age. Years lived with disability (YLDs) is the number of years of life lived with health loss weighted by the severity of the disabling sequelae of diseases and injuries. DALY is the key summary measure of population health used in GBD to quantify health loss which allows comparison of health loss across different diseases and injuries. They are a measure of the number of years of healthy life that are lost due to death, nonfatal illness, or impairment, and thus, they are calculated as the sum of YLLs and YLDs.[14,17]

Uncertainty interval (UI) is a range of values that is likely to include the correct estimate of disease burden for a given cause. Narrow uncertainty intervals indicate that evidence is strong, while wide uncertainty intervals show that evidence is weaker.[14,17]

The term tobacco includes tobacco use in all forms either smoking or smokeless or both.

Statistical analysis

The extracted data from IHME were imported into Microsoft Excel, then were quantitatively analyzed and presented in the graphical, tabular forms and histograms to show the trends and patterns in age-sex-specific mortality and DALYs in Nepal. The age-standardized prevalence of tobacco use only in form of daily tobacco smoking was available up to the year 2015. A percentage change was calculated to present the difference in mortality and DALYs between 1990 and 2017. An uncertainty interval of 95% was presented to show the strength of the estimates.

RESULTS

Here we report the GBD study results for Nepal on the prevalence of tobacco use, mortality, and burden caused by different forms of tobacco, smoking, and smokeless tobacco, between 1990 and 2017.

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Tobacco smoking

The trend of daily tobacco smoking is in decreasing trend during the period 1990 to 2015 in both sexes. In 1990, the age-standardized prevalence of tobacco smoking at all ages was 27.5% for both sexes. The prevalence was more for males (35.6%) than the females (19.8%). In 2015, the prevalence of tobacco smoking decreased to 19.7% in both sexes at all ages, with male 23.7% and female 10.3% [Figure 1].

Figure 1: Prevalence of smoking from the year 1990 to 2015 in Nepal

Deaths and DALYs

In Nepal, both the age-standardized mortality rate and the DALYs attributable to tobacco are in decreasing trend from 1990 to 2017 [Figure 2]. The age-standardized attributable deaths to tobacco use, including all forms, decreased (34.5%) in the general population from 216 (95% UI 183-258) per 100,000 in 1990 to 141 (95% UI 120-163) per 100,000 in 2017. While DALYs decreased by 41.3% from 5474 per 100,000 in 1990 to 3216 per 100,000 in 2017. This finding was found in both males and females. Similarly, over the same time, the age-standardized deaths and DALYs attributable to tobacco smoking, chewing tobacco, second-hand smoking, showed a falling trend for both sexes and males and females separately [Table 1]. In absolute terms, the attributable deaths at all ages to tobacco use, including all forms, increased (38.99%) in the general population (both male and female) from 19372 (95% UI 16060-23310) in 1990 to 26926 (95% UI 22826-31135) in 2017. While DALYs for all ages due to tobacco use increased (10.52%) in males from 403665 (95% UI 319794-512870) in 1990 to 446132 (95% UI 364622-524648) in 2017, it decreased (8.78%) in females from 280977 (95% UI 205487-373384) in 1990 to 256301 (95% UI 205569-316573) in 2017 [Supplementary Table 1].

Figure 2: Trend of age-standardized mortality rate and DALYs attributable to tobacco from 1990-2017 in Nepal

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Table 1. Age-standardized deaths and DALYs for different diseases attributable to tobacco and their percentage change in Nepal, 1990-2017

Subcategory	Age-Standardized Deaths, in Rates per 100,000 (95%UI)			Age Standardized DALYs, in Rate per 100,000 (95%UI)		
	1990	2017	change, %	1990	2017	Change, %
All causes						
Tobacco						
Male	258.31 (210.40-311.96)	192.61 (157.59-222.97)	-25.44	6479.90 (5370.92-7761.64)	4273.77 (3503.41-4989.62)	-34.06
Female	173.77 (132.36-221.72)	97.55 (76.10-122.53)	-43.86	4417.82 (3434.48-5521.70)	2261.71 (1807.00-2790.11)	-48.85
Both	216.59 (183.28-258.18)	141.95 (120.86-163.38)	-34.46	5474.76 (4575.91-6509.77)	3216.40 (2731.40-3706.93)	-41.25
Smoking						
Male	233.81 (188.33-287.71)	173.70 (140.69-202.11)	-25.71	5460.34 (4494.44-6658.41)	3760.43 (3080.63-4416.59)	-31.13
Female	145.70 (107.91-191.96)	82.34 (62.37-105.36)	-43.49	3280.63 (2506.14-4233.47)	1809.83 (1404.38-2286.84)	-44.71
Both	190.28 (157.79-229.81)	124.98 (104.95-145.25)	-34.32	4397.13 (3669.32-5255.62)	2741.68 (2284.27-3196.91)	-37.72
Chewing tobacco	6.27 (4.33-8.66)	5.88 (4.11-7.71)	-6.16	168.65 (114.63-236.68)	141.37 (97.27-186.23)	-16.18
Male	3.50 (2.47-4.87)	2.61 (1.89-3.45)	-25.46	73.41 (50.23-103.75)	52.22 (37.00-70.13)	-28.87
Female	4.94 (3.79-6.31)	4.18 (3.24-5.21)	-15.49	122.55 (91.82-159.88)	95.91 (71.42-119.17)	-22.55
Both						
Secondhand smoking						
Male	29.06 (19.32-41.14)	21.46 (15.18-28.93)	-26.17	1086.43 (673.97-1635.96)	548.55 (390.79-739.73)	-49.42
Female	32.52 (20.82-48.22)	16.96 (11.54-23.68)	-47.84	1224.70 (741.83-1844.80)	489.98 (332.88-653.52)	-60.73
Both	30.79 (20.61-43.63)	19.07 (13.58-25.41)	-38.06	1154.42 (715.21-1723.62)	518.66 (368.38-681.62)	-55.51
Cardiovascular diseases						
Tobacco						
Male	79.77 (62.88-100.16)	72.14 (55.43-87.12)	-9.56	1936.27 (1511.95-2423.60)	1647.74 (1249.24-2025.45)	-14.90
Female	44.72 (32.51-60.62)	25.56 (18.65-33.50)	-42.84	1031.71 (759.76-1395.12)	552.31 (436.90-754.23)	-43.46
Both	62.60 (50.60-76.99)	47.59 (37.76-58.00)	-23.99	1496.61 (1211.38-1833.80)	1091.61 (864.04-1335.54)	-27.06
Smoking						
Male	72.05 (56.17-91.65)	63.81 (48.14-78.29)	-11.43	1764.47 (1368.64-2229.23)	1468.62 (1100.22-1816.26)	-16.88
Female	37.58 (26.31-52.83)	21.28 (15.00-28.47)	-43.37	866.98 (622.05-1191.46)	487.20 (350.81-645.50)	-43.81
Both	55.18 (43.64-69.61)	41.42 (32.17-50.97)	-24.94	1328.36 (1051.46-1644.91)	952.25 (741.81-1176.85)	-28.09
Secondhand smoking						
Male	10.33 (7.50-13.98)	10.55 (7.71-13.79)	2.12	239.06 (170.65-325.81)	237.07 (164.09-318.59)	-0.83
Female	8.93 (6.42-12.28)	5.15 (3.72-6.88)	-42.30	209.45 (149.20-289.64)	117.97 (83.21-157.40)	-43.68
Both	9.63 (7.30-12.52)	7.68 (5.71-9.91)	-20.28	224.55 (167.63-294.69)	174.52 (127.17-225.73)	-22.28
Diabetes and kidney diseases						
Tobacco						

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Male	2.40 (1.24-3.52)	4.04 (2.52-5.88)	68.81	122.02 (76.26-170.75)	17[illegible].45 (100.86-216.42)	27.40
Female	2.25 (1.08-3.91)	3.36 (1.88-5.12)	49.56	100.14 (56.08-152.06)	11[illegible].21 (65.15-166.66)	14.05
Both	2.32 (1.40-3.39)	3.68 (2.34-5.22)	58.71	111.38 (69.92-157.69)	15[illegible].85 (84.28-188.70)	20.17
Smoking						
Male	1.52 (0.79-2.35)	2.49 (1.44-3.68)	63.05	81.42 (48.91-117.42)	9[illegible].71 (60.36-139.06)	18.78
Female	0.99 (0.44-1.80)	1.39 (0.72-2.29)	39.87	44.00 (23.92-69.99)	[illegible]5.15 (25.44-69.43)	2.61
Both	1.26 (0.73-1.84)	1.90 (1.09-2.82)	50.83	63.12 (39.32-92.22)	[illegible].58 (42.63-100.74)	10.23
Secondhand smoking						
Male	1.02 (0.37-1.76)	1.78 (0.65-2.96)	73.70	47.87 (18.20-78.84)	[illegible].04 (24.88-109.93)	40.04
Female	1.38 (0.47-2.58)	2.12 (0.79-3.57)	53.42	61.56 (22.44-103.23)	[illegible].72 (28.41-119.04)	19.75
Both	1.20 (0.44-2.01)	1.96 (0.74-3.16)	63.59	54.62 (20.91-90.45)	[illegible].65 (26.68-113.48)	29.34
All Neoplasms						
Tobacco						
Male	30.95 (24.06-39.91)	28.96 (22.83-37.32)	-6.44	719.64 (561.48-925.16)	[illegible].10 (461.65-774.18)	-16.75
Female	19.39 (13.78-25.56)	12.94 (9.36-16.79)	-33.27	449.04 (319.58-604.71)	[illegible].74 (191.97-350.53)	-41.04
Both	25.33 (20.13-31.34)	20.51 (16.50-24.68)	-19.00	588.97 (467.75-728.93)	[illegible].87 (338.03-516.50)	-27.86
Smoking						
Male	27.08 (21.06-35.75)	25.14 (19.63-32.65)	-7.15	608.89 (473.84-798.63)	[illegible].77 (383.81-659.25)	-17.59
Female	16.42 (11.15-22.30)	10.55 (7.22-14.28)	-35.75	379.46 (255.47-531.95)	[illegible].28 (145.63-284.73)	-44.59
Both	21.87 (17.21-27.66)	17.43 (13.68-21.32)	-20.30	498.15 (390.94-629.30)	[illegible].81 (272.49-429.49)	-29.78
Chewing tobacco	6.27 (4.33-8.66)	5.88 (4.11-7.71)	-6.16	168.65 (114.63-236.68)	[illegible].37 (97.27-186.23)	-16.18
Male	3.50 (2.47-4.87)	2.61 (1.89-3.45)	-25.46	73.41 (50.23-103.75)	[illegible].22 (37.00-70.13)	-28.87
Female	4.94 (3.79-6.31)	4.18 (3.24-5.21)	-15.49	122.55 (91.82-159.88)	[illegible].91 (71.42-119.17)	-22.55
Both						
Secondhand smoking						
Male	0.45 (0.19-0.91)	0.42 (0.19-0.78)	-7.22	10.32 (4.34-20.07)	[illegible].81 (3.99-16.65)	-14.62
Female	0.71 (0.28-1.28)	0.62 (0.26-1.08)	-12.63	19.02 (7.78-34.41)	[illegible].60 (6.95-28.67)	-12.76
Both	0.58 (0.30-0.97)	0.53 (0.27-0.87)	-9.13	14.61 (7.44-23.91)	[illegible].97 (6.68-20.93)	-11.21
Non-communicable diseases						
Tobacco						
Male	218.16 (173.73-265.37)	175.89 (142.88-204.64)	-19.38	5073.68 (4093.17-6082.55)	[illegible]03 (3172.91-4519.86)	-23.76
Female	142.34 (104.66-187.72)	86.99 (66.91-110.32)	-38.88	3221.12 (2456.18-4144.06)	[illegible].52 (1586.27-2466.11)	-38.39
Both	180.75 (151.51-216.69)	128.54 (108.71-148.12)	-28.88	4171.13 (3497.48-4911.28)	[illegible].23 (2423.63-3338.29)	-30.95
Smoking						
Male	201.54 (159.38-247.44)	159.02 (128.76-185.87)	-21.10	4660.11 (3736.64-5631.05)	[illegible].52 (2818.29-4056.89)	-25.74
Female	123.38 (88.81-165.96)	74.07 (55.75-95.36)	-39.97	2750.38 (2049.71-3589.87)	[illegible].40 (1277.75-2100.42)	-39.85
Both	162.93 (134.84-196.44)	113.74 (94.11-132.80)	-30.19	3729.23 (3088.40-4466.96)	[illegible]85 (2093.96-2941.53)	-32.62
Chewing tobacco	6.27 (4.33-8.66)	5.88 (4.11-7.71)	-6.16	168.65 (114.63-236.68)	[illegible].37 (97.27-186.23)	-16.18

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Male	3.50 (2.47-4.87)	2.61 (1.89-3.45)	-25.46	73.41 (50.23-103.75)	52.22 (37.00-70.13)	-28.87
Female	4.94 (3.79-6.31)	4.18 (3.24-5.21)	-15.49	122.55 (91.82-159.88)	94.91 (71.42-119.17)	-22.55
Both						
Secondhand smoking						
Male	20.73 (13.44-29.41)	19.10 (13.45-25.79)	-7.84	472.79 (313.93-651.81)	439.77 (311.91-580.57)	-6.99
Female	23.01 (14.20-34.45)	14.46 (9.48-20.35)	-37.17	551.53 (358.70-804.61)	361.85 (243.59-491.64)	-34.39
Both	21.88 (14.28-30.81)	16.64 (11.75-22.37)	-23.92	511.51 (349.86-717.58)	399.22 (283.70-522.97)	-21.95
Tuberculosis						
Tobacco						
Male	20.61 (11.78-33.64)	5.29 (2.98-8.12)	-74.34	581.11 (338.60-930.65)	140.92 (80.10-214.54)	-75.75
Female	13.55 (4.08-27.10)	2.43 (1.04-4.25)	-82.06	374.51 (122.68-703.54)	64.02 (28.35-105.50)	-83.44
Both	17.14 (9.42-27.10)	3.78 (2.13-5.69)	-77.94	480.01 (273.37-734.23)	102.52 (55.66-146.98)	-79.27
Smoking						
Male	20.61 (11.78-33.64)	5.29 (2.98-8.12)	-74.34	581.11 (338.60-930.65)	140.92 (80.10-214.54)	-75.75
Female	13.55 (4.08-27.10)	2.43 (1.04-4.25)	-82.06	374.51 (122.68-703.54)	64.02 (28.35-105.50)	-83.44
Both	17.14 (9.42-27.10)	3.78 (2.13-5.69)	-77.94	480.01 (273.37-734.23)	102.52 (55.66-146.98)	-79.27

Figure 3 demonstrates a clear trend of the increasing rate of deaths and DALYs attributable to tobacco with an increase in age. Around 27,000 deaths are attributable to tobacco comprising of 90% deaths due to NCDs. Similarly, more than 702,000 DALYs were attributable to tobacco use comprising 89% DALYs for NCDs [Figure 4].

Figure 3: Age-wise deaths (A) and DALYs (B) rates in all causes in both sexes attributable to tobacco, including all types, in 2017

Figure 4: All-age deaths (A) and DALYs (B) from different diseases attributable to tobacco use (including all types) in Nepal in 2017

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47

Cardiovascular diseases

The age-standardized deaths from cardiovascular diseases showed falling trends in both sexes due to tobacco use (of all types), tobacco smoking, and in females due to second-hand smoking, while age-standardized deaths showed increasing trends in males from second-hand smoking. The age-standardized DALYs from cardiovascular diseases showed falling trends in both sexes due to tobacco use, tobacco smoking, and second-hand smoking. The major cause of deaths and DALY in cardiovascular disease attributable to tobacco was found to be smoking.

Diabetes and kidney diseases

The attributable deaths and DALYs from diabetes and kidney diseases showed rising trends in both sexes due to tobacco smoking and second-hand smoking in both sexes.

Neoplasms

The age-standardized deaths and age-standardized DALYs from all neoplasms showed falling trends in both sexes due to tobacco use, tobacco smoking, chewing tobacco, and secondhand smoking.

Non-communicable diseases

The attributable age-standardized death from NCD due to tobacco use decreased (29%) from 180 (95% UI 215-216) in 1990 to 128 (95% UI 108-148) in 2017 in both sexes, with deaths occurring mostly from tobacco smoking. The DALYs also decreased by 31%from 4171 (95% UI 3197-4911) in 1990 to 2880 (95% UI 2423-3338) in 2017 in both sexes, with disability mostly resulting from smoking. Over the same period, deaths and DALYs from NCDs showed decreasing trends in both sexes due to tobacco smoking, second-hand smoking, and chewing tobacco,

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Tuberculosis

The attributable age-standardized deaths and DALYs from tuberculosis due to tobacco use showed falling trends in both sexes.

DISCUSSION

Prevalence and patterns of tobacco use

The GBD study results indicate that throughout the time between 1990 and 2015, the prevalence of daily tobacco smoking decreased by 33% in male (24% in 1990 and 36% in 2015), by 48% in female (20% in 1990 and 10% in 2015) and by 38% in the general population (28% in 1990 and 20% in 2015). One reason for the decrease in the prevalence of daily tobacco use could be Nepal's implementation of WHO FCTC in 2006[12] and Tobacco Control and Regulatory Bill in 2011[5], which regulate the law of tobacco use in Nepal. In reviewing previous literature, it is evident that gender, geographical and socio-economic variation do play a role in observed differences in the pattern of tobacco use. In Nepal, the use of tobacco products is practiced extensively in the elderly population, males, people with lower education levels, rural areas, mountainous areas than in plain areas, and Far- and Mid-western region than in Eastern, Central, and Western regions.[18] In addition to that, in Nepal, people in mountainous areas tend to smoke more while, people in plain areas tend to chew tobacco more.[18,19] Elderly people have different beliefs around tobacco use, like continuing tobacco does no harm, and stopping tobacco does not improve health status.[20] People who are less educated might have a lower level of awareness of the harmful hazards of tobacco use. However, in recent times, males of the young age group have high tobacco consumption.[6] A similar pattern of variation in tobacco use was noticed in the Southeast Asian population. The higher prevalence of smoking in males was observed in Asian countries like Malaysia, the Philippines, Singapore, Vietnam, Indonesia, Maldives, and Bangladesh.[21,22] In these countries, gender seems to be an important determinant of the initiation of the smoking habit and for perpetuating it. Social norms and the prohibition of tobacco use can

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be one of the factors responsible for the lower prevalence of tobacco use in the female population in Southeast Asian countries.[23] Smokeless form of tobacco was common in countries like India, Nepal, Bangladesh, Maldives, and Cambodia.[7] Increasing age, poverty, and poor education were associated with higher consumption of tobacco in these countries.

It was evident from the results that, age-standardized rates of death and disability due to smokeless tobacco are in decreasing, however, the absolute number of deaths and disabilities due to smokeless tobacco is increasing. In recent years in the Southeast Asia region, including Nepal, there is a clear increase in preference to using smokeless tobacco over tobacco smoking, with a higher prevalence of smokeless tobacco in males.[6–8,24] Smokeless tobacco is associated with a higher risk of getting cancer[25] and cardiovascular risk factors like hypertension, metabolic syndrome, and cardiovascular events like acute coronary syndrome[26] than non-tobacco users, although less than tobacco smoking. The increased prevalence of smokeless tobacco in the Nepalese population and the potential increase in the risk of cancer associated with it might be the reason for the increase in disability rate from all neoplasms due to chewing tobacco. According to a study in Nepal, most of the consumers of smokeless tobacco are unaware of its harmful health hazards.[27] Studies have shown that smokers tend to perceive smokeless tobacco as less harmful than smoking.[28] This belief might exist among smokers in Nepal and the extent of such beliefs needs to be explored in detail. The production of smokeless tobacco products is unhindered in Nepal and the increased import of smokeless from the neighboring country, India made the products easily accessible all over the country.[27] And, owing to the government's lower taxation imposed on smokeless products compared with smoking tobacco products, smokeless tobacco products have an added affordability.[6] Tobacco products such as bidis and smokeless tobacco are perceived as "hard to tax" due to their more informal nature. Thus, all these factors with more emphasis on tobacco control policy on tobacco smoking over smokeless tobacco with lack of awareness towards the hazards of smokeless tobacco products seem to be the cause for shifting the preference of consumers from smoking to smokeless tobacco.

The results indicate that the age-standardized rates of death among males due to cardiovascular diseases, and age-standardized deaths and disability due to diabetes and kidney diseases in both sexes, attributable to second-hand smoking are in the increasing pattern. At the global level, around 40% of children, 33% of male non-smokers, and 35% of female non-smokers are estimated to have been exposed

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to second-hand smoke regularly, with Southeast Asia and the Western Pacific region accountable for 50% of the globe's total burden from second-hand smoke exposure.[29] Most of the deaths attributable to second-hand smoke occurred from ischemic heart disease in adults and lower respiratory tract infections in children, women having the greatest burden among all. Most DALYs lost secondary to second-hand smoke exposure occurred due to lower respiratory tract infections and ischemic heart disease, children being the most affected ones.[29] In Nepal, public transports and restaurants are the major areas of second-hand smoke exposure in public places, while homes and workplaces are indoor areas of second-hand smoke exposure.[5]

Deaths and DALYs attributable to tobacco

Tobacco use was the second most common risk factor for deaths and the third most common risk factor for total DALYs in Nepal in 2017.[30] In numbers, 14.73% (95% UI 12.52-16.58) of total deaths and 7.8% (95% UI 6.68-9.06) of total DALYs were attributed to tobacco use in 2017.[30] In between 1990 and 2017, the total deaths attributable to tobacco use, including any form, in all ages increased by 39% in the general population (both males and females) and DALYs attributable to tobacco use, including any form, in all ages increased by 11% males but decreased by 9% in females, with tobacco smoking having the most contribution. Also, in 2017 most of the tobacco attributable deaths were due to cardiovascular disease, diabetes, neoplasm, and kidney disease. Between 1990 and 2017 tobacco attributable disease occupied a larger proportion of cause of death in Nepal. In contrary to an overall decrease in the prevalence of tobacco use and age-standardized deaths and DALYs in both males and females in recent decades, the total deaths and DALYs were higher in 2017 compared with 1990. One plausible explanation for this pattern could the population growth in Nepal, 29 million in 2019 compared with 18.9 million in 1990.[31] The rising number of tobacco consumers despite the overall decrease in the prevalence of tobacco use can be attributed to population growth compared with 1990. Furthermore, the elderly population tends to have smoked for more decades considering they started consuming tobacco from an early age. Thus, they tend to have the highest exposure to tobacco which can support a fact that the mortality attributable to tobacco becomes evident usually after the two to three decades of tobacco use.[32] This

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evidence also explains the reason why there are increasing deaths and disabilities with an increase in age. Consequently, the deaths attributed to tobacco use may continue to rise in the long run despite the decrease in the prevalence of tobacco use.

Policy related to tobacco in Nepal

In response to the global tobacco epidemic, WHO launched a global public health treaty in 2003 named WHO framework convention on tobacco control (WHO FCTC).[33] Nepal signed the WHO FCTC in 2003 with the ratification of the treaty in 2006.[12] In 2008, to efficiently implement the FCTC, WHO launched the MPOWER policy to lower the tobacco demand in individual countries,[34] which was adopted by Nepal. The Parliament of Nepal passed the Tobacco Control and Regulatory Bill in 2011 incorporating the provisions of WHO FCTC which is currently the primary law that governs tobacco use. This act regulates the use of tobacco in public workplaces and public transport, advertisement, and promotion of any kind of tobacco products, and packaging and labeling of tobacco products. However, the question that arises is how effective the law is, and how effective we have been in protecting people from tobacco use, tobacco-related deaths, and disability. The decreasing trends in the prevalence of tobacco use and age-standardized deaths and DALYs attributable to tobacco suggest that tobacco control has been effective so far. Nepal received a Bloomberg Philanthropies Award for Global Tobacco Control in 2015 for its work in control and reduction of tobacco product use by warning people about the hazards of tobacco use.[35] The tobacco act has emphasized more on packaging and promotion to abate the consumption of tobacco products. In the STEPS survey conducted in 2019, 75.7% of adults noticed health warnings on tobacco packages and 44.8% of current users thought of quitting because of such warnings. However, the tobacco act is limited by a lack of knowledge on the implementation of regulations in public places and around the educational hubs. Though the control of tobacco use in Nepal appears well in the last few decades, the progress seems static in recent times. The STEPs survey conducted in Nepal in 2019 showed only a minor drop in the prevalence of former smokers or former smokeless tobacco users in comparison to 2013.[5] Tobacco control, not only contributes to improving the health of its consumers but also is very important for economic development. On

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average, the average amount of money spent per year on cigarettes is around 11% of GDP per capita.[5] Nepal currently imposes a tobacco tax of just 15.5 percent of retail price (excluding VAT) which is the lowest among the South Asian countries and far below the WHO guideline of 70 percent of the retail price.[36] Tobacco taxation increases the retail price of tobacco products and reduces the demand therefore is considered to be the most cost-effective method in tobacco control.[37] A 10 percent increase in the price of tobacco products is expected to reduce the demand by 5-10% in lower and middle-income countries.[4] Given the high burden of tobacco use in Nepal, an increment of the tax on tobacco products should be given high priority.

Limitations of study

There are a few limitations to the study. First is the lack of primary data sources from Nepal and those included sources used in GBD are limited in scope, coverage, and quality. Nepal also lacks a cause of death surveillance system to document disease-related deaths. However, in resource-limited countries like Nepal, where reliable health statistics are limited, the GBD data provide nationally representative findings, providing evidence-based strategies for policymaking. Second, the prevalence of smoking could have been underestimated as the GBD data only takes into account the prevalence of daily smoking and lacked the data for the prevalence of smokeless tobacco and second-hand exposure. This could have resulted in an underestimation of attributable disease burden especially in populations who tend to use less tobacco every day. Also, the data did not account for the duration and intensity of tobacco use. Third, the burden estimates are limited by not considering indoor and outdoor air pollution. Nepal has experienced a massive increase in air pollution during the time in most of the cities, which could confound the findings.

CONCLUSIONS

This study is one of the first studies in Nepal to show the trend of mortality and DALY attributable to tobacco use. There is a decreasing trend in the prevalence of smoking, age-standardized mortality, and DALYs between 1990 and 2017. However, there was a more than one-third increase in crude mortality rate. NCDs contributed the most deaths and disabilities attributable to tobacco. There is a huge

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increase in deaths and DALY due to chewing tobacco from 1990 to 2017. Awareness along with the strong implementation of tobacco control strategies on all forms of tobacco including second-hand exposure and increasing taxation can further help to decrease the trend in the future. There is also a need for a robust and reliable data representative of all regions in Nepal to understand the effect of tobacco control policies.

Conflict of interest

The authors declared that they have no conflict of interest.

Contributorship statement

Gambhir Shrestha: Conceptualization, Methodology, Software, Formal analysis, Supervision, Writing-Original draft preparation.

Prabin Phuyal: Software, Formal analysis, Visualization, Writing-Original draft preparation.

Rabin Gautam: Conceptualization, Methodology, Software, Formal analysis, Writing-Original draft preparation.

Rashmi Mulmi: Conceptualization, Visualization, Writing-Reviewing, and Editing.

Pranil Man Singh Pradhan: Methodology, Visualization, Writing-Reviewing, and Editing.

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Data sharing statement

All data relevant to the study are included in the article and can be assessed through the website http://ghdx.healthdata.org/

Ethics approval statement

This is a database study that used the freely available data from GBD study and does not require ethics approval.

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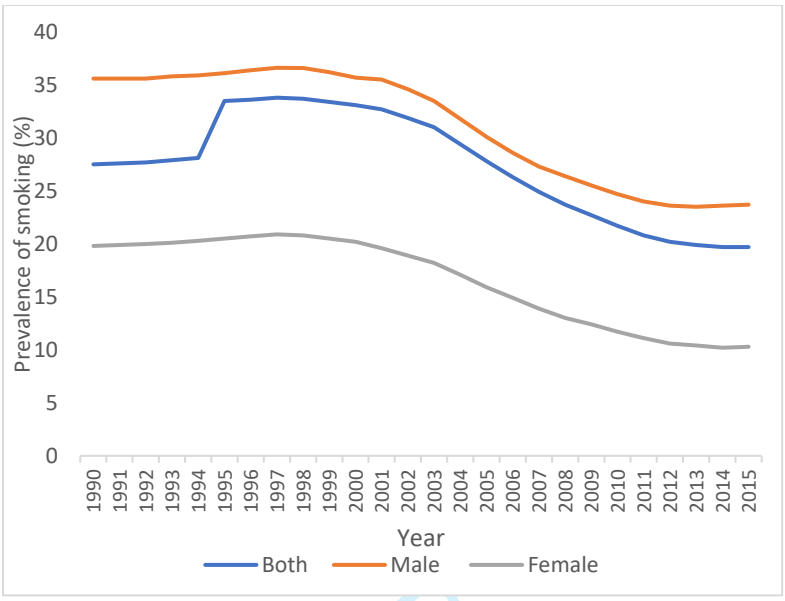

Figure 1: Prevalence of smoking from the year 1990 to 2015 in Nepal

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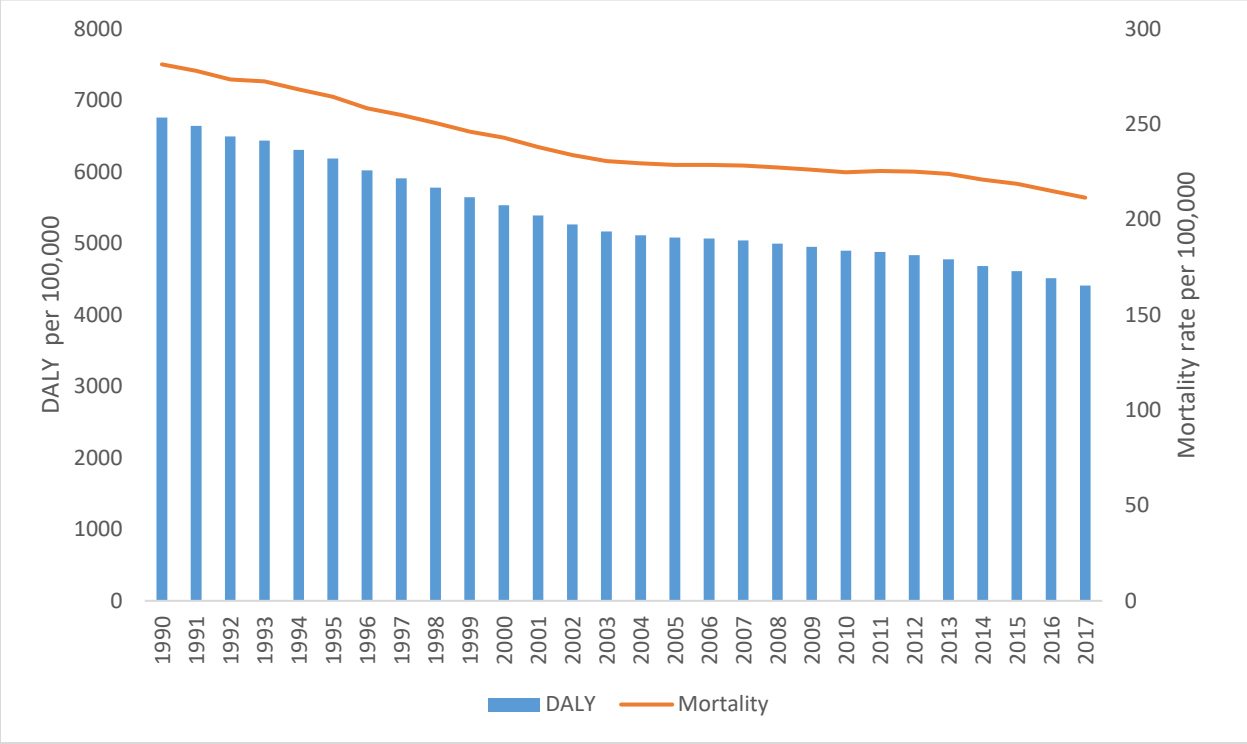

Figure 2: Trend of age-standardized mortality rate and DALYs attributable to tobacco from 1990-2017 in Nepal

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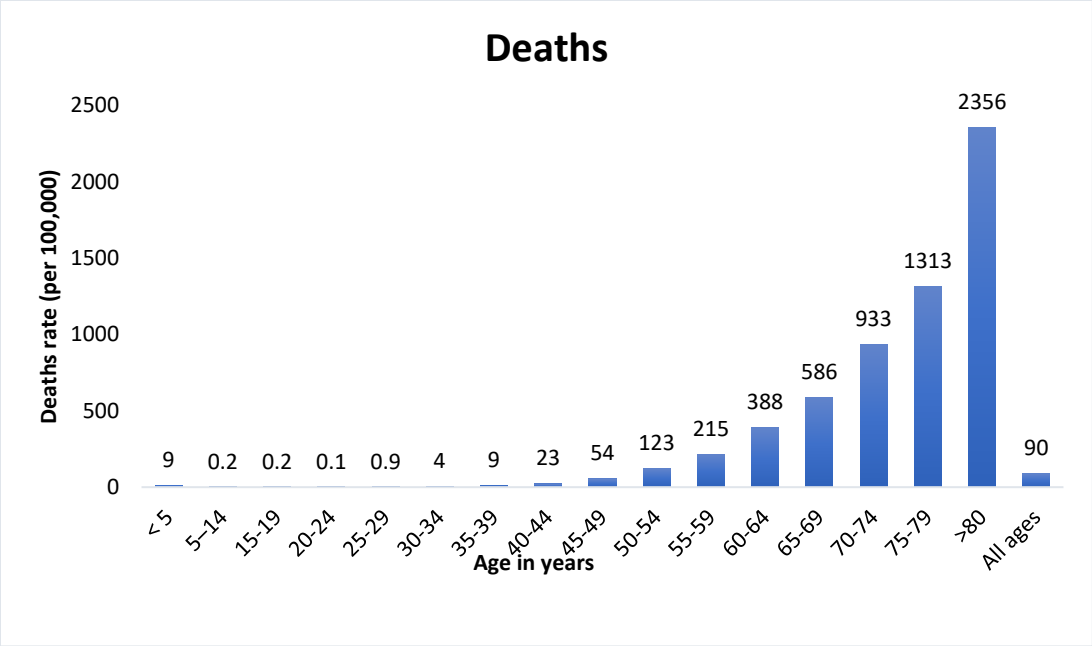
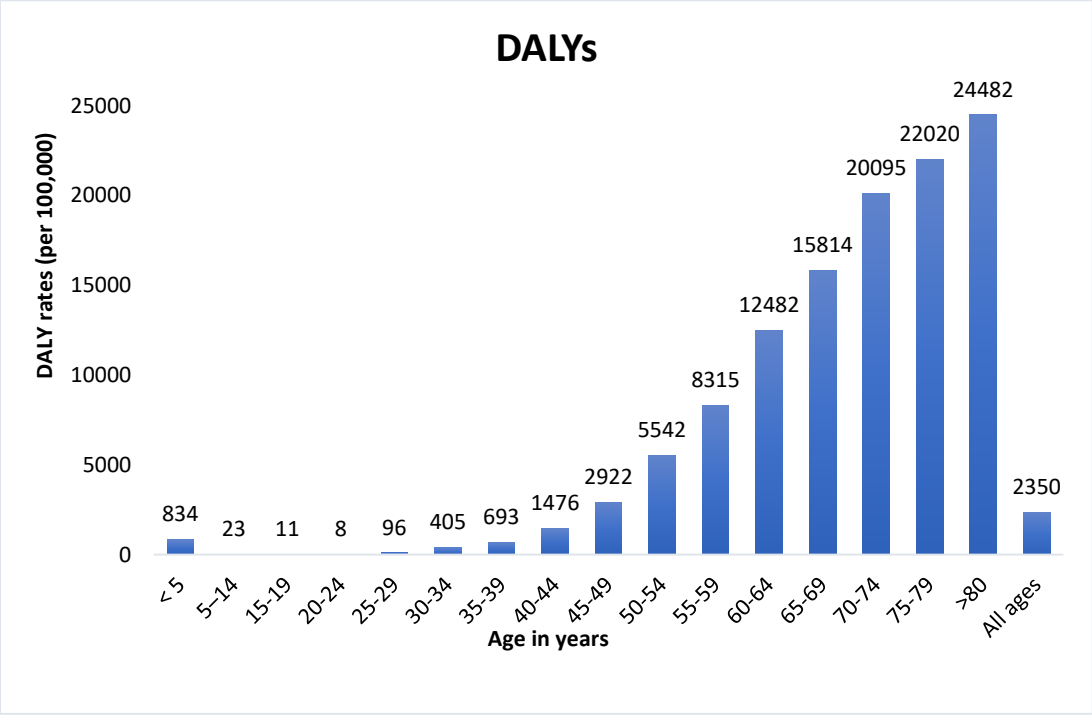


A



B

Figure 3: Age-wise deaths (A) and DALYs (B) rates in all causes in both sexes attributable to tobacco, including all types, in 2017

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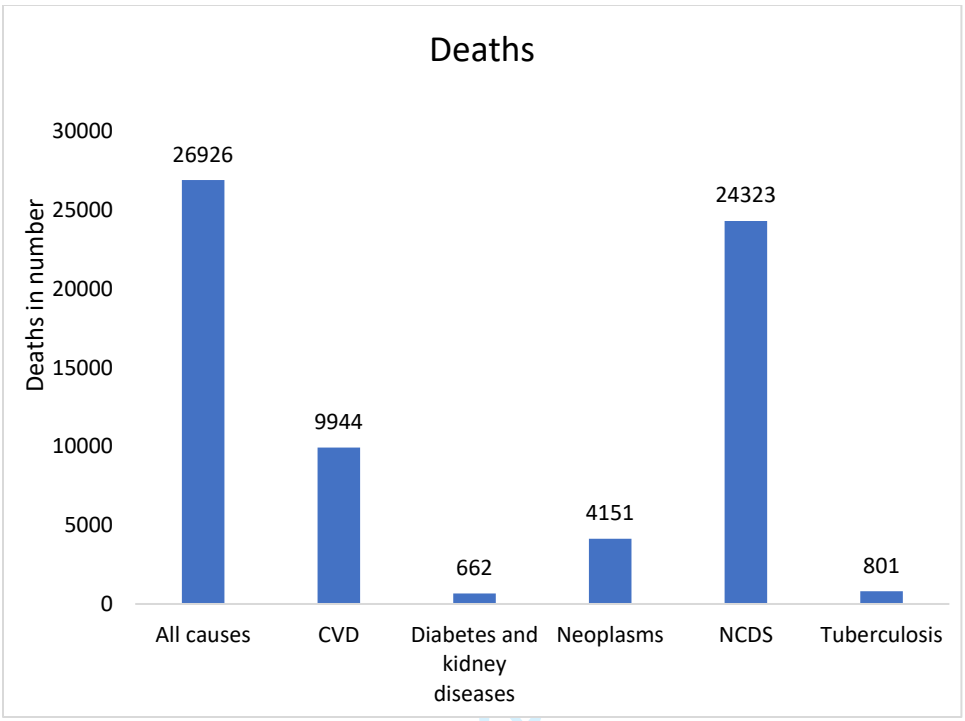
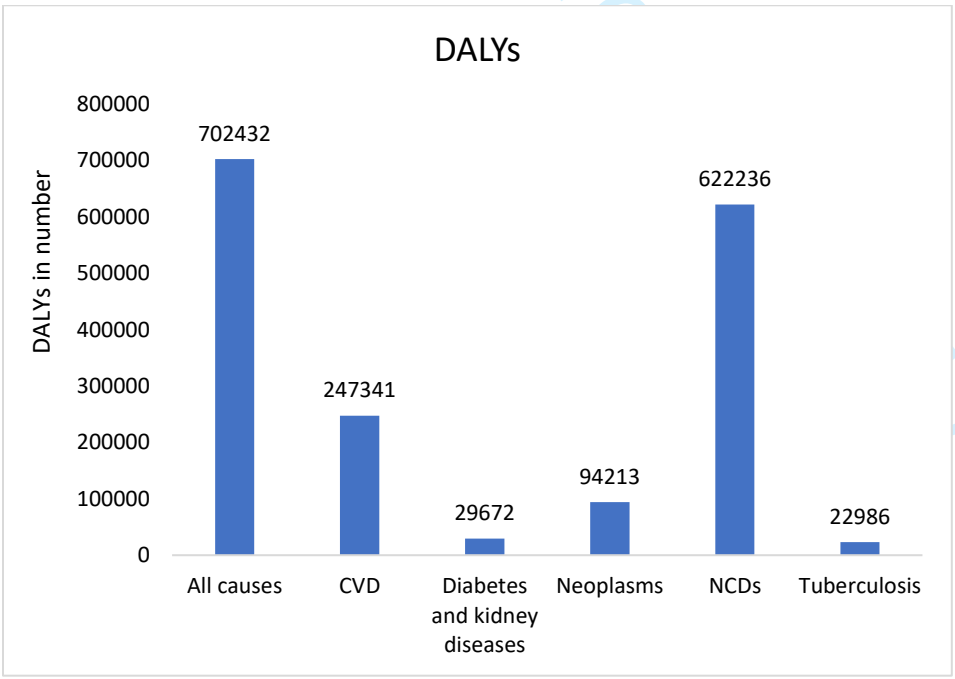


A



B

Figure 4: All-age deaths (A) and DALYs (B) from different diseases attributable to tobacco use (including all types) in Nepal in 2017

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Supplementary Table 1. All-age deaths and DALYs for different diseases attributable to tobacco and their percentage change in Nepal, 1990-2017

Subcategory	All-Age Deaths, No. in Thousands (95% UI)			All-Age DALYs, No. in Thousands (95% UI)		
	1990	2017	change, %	1990	2017	Change, %
All causes						
Tobacco						
Male	11763.49 (9612.18-14237.80)	17372.20 (14056.39-20307.12)	47.68	403665.07 (319794.17-512869.65)	446131.88 (344621.77-524648.21)	10.52
Female	7608.83 (5827.14-9679.57)	9553.55 (7463.66-12031.65)	25.56	280977.20 (205487.39-373383.63)	256300.38 (185568.71-316572.58)	-8.78
Both	19372.32 (16059.91-23310.44)	26925.75 (22826.17-31135.35)	38.99	684642.27 (538331.13-875950.09)	702432.26 (552052.53-812425.42)	2.60
Smoking						
Male	9858.89 (8016.19-12138.96)	15573.83 (12511.70-18320.09)	57.97	280385.51 (227328.27-345198.66)	387323.83 (314734.78-458240.78)	38.14
Female	5619.71 (4163.78-7373.09)	7984.05 (6026.50-10280.06)	42.07	153618.50 (116802.49-200154.70)	201074.80 (153098.74-253269.80)	30.89
Both	15478.60 (12838.83-18675.51)	23557.88 (19798.77-27400.07)	52.20	434004.01 (360694.99-523145.50)	588397.83 (497193.19-690655.02)	35.57
Chewing tobacco	324.53 (221.95-453.10)	595.13 (412.87-782.12)	83.38	9802.97 (6587.60-13907.45)	15546.9[illegible] (10381.34-20552.20)	58.59
Male	142.83 (98.54-201.01)	268.19 (194.01-356.27)	87.76	3558.17 (2385.54-5110.57)	6011.17 (4[illegible]98-8176.42)	68.94
Female	467.36 (351.24-609.37)	863.32 (664.09-1073.70)	84.72	13361.13 (9934.89-17759.87)	21558.1[illegible] (16[illegible]05.69-27194.58)	61.35
Both						
Secondhand smoking						
Male	2023.02 (1223.08-3116.32)	1966.04 (1388.69-2649.68)	-2.82	125282.54 (64552.81-208075.08)	61759.1[illegible] (44[illegible]9.97-84284.35)	-50.70
Female	2133.57 (1257.73-3283.64)	1717.76 (1179.09-2388.87)	-19.49	130921.51 (68925.95-212905.05)	58748.[illegible] (40[illegible]21.33-80159.30)	-55.13
Both	4156.59 (2503.94-6381.37)	3683.80 (2641.33-4882.95)	-11.37	256204.06 (133797.03-415607.64)	120507.[illegible]43 (8[illegible]416.83-162640.49)	-52.96
Cardiovascular diseases						
Tobacco						
Male	3791.45 (2966.34-4752.99)	7184.91 (5484.11-8728.33)	89.50	106045.53 (82267.08-133672.18)	178781.[illegible]2 (1[illegible]5047.16-220860.34)	68.59
Female	1939.91 (1409.64-2638.17)	2759.22 (2031.88-3598.37)	42.23	51596.75 (37925.85-69499.33)	68559.0[illegible]2 (51[illegible]46.16-88568.29)	32.87
Both	5731.36 (4645.29-7010.77)	9944.13 (7888.43-12157.90)	73.50	157642.28 (126776.05-193554.33)	247340.[illegible]2 (1[illegible]4740.00-303138.58)	56.90
Smoking						
Male	3453.41 (2688.03-4375.06)	6398.37 (4808.50-7886.57)	85.28	96619.66 (74256.90-122738.75)	159276.[illegible]4 (1[illegible]9281.99-198937.41)	64.85
Female	1631.37 (1150.06-2269.44)	2305.75 (1631.12-3096.08)	41.34	42772.31 (30386.44-59660.41)	56949.0[illegible] (41[illegible]94.34-75687.19)	33.14
Both	5084.78 (4033.28-6349.49)	8704.12 (6785.50-10755.96)	71.18	139391.98 (110502.77-173724.72)	216225.[illegible]3 (1[illegible]7097.28-267200.96)	55.12
Secondhand smoking						
Male	470.29 (335.36-642.16)	1019.62 (716.19-1367.19)	116.81	13262.84 (9357.97-18103.45)	25748.7[illegible] (17[illegible]29.80-34584.44)	94.14
Female	392.38 (279.69-543.01)	552.72 (399.72-738.60)	40.86	11177.24 (7815.41-15454.67)	14258.6[illegible] (10[illegible]12.59-19091.91)	27.57
Both	862.67 (645.37-1136.15)	1572.35 (1155.62-2052.89)	82.27	24440.09 (18131.54-32553.33)	40007.4[illegible] (28[illegible]71.94-52101.01)	63.70
Diabetes and kidney diseases						
Tobacco						
Male	89.86 (46.50-132.87)	341.19 (212.30-499.97)	279.71	6537.41 (4043.63-9355.31)	16371.62 (10[illegible]53.78-22939.55)	150.43
Female	83.46 (40.03-146.03)	320.67 (180.70-493.02)	284.24	5137.20 (2824.43-7939.95)	13300.29 (7[illegible]4.24-19447.89)	158.90
Both	173.31 (104.61-250.63)	661.86 (423.10-933.46)	281.89	11674.62 (7240.42-16558.61)	29671.92 (18[illegible]47.14-41567.02)	154.16
Smoking						
Male	60.05 (31.00-92.21)	215.64 (125.04-325.16)	259.10	4392.28 (2637.49-6322.29)	10215.58 (6[illegible]0.69-14596.02)	132.58
Female	38.47 (16.74-70.51)	135.17 (71.15-222.16)	251.37	2188.41 (1197.36-3496.51)	5142.53 (290[illegible]20-7975.01)	134.99
Both	98.52 (56.73-144.71)	350.81 (205.70-514.87)	256.08	6580.70 (4055.51-9682.42)	15358.11 (9[illegible]56.86-22203.75)	133.38

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Secondhand smoking						
Male	35.40 (12.48-60.40)	143.98 (52.67-241.44)	306.69	2525.21 (955.13-4178.18)	7028.35 (2626.10-11459.51)	178.33
Female	49.68 (16.07-97.51)	199.24 (74.84-338.96)	301.03	3218.62 (1162.47-5459.71)	8689.48 (3313.27-13987.41)	169.98
Both	85.08 (30.02-145.39)	343.22 (128.33-559.19)	303.39	5743.83 (2138.89-9608.90)	15717.8 (5956.86-24952.45)	173.65
All Neoplasms						
Tobacco						
Male	1458.30 (1139.03-1890.08)	2795.38 (2190.73-3628.29)	91.69	38763.61 (30206.76-49414.72)	63597.5 (49718.72-82150.39)	64.06
Female	850.81 (606.63-1144.57)	1355.16 (979.14-1773.62)	59.28	22919.15 (16055.39-31167.33)	30615.3 (21387.11-40608.53)	33.58
Both	2309.11 (1829.24-2855.31)	4150.54 (3336.01-5024.85)	79.75	61682.77 (48392.88-76293.78)	94212.8 (74227.14-114859.20)	52.74
Smoking						
Male	1250.10 (975.25-1649.62)	2401.44 (1848.26-3151.69)	92.10	32126.79 (24809.85-42129.01)	52760.1 (39959.53-69669.29)	64.22
Female	720.15 (488.16-1000.56)	1097.67 (750.55-1488.11)	52.42	19297.97 (12618.21-27388.48)	24084.5 (16009.46-32930.07)	24.80
Both	1970.25 (1545.76-2475.89)	3499.11 (2734.84-4290.12)	77.60	51424.76 (40202.22-65087.14)	76844.6 (60207.14-94791.62)	49.43
Chewing tobacco	324.53 (221.95-453.10)	595.13 (412.87-782.12)	83.38	9802.97 (6587.60-13907.45)	15546.9 (10081.34-20552.20)	58.59
Male	142.83 (98.54-201.01)	268.19 (194.01-356.27)	87.76	3558.17 (2385.54-5110.57)	6011.17 (4423.98-8176.42)	68.94
Female	467.36 (351.24-609.37)	863.32 (664.09-1073.70)	84.72	13361.13 (9934.89-17759.87)	21558.1 (16005.69-27194.58)	61.35
Both						
Secondhand smoking						
Male	21.07 (8.88-41.47)	41.08 (18.62-77.70)	95.01	551.75 (228.76-1067.50)	939.60 (382.21-1780.49)	70.29
Female	34.30 (13.82-61.95)	71.29 (29.95-123.53)	107.84	1071.97 (442.54-1953.02)	2081.06 (870.59-3602.03)	94.13
Both	55.37 (28.26-90.91)	112.37 (57.13-183.26)	102.96	1623.73 (810.67-2684.85)	3020.66 (1541.52-4853.92)	86.03
Non-communicable diseases						
Tobacco						
Male	9084.74 (7213.20-11113.09)	15843.57 (12712.23-18568.33)	74.40	258037.36 (208400.97-311823.54)	399996.34 (325615.15-473155.30)	55.02
Female	5405.68 (4000.45-7169.95)	8479.47 (6562.76-10786.52)	56.86	149766.37 (113912.16-195422.04)	222238.88 (166225.32-276201.22)	48.39
Both	14490.42 (12108.44-17315.76)	24323.04 (20523.48-28032.74)	67.86	407803.74 (341565.27-482686.51)	622235.22 (521551.91-724024.44)	52.58
Smoking						
Male	8360.61 (6594.62-10279.50)	14278.19 (11397.99-16901.41)	70.78	235498.35 (188051.06-288093.77)	356411.33 (288822.06-421623.66)	51.34
Female	4650.42 (3337.03-6281.82)	7178.97 (5429.79-9244.20)	54.37	125863.59 (93741.89-167530.95)	183252.88 (141279.02-232004.89)	45.60
Both	13011.04 (10706.22-15734.95)	21457.17 (17836.70-25205.32)	64.92	361361.93 (297489.31-433996.59)	539664.42 (445211.65-635293.86)	49.34
Chewing tobacco	324.53 (221.95-453.10)	595.13 (412.87-782.12)	83.38	9802.97 (6587.60-13907.45)	15546.9 (10081.34-20552.20)	58.59
Male	142.83 (98.54-201.01)	268.19 (194.01-356.27)	87.76	3558.17 (2385.54-5110.57)	6011.17 (4423.98-8176.42)	68.94
Female	467.36 (351.24-609.37)	863.32 (664.09-1073.70)	84.72	13361.13 (9934.89-17759.87)	21558.1 (16005.69-27194.58)	61.35
Both						
Secondhand smoking						
Male	826.51 (544.18-1157.79)	1707.58 (1204.09-2298.64)	106.60	24185.68 (16369.38-33055.50)	46057.83 (32353.64-60548.19)	90.43
Female	885.80 (562.91-1315.63)	1428.84 (955.94-2015.36)	61.31	27170.66 (17935.98-39583.53)	42147.61 (28647.28-57043.88)	55.12
Both	1712.31 (1160.43-2406.58)	3136.42 (2218.91-4183.96)	83.17	51356.35 (35980.77-71788.94)	88205.44 (62308.63-115112.33)	71.75
Tuberculosis						
Tobacco						
Male	1065.82 (611.69-1723.30)	533.34 (298.43-827.30)	-49.96	34317.44 (19894.39-54836.53)	15474.57 (8966.80-23623.93)	-54.91
Female	667.34 (210.36-1288.01)	267.93 (114.47-461.56)	-59.85	21064.12 (7035.82-39071.66)	7511.65 (3422.62-12761.83)	-64.34

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Both	1733.16 (962.41-2696.31)	801.27 (445.52-1198.40)	-53.77	55381.56 (31368.85-84009.28)	22986.2[illegible] (12[illegible]14.67-33890.22)	-58.49
Smoking						
Male	1065.82 (611.69-1723.30)	533.34 (298.43-827.30)	-49.96	34317.44 (19894.39-54836.53)	15474.5[illegible] (86[illegible]6.80-23623.93)	-54.91
Female	667.34 (210.36-1288.01)	267.93 (114.47-461.56)	-59.85	21064.12 (7035.82-39071.66)	7511.65 (3342.62-12761.83)	-64.34
Both	1733.16 (962.41-2696.31)	801.27 (445.52-1198.40)	-53.77	55381.56 (31368.85-84009.28)	22986.2[illegible] (12[illegible]14.67-33890.22)	-58.49

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The burden of tobacco in Nepal: a systematic analysis from the Global Burden of Disease Study 1990-2017

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Please insert check where included or N/A where not applicable
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	**Pg 1-2**
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	**Pg 2**
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	**Pg 3-4**
Objectives	3	State specific objectives, including any prespecified hypotheses	**Pg 4**
Methods			
Study design	4	Present key elements of study design early in the paper	**Pg 5**
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	**Pg 5**
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	**NA**
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	**Pg 6**
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	**Pg 5-6**
Bias	9	Describe any efforts to address potential sources of bias	**Pg 17**
Study size	10	Explain how the study size was arrived at	**N/A**
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	**Pg 6**
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	**Pg 6**
		(*b*) Describe any methods used to examine subgroups and interactions	**Pg 5-6**
		(*c*) Explain how missing data were addressed	**N/A**
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	**N/A**
		(*e*) Describe any sensitivity analyses	**N/A**
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	**N/A**
		(b) Give reasons for non-participation at each stage	**NA**
		(c) Consider use of a flow diagram	**-**
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical,	**N/A**

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		social) and information on exposures and potential confounders	
		(b) Indicate number of participants with missing data for each variable of interest	**N/A**
Outcome data	15*	Report numbers of outcome events or summary measures	**N/A**
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	**Pg 7-12**
		(*b*) Report category boundaries when continuous variables were categorized	**Pg 7-12**
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	**N/A**
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	**Pg 7-12**
Discussion			
Key results	18	Summarise key results with reference to study objectives	**Pg 13-15**
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	**Pg 17**
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	**Pg 17**
Generalisability	21	Discuss the generalisability (external validity) of the study results	**Pg 17**
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	**Pg 18**

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