Socio-demographic correlates and clustering of non-communicable diseases risk factors among reproductive aged women of Nepal: Results from Nepal Demographic Health Survey 2016

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Abstract

Globally, Non Communicable Diseases (NCDs) are the major killer diseases, majority of which are attributable to common risk factors like smoking, alcohol intake, physical inactivity and low fruits/vegetable consumption. Clustering of these risk factors increases the risk of developing NCDs. The occurrence of NCDs among women is alarmingly high, and this invites impact on upcoming generation too. So, this study aimed to assess the prevalence and clustering of selected risk factors and their socio-demographic determinants in Nepalese women using Nepal Demographic and Health Survey (NDHS) 2016 data.

NDHS applied stratified multi-stage cluster sampling to reach to the individual respondent for representing the whole nation .This study included analysis of data of 6,396 women of age 15 to 49 years. Chi-square test for bivariate analysis and multiple poisson regression to calculate adjusted prevalence ratio was applied.

A total of 8.91% participants were current smoker. Similarly, 22.19% and 11.45% of participants were overweight and hypertensive respectively. Around 6.02% of participants had a co-occurrence of two NCDs risk factors. Smoking, overweight and hypertension were significantly associated with age, education, province, wealth index and ethnicity. Risk factors were more likely to cluster in women aged 40-49 years (APR=2.95, CI: 2.58-3.38), widow/separated (APR=3.09, CI: 2.24-4.28) and Dalit) (APR=1.34, CI: 1.17-1.55).

This study found that NCD risk factors were disproportionately distributed by age, education, socio-economic status and ethnicity and clustered in more vulnerable groups such as widow/separated, Dalit and Janajati. .

Keywords

Women, smoking, overweight, hypertension, risk factors, clustering

Introduction

Globally, non-communicable disease (NCDs) are the number one causes of death and disability. NCDs account for 41 million deaths each year and 85% of these deaths occur in low- and middle-income countries while nearly half of NCDs deaths (15 million out of 41 million) occur between the age of 30 and 69 years.[1] Cardiovascular diseases, cancers, diabetes, and respiratory diseases, also called the 'Group of Four' are responsible for 80% of all NCDs deaths. [1]

NCDs share the common risk factors such as low intake of fruit and vegetables, low level of physical activity, tobacco use, harmful use of alcohol, obesity, raised blood pressure, raised blood cholesterol and glucose. The co-occurrence of these risk factors in individual is known as clustering of risk factors. Clustering of risk factors is related with an increased risk of developing NCDs.[2,3] In context of Nepal, STEPS survey 2013, reported that 15.5% of general population and 11.4% of women had three or more risk factors of NCD in them.[4] Evidence show that women are more likely to experience the co-occurrence of behavioral and metabolic risk factors increasing the risk of NCDs among themselves and in future generation.[5-7] Similarly, compared to men, women experience fewer symptoms and show less apparent signs of certain NCDs like cardiovascular disease. They are thus less likely to be identified and treated or less likely to be the focus of disease prevention.[8]

NCDs have broader impact that varies from –impact on maternal to child health, individual to national level and physical burden to financial burden. Thus to tackle with NCDs, the best strategy is to identify and modify the behavioral risk factors that causes NCDs. This study, therefore, aims to assess the magnitude of selected risk factors, individually or in cluster and determines their socio-demographic distributions in Nepalese women.

Methodology

This study is based on the data from the Nepal Demographic Health Survey (NDHS) 2016.NDHS is periodic survey that consist of a nationally representative sample. A detailed description of NDHS methodology is reported elsewhere.[9] Briefly, NDHS applied the stratified multi-stage cluster sampling to reach to the individual respondent. Firstly, 383 primary sampling units (PSU) (wards) were selected based on probability proportional to PSU size. Subsequently, 30 households per PSU (total 11040 households) were selected using an equal probability systematic selection criterion. The 2016 NDHS was first time included the measurements of biomarker information including blood pressure. Blood pressure and anthropometric measurements were only obtained from the systematically selected subsample of the total study participants. For this study, we have only included 6396 women aged between 15 and 49 years who had their blood pressure recorded.

Data collection

Blood pressure: Trained enumerator measured blood pressure with UA-767F/FAC (A&D Medical, Tokyo, Japan) blood pressure machines. Enumerators took three readings of blood pressure at the interval of five minutes between each reading and averaged last two readings to get more accurate blood pressure level. Participants whose systolic blood pressure (SBP)at the level of 140 mmHg or higher and/or diastolic blood pressure (DBP) of ≥90 mm Hg or higher or currently taking antihypertensive medicines at the time of data collection were considered hypertensive.

Overweight: Weight in kilograms was divided by height in meters-squared to calculate BMI. Women having (BMI $\geq$ 25kg/m^2) were categorized as 'Overweight" and the remaining (BMI< 25kg/m^2) were categorized as "Not overweight".

Current tobacco use: Current tobacco use includes either daily or occasional smoking or use of smokeless tobacco (snuff by mouth, snuff by nose, chewing tobacco and betel quid with tobacco)

Explanatory variables

For this study purpose, information related to socio-demographic variables including age of the participants, ethnicity, educational status, place of residence (rural/urban), province and ecological zone and wealth index were extracted from the NDHS original datasets.

Statistical analysis

All analyses were performed on STATA 15.2 version using survey set command. All estimates were weighted by sample weights and presented with 95% Confidence Intervals. Prevalence estimates were calculated using Taylor series linearization. Chi-square test was used for bivariate analysis to test associations between covariates and dependent variables. Furthermore, multiple Poisson regression was used to calculate adjusted prevalence ratio (APR). The numbers of risk factors present within each participant (from 0 to 3) were counted to assess clustering of risk factors and analyzed using the Poisson regression.

Ethical consideration

The 2016 NDHS ethical approval was sought from Ethical Review Board (ERB) of the Nepal Health Research Council (NHRC), Nepal and ICF Macro Institutional Review Board, Maryland, USA. Written informed consent was obtained from each participant before enrolling in the survey.

Results

Just over half (53.95%) of the participants were of aged 15-29 years. Largest proportions (36.62%) of the participants were from Janjati group (indigenous group). One thirds (33.34%) had no formal schooling while 76.55% of the participants were married. Most of the participants belonged to Terai belt (49.89%) and rural areas (63.30%).Similarly, 22.43% and 20.92% of participants belonged to richer and richest wealth quintile. Most of participants were engaged in agriculture or were self employed.

Table 1: Socio-demographic distribution of participants.

Characteristics	un-weighted count	weighted percent
Age group		
15-29	3,498	53.95
30-39	1,697	27.09
40-49	1,201	18.96
Educational status		
No education	2,161	33.34
Primary	1,017	16.7
Secondary	2,324	35.48
Higher	894	14.48
Marital status		
Never in union	1,305	20.73
Married or living together	4,919	76.55
Widowed/divorced/separated	172	2.72

Ecological region		
Mountain	454	6.05
Hill	2,916	44.06
Terai	3,026	49.89
Residence		
Rural	4,129	63.03
Urban	2,267	36.97
Province		
Province 1	909	16.84
Province 2	1,051	19.94
Province 3	853	22.07
Gandaki	803	9.81
Province 5	988	16.87
Karnali	888	5.66
Sudurpaschim	904	8.82
Wealth index		
Poorest	1,347	16.96
Poorer	1,304	19.11
Middle	1,319	20.57
Richer	1,319	22.43
Richest	1,107	20.92
Occupational status		
Did not work	2,003	32.34

Services	863	15.01
Agriculture/ self-employed	3,196	46.88
Manual	331	5.77
Ethnic group		
Advantage group	2,254	31.31
Dalit	851	12.56
Janjati	2,268	36.62
Other	1,023	19.51
Total	6,396	100

Fig 2: Prevalence of number of NCDs risk factors among participants

26.08% of participants had one NCDs risk factors and 6.3% participants had two NCD risk factors (Fig 1)

Distribution of non communicable diseases risk factors

Table 2: Prevalence (%) of non-communicable diseases risk factors among 15-49 years women

	Current tobacco use		Overweight		Hypertension	
Characteristics	**n**	**Prevalence**	**n**	**Prevalence**	**n**	**Prevalence**
Age(yrs)						
15-29	3,498	2.57 [1.94-3.41]	3,169	11.96 [10.59-13.48]	3,498	4.01 [3.25-4.95]
30-39	1,697	12.09 [10.28-14.17]	1,647	33.28 [29.99-36.75]	1,697	13.09 [11.34-15.07]
40-49	1,201	22.38 [19.34-25.75]	1,197	34.21 [30.26-38.38]	1,201	24.97 [21.93-28.28]
P-value		<0.001		<0.001		<0.001
Educational level						
no education	2,161	18.81 [16.61-21.24]	2,073	19.87 [17.57-22.39]	2161	12.85 [11.14-14.77]
Primary	1,017	9.85 [7.77-12.4]	936	27.84 [24.39-31.59]	1,017	12.39 [10.38-14.73]
secondary	2,324	2.51 [1.8-3.49]	2,173	20.35 [17.71-23.26]	2,324	7.83 [6.6-9.27]
Higher	894	0.69 [0.33-1.43]	831	27.03 [22.86-31.67]	894	9.09 [6.42-12.71]
P-value		<0.001		<0.001		<0.001
Marital status						

never in union	1,305	1.83 [0.97-3.43]	1,305	5.28 [3.97-6.99]	1305	2.98 [2.14-4.13]
married or living together	4,919	10.11 [9.03-11.3]	4,537	27.27 [25.02-29.65]	4919	12.24 [10.97-13.63]
widowed/divorced/separated	172	29.07 [21.1-38.59]	171	25.45 [18.22-34.34]	172	16.87 [11.43-24.2]
P-value		<0.001		<0.001		<0.001
Ecological zone						
Mountain	454	14.56 [10.44-19.93]	412	20.65 [15.01-27.7]	454	10.62 [7.16-15.48]
Hill	2,916	10.99 [9.22-13.05]	2,776	26.92 [23.91-30.16]	2916	12.24 [10.43-14.32]
Terai	3,026	6.38 [5.34-7.62]	2,825	18.46 [16.4-20.71]	3026	8.84 [7.73-10.08]
P-value		<0.001		<0.001		0.008
Residence						
Urban	4,129	8.51 [7.1-10.16]	3,892	26.28 [23.69-29.04]	4,129	11.01 [9.63-12.55]
Rural	2,267	9.59 [8.18-11.21]	2,121	15.64 [13.65-17.86]	2,267	9.49 [8.05-11.16]
P-value		0.334		<0.001		0.171
Province						
Province 1	909	10.78 [8.59-13.46]	863	27.61 [23.61-32]	909	10.74 [8.76-13.1]
Province 2	1,051	3.04 [2.03-4.52]	953	10.95 [8.86-13.47]	1,051	6.6 [5.36-8.09]
Province 3	853	10.11 [7.19-14.03]	815	34.85 [29.49-40.63]	853	13.31 [10.19-17.19]

Gandaki	803	10.14 [7.36-13.82]	774	31.68 [27.72-35.92]	803	15.37 [12.48-18.8]
Province 5	988	7.48 [5.63-9.86]	930	18.77 [15.67-22.34]	988	11.93 [9.52-14.84]
Karnali	888	15.94 [13.06-19.31]	833	10.55 [7.78-14.16]	888	7.41 [5.35-10.19]
Sudurpaschim	904	12.43 [10.04-15.29]	845	9.13 [5.75-14.2]	904	5.05 [3.55-7.14]
P-value		<0.001		<0.001		<0.001
Wealth index						
Poorest	1,347	19.53 [17-22.34]	1,265	10.01 [8.05-12.38]	1347	8.33 [6.61-10.45]
Poorer	1,304	10.73 [9.14-12.57]	1,215	15.62 [13.48-18.04]	1304	10.75 [8.92-12.89]
Middle	1,319	6.21 [4.93-7.8]	1,227	14.08 [11.83-16.67]	1319	9.04 [7.47-10.9]
Richer	1,319	6.64 [4.19-10.37]	1,246	23.41 [20.76-26.3]	1,319	8.49 [6.84-10.51]
Richest	1,107	3.71 [2.39-5.7]	1,060	44.9 [41.09-48.77]	1107	15.36 [13.23-17.76]
P-value		<0.001		<0.001		<0.001
Occupation*						
Did not work	2,003	4.41 [3.48-5.58]	1,826	24.17 [21.69-26.84]	2,003	9.92 [8.55-11.49]
Services	863	6.36 [4.27-9.39]	836	39.47 [34.75-44.4]	863	14.15 [11.08-17.91]
Agriculture (self-employed)	3,196	12.38 [10.94-13.98]	3,035	14.62 [13.04-16.34]	3,196	9.53 [8.31-10.91]
Manual	331	12.57 [8.71-17.8]	313	30.85 [23.76-38.98]	331	11.24 [7.74-16.06]

P-value		<0.001		<0.001		0.014
Ethnicity						
Advantage group	2,254	7.24 [6.06-8.62]	2,142	24.54 [21.14-28.29]	2254	9.85 [8.33-11.62]
Dalit	851	14.95 [12.11-18.31]	782	18.45 [15.34-22.04]	851	10.7 [8.54-13.33]
Janjati	2,268	11.3 [9.55-13.33]	2,146	26.57 [23.34-30.06]	2268	12.14 [10.5-14.00]
Others	1,023	3.2 [2.21-4.62]	943	13.21 [10.97-15.83]	1,023	8.05 [6.64-9.72]
P-value		<0.001		<0.001		0.005
Total	6396	8.91 [7.89-10.05]	6,013	22.19 [20.46-24.02]	6396	10.45 [9.43-11.56]

*10 cases missing

Current tobacco use

The prevalence of current tobacco use was 8.91%.Women aged 40-49 years (22.38%), no education (18.81%) and widowed/divorced/separated (29.07%) had the highest prevalence of current tobacco use among their respective categories "Table 2". Similarly, current tobacco use was significantly associated with ecological zone, province, wealth index, occupation and ethnicity "Table 2".

Overweight

The prevalence of overweight/obesity was 22.19%. The rate was significantly high in women aged 40-49 years compared to that of 15- 29 (11.96%) years women "Table 2". Similarly, prevalence of overweight significantly varied by education status "Table 2". Compared to never union, prevalence of overweight is significantly high among married/ living together women (27.27%) or divorcee/widowed/separated (25.45%). Current tobacco use is also significantly associated with residence status, province, wealth index, occupation and ethnicity "Table 2".

Hypertension:

Prevalence of hypertension was 10.45%. The prevalence of hypertension significantly varied by the age of the participants, where women aged 40-49 years had the highest rate of hypertension. .Secondary education was significantly associated with higher prevalence of hypertension compared to primary and no education. Likewise, the rate of hypertension was also significantly different in province, wealth index, occupation and ethnicity "Table 2".

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147 **Multivariable analysis of socio-demographic characteristics with non-communicable diseases risk factors**

148 **Table 3: Relationship of socio-demographic characteristics with non-communicable diseases risk factors.**

	Current tobacco use APR	Overweight APR	Hypertension APR	Clustering of NCD risk factors APR
Age group (Years)				
15-29	1	1	1	1
30-39	2.46 [1.77 - 3.43]***	1.85 [1.60 - 2.13]***	2.8 [2.09 - 3.76]***	2.16 [1.90 - 2.46]***
40-49	3.7 [2.65 - 5.17***	1.97 [1.68 - 2.31]***	5.73 [4.25 - 7.71]***	2.95 [2.58 - 3.38]***
Educational status				
No education	1	1	1	1
Primary	0.71 [0.57 - 0.88]**	1.27 [1.10 - 1.46]**	1.28 [1.03 - 1.59]*	1.07 [0.97 - 1.19]
Secondary	0.28 [0.20 - 0.40]***	1.09 [0.94 - 1.25]	1.2 [0.88 - 1.62]	0.87 [0.77 - 0.98]*
Higher secondary level or more	0.09 [0.04 - 0.22]***	1.12 [0.93 - 1.36]	1.31 [0.90 - 1.91]	0.92 [0.78 - 1.08]
Marital status				
Never in union	1	1	1	1

Married or living together	1.37 [0.75 - 2.49]	4.02 [2.98 - 5.40]***	1.97 [1.35 - 2.89]***	2.91 [2.27 - 3.74]***
Widowed/divorced/separated	2.03 [1.04 - 3.98]*	3.29 [2.06 - 5.25]***	1.91 [1.11 - 3.30]*	3.09 [2.24 - 4.28]***
Ecological region				
Mountain	1	1	1	1
Hill	1.01 [0.72 - 1.43]	0.8 [0.57 - 1.11]	0.79 [0.55 - 1.13]	0.88 [0.74 - 1.04]
Terai	1.19 [0.79 - 1.79]	0.71 [0.50 - 1.01]	0.71 [0.48 - 1.06]	0.85 [0.70 - 1.03]
Residence				
Rural	1	1	1	1
Urban	1.16 [0.96 - 1.41]	0.98 [0.85 - 1.13]	0.94 [0.75 - 1.16]	1.01 [0.91 - 1.12]
Province				
Province 1	1	1	1	1
Province 2	0.28 [0.17 - 0.46]***	0.46 [0.36 - 0.58]***	0.61 [0.43 - 0.87]**	0.45 [0.37 - 0.55]***
Province 3	1 [0.72 - 1.39]	0.9 [0.76 - 1.07]	1.1 [0.80 - 1.51]	0.99 [0.87 - 1.12]
Gandaki	0.92 [0.67 - 1.26]	1 [0.84 - 1.19]	1.3 [0.93 - 1.82]	1.07 [0.92 - 1.23]
Province 5	0.64 [0.45 - 0.90]**	0.71 [0.59 - 0.86]***	1.2 [0.89 - 1.63]	0.8 [0.69 - 0.93]**
Karnali	1.02 [0.75 - 1.39]	0.52 [0.38 - 0.71]***	0.81 [0.53 - 1.25]	0.73 [0.62 - 0.86]***
Sudurpaschim	0.89 [0.66 - 1.21]	0.42 [0.28 - 0.63]***	0.58 [0.37 - 0.89]*	0.61 [0.51 - 0.74]***

Wealth index				
Poorest	1	1	1	1
Poorer	0.69 [0.55 - 0.86]***	1.58 [1.27 - 1.97]***	1.34 [1.00 - 1.79]	1.05 [0.92 - 1.18]
Middle	0.51 [0.38 - 0.68]***	1.61 [1.23 - 2.12]***	1.22 [0.88 - 1.69]	0.93 [0.78 - 1.10]
Richer	0.52 [0.34 - 0.81]**	2.32 [1.80 - 2.97]***	1.04 [0.72 - 1.48]	1.1 [0.94 - 1.30]
Richest	0.37 [0.22 - 0.60]***	3.38 [2.63 - 4.34]***	1.45 [1.00 - 2.09]*	1.5 [1.27 - 1.77]***
Occupational status				
Did not work	1	1	1	1
Services	1.5 [0.98 - 2.27]	1.05 [0.93 - 1.19]	1.02 [0.81 - 1.28]	1.09 [0.97 - 1.22]
Agriculture (self-employed)	1.3[0.97 - 1.74]	0.71[0.62 - 0.82]***	0.78[0.64 - 0.96]*	0.83 [0.75 - 0.92]***
Manual	1.4 [0.93 - 2.11]	0.9 [0.73 - 1.12]	0.78 [0.53 - 1.16]	0.94 [0.78 - 1.12]
Ethnic group				
Advantage group	1	1	1	1
Dalit	1.68 [1.27 - 2.23]***	1.09 [0.86 - 1.36]	1.47 [1.09 - 1.97*]	1.34 [1.17 - 1.55]***
Janjati	1.24 [0.98 - 1.57]	1.1 [0.97 - 1.26]	1.28 [1.04 - 1.57*]	1.16 [1.05 - 1.28]**
Others	0.78 [0.49 - 1.26]	0.82 [0.67 - 1.02]	1.34 [0.97 - 1.86]	0.95 [0.80 - 1.13]

*** *significant at p-value < 0.001.*

significant at p-value < 0.01.

151 * *significant at p-value < 0.05.*

Current tobacco use:

Women of age 30-39 years and 40-49 years were 2.56 and 3.70 times more likely to be tobacco user than that of 15-29 years old women "Table 2". Similarly, educated women were less likely to be tobacco user (APR primary: 0.71, APR secondary: 0.28, APR Higher: 0.09) than that of uneducated women. Widowed/divorced/separated women were 2.03 times more likely to be tobacco user than that of women who were never in union. Furthermore, women residing on province 2 (APR: 0.28) and province 3 (APR: 0.64) were less likely to be tobacco user in comparison to province 1 women. Similarly, poor women (APR: 0.69) were more like to be smoker than that of poorest women. Dalit women were 1.68 times more likely to be tobacco user in comparison to advantage women.

Overweight:

Women of age 30-39 years were 1.85 and 1.97 more likely to overweight in reference to 15-29 years "Table 2". Similarly, married and single women were 4.02 and 3.29 respectively times more likely to be overweight than that of never in union women. Further, more women residing in province 2,province 5,Karnali and Sudurpaschim were less likely to overweight in comparison to province 1.Regarding wealth, as the gradient of wealth increases women were more likely to be overweight in comparison to poor women. Women involved self-employed agriculture were less likely to be overweight in reference to who didn't have work.

Hypertension:

Women of 40-49 years and 30-39 years were 1.97 and 1.85 times more likely to be hypertensive in comparison to 15-29 years women "Table 2". Primary educated women were 1.27 times more likely to be hypertensive in comparison to uneducated women. Married and single

(widowed/separated/divorced women) were 4.02 and 3.29, respectively, times more likely to be hypertensive than that of never in union women. Similarly women residing in province 2 province 4 province 5 province 6 and province 7 were less likely to hypertensive in comparison to province 1 women. Richest women were 3.38 times more likely to be hypertensive than that of poorest women. Women whose occupation was agriculture were less likely to be hypertensive in comparison to who didn't have work.

Clustering of NCDs risk factors

Women of 40-49 years age group were 2.95 more times likely to have NCD risk factors than that of 15-29 years of women "Table 3". Women who had pursued secondary level of education were 0.87 times less likely to have NCD risk factors. Married and widowed/divorced/separated women were 2.91 and 3.09 times more likely to have NCD risk factors. Similarly, richest women were 1.5 times more likely to suffer from NCDs risk factors in comparison to poorest women. Furthermore, women employed in agriculture sector were 0.83 times less likely to suffer from NCD risk factors than women who were not employed. Regarding ethnicity, Dalit women were more likely to have NCD risk factors in comparison to advantage group.

Discussion

NCDs have different consequences for women in comparison to men.[10] In resource challenged setting like Nepal, diagnosis and care for NCDs are less accessible and affordable to women due to limited health infrastructure and human-resource capacity. As a result, NCDs are often detected at the late stage that invites women for a premature death. So, this study aimed to identify at risk women to possess NCDs risk factors. This information could be useful in designing preventative strategies against NCDs risk factors.

Tobacco use

Our study demonstrated that the proportion of tobacco use was nearly 3 fold higher in 30-40 years age group women. This finding is in line with previous studies conducted across different countries.[11,12] Women aged between 30 and 40 years are likely to possess the adolescent children thus maternal smoking could significantly contribute to tobacco use in young adolescent.[13] High prevalence of tobacco use in the women with childbearing age is also critical in terms of adverse maternal and child health outcomes in perinatal period.[14]

Our study showed a negative association between smoking and education; the prevalence ratios among the participants having secondary and higher education being lower than those having no education. This finding is similar to that of previous studies.[11,12]

In this study, tobacco use was higher in divorced women than married women. Similar kind of evidence was reported in other studies, especially related with tobacco smoke.[11,15], which suggest that the death of loved ones can encourage women to opt smoking with intention of coping stress arising from the death of intimate partner.[16,17]

Unlike the findings from other national studies, [11,18] it is interesting to note that prevalence of smoking did not vary significantly between rural and urban participants. However, it should be

taken into consideration that large number of geographical cluster previously considered as rural areas have recently been upgraded as urban that somehow makes the comparison difficult. Generally, people with low socioeconomic status are likely to use tobacco, probably due to lack of proper social support environment against tobacco use.[19] Our study also demonstrated the same finding that the poorest has the highest proportion of tobacco user across all hierarchies of wealth quintile. Evidence suggest that increase in taxation can be other effective strategy in controlling tobacco as there seem to be high price elasticity particularly low and middle income countries like Nepal.[20] Around 10% increase in price is found to reduce smoking by about 8% in low- and middle-income countries and by 4% in high-income countries.[21]

This is the first study to repute and compare smoking prevalence by Provinces of Nepale. Findings show that women from province 2 and province 5 were less likely to use any form of tobacco in comparision to women residing in other provinces. Province 2 and a major portion of province 5 share a similar kind geographical terrain i.e plain, where the media accessibility among women is high in comparison to other.[22]

The observed discrepancy in smoking prevalence by socioeconomic status may be related to less successful quiet attempts in disadvantaged groups.[19] Population level interventions such as smoke free legislation and mass media campaign tailored to the need of disadvantaged communities are thus need to reduce high smoking prevalence in the disadvantaged groups.

Obesity

The current study found that the likelihood of being overweight/obesity is influenced by age, married marital status and wealth status. There is an increase in prevalence of overweight with

increase age, this finding is line with findings of STEPS Nepal 2013 survey and studies from Bangladesh[2,4]. Similarly, this study found that married women were more likely to be overweight in comparison to unmarried women. Broadly, literatures explain that smoking and habit of looking attractive is related with obesity. [23,24] However, our another findings related with widowed/divorce were different than established crisis model. This model explains that stresses linked to marital disruption can invite psychological, physiological, and social consequences that might lead to weight loss.[24,25] However, this model explains that weight loss is short lived, individuals are expected to gain weight to their new social and economic environment.

Furthermore; wealthy women are on risk of getting overweight in comparison to poor women. The increased risk of getting overweight among wealthy and elderly women may be due to reduced level of physical activity with increased age and wealth status. Maternal obesity is a public health concern. The prevalence of overweight/obesity in reproductive age women is nearly tripled from 9% in last ten years in Nepal.[9,22,26].With the global rise in maternal obesity,[27] more mother and child are at risk of dying. There is a growing evidence that maternal obesity can substantially interfere in fetal development and determines the long term health of the offspring.[28] Similarly, it is also a major risk factor for gestational diabetes, preeclampsia and pregnancy induced hypertension in women. [29,30]

On the other hand, societal and nutritional changes due to economic growth and globalization of food market might have contributed the rising obesity rates. The lower level of education and health literacy among poor also contributes to difficulty in purchasing less energy dense food such as fruits and vegetable.

Further research in the area of food security, dietary pattern and physical activities by socio economic status is needed to rule out causes of obesity for women from low socioeconomic background versus high socioeconomic status. Intervention to tackle obesity requires targeting social and economic factors**.**

Hypertension

The prevalence of hypertension seems to increase with increasing age, which is in line with results of secondary data analysis of Nepal STEPS survey 2013 and other evidences as well.[31-33] However, age being a non-modifiable risk factor, hypertension control initiatives should focus on lowering other modifiable risk factors that can be useful in countering the effect of increasing age.

The prevalence of hypertension was significantly higher among the richest segment of study participants. Similarly, chance of getting hypertension is significant in richest segment of population. Similar type of evidence was observed i.e higher prevalence of hypertension among richest segment in general population of Bangladesh.[33] It could be because of lower level of physical activity associated with involvement in more sedentary type of occupation, consumption of red meat, smoking and alcohol consumption.

Compared to province 1, province 7 have lower prevalence of hypertension. It can be due to differences in level of physical activity associated with occupational practices, dietary pattern, and differences in established risk factors of hypertensions like smoking and alcohol consumption.

Clustering of NCDs risk factors and its implication

Our study suggested that clustering of NCDs risk factors increases with growing age, among well-off, and in Dalits and Janajatis - known as the disadvantaged ethnic groups in Nepal.

Previous studies have also revealed that clustering of risk factors becomes increasingly common with increasing age [2,3,34]. A multi country study from Bangladesh, Vietnam, India, Indonesia and Thailand shows that there is increase in clustering of risk factors with increasing age among females.[35] As Nepal has been witnessing rapid increase in life expectancy and median age of the population, the problems can escalate in coming years.[36] Country may need additional investment in prevention as well as long term care for NCDs to cater the need of geriatric population. Moreover, NCDs are considered to have serious impact in economic growth of the country reducing it by almost 5–10%.[37]

Similarly, this study depicts the odds of clustering of NCDs risk factors higher among wealthiest women. This findings is similar to that of secondary data analysis of national STEPS survey from Bhutan.[38] Clustering of more NCDs risk factors in wealthy group can be linked with adoption of sedentary lifestyle among wealthy women. Furthermore, from provincial point of view provincial 3 and Gandaki province is not related with clustering of NCDs risk factors, however, other provinces had reduced odds of clustering of NCDs risk factors. This can be again viewed from the perspective of sedentary lifestyle with reference to urbanization. In comparison to province 1, province 3 and Gandaki province, other provinces are less urbanized that reduces odds of adoption of sedentary lifestyle. Ultimately, this might have contributed in reducing odds of clustering of NCD risk factors among women residing in province 5, Karnali and Sudurpaschim.

In contradiction to the study in Bangladesh, which revealed an increase in clustering of risk factors with increasing educational level, however our study shows that women who have secondary level of education had lower risk of clustering of NCDs risk factors. [35] The

difference in evidence may be due to difference in NCDs prevention and control contents in secondary level education.

Furthermore, women involved in agriculture (self-employed) sector have low odds of clustering of NCDs risk factors. Generally, self-employed agriculture work is expected to increase the vigorous physical activity. Vigorous physical activity is a protective factor against obesity and it is expected to lower down the risk of clustering NCDs risk factors.[39]

As the burden of NCDs is increasing, evidence on clustering of NCDs risk factors is useful form the perspective of allocating and mobilizing resources in public health programme. The clustering of NCDs risk factors in a particular group indicte higher chances of NCDs burden on that particular group. This situation creates public health challenge; however, it can be also be an opportunity to tailor intervention for specific group of population to prevent the burden of NCDs. The limitation of this study is the nature of study i.e cross-sectional design that limit to establish causality. Similarly, all NCD risk factors like physical inactivity, fruit and vegetable intake, cholesterol level related information was not taken main survey. That had limited us to understand completed picture of NCDs risk factors among women.

Conclusion

Overweight is the common NCD related risk factors among the 15-49 years women. The occurrence of NCDs related risk factors is higher in higher age group. However, in case of relationship of smoking with respect to wealth quintile relationship is inverse. Similarly, study reveals that chances of clustering of NCDs related risk factors get increases with increasing age. Furthermore, chances of clustering of NCDs risk factors are higher on disadvantaged ethnic group and richest women.

References

1. World Health Organization(WHO) (2018) Noncommunicable diseases. WHO.

2. Zaman MM, Bhuiyan MR, Karim MN, MoniruzZaman, Rahman MM, et al. (2015) Clustering of non-communicable diseases risk factors in Bangladeshi adults: An analysis of STEPS survey 2013. BMC Public Health 15: 659.

3. Ahmed SM, Hadi A, Razzaque A, Ashraf A, Juvekar S, et al. (2009) Clustering of chronic non-communicable disease risk factors among selected Asian populations: levels and determinants. Global health action 2: 10.3402/gha.v3402i3400.1986.

4. Ministry of Health, Nepal Health Research Council, Organization WH (2013) Non-communicable Diseases Risk Factors: STEPS survey Nepal 2013. Kathmandu: Nepal Health Research Council.

5. Khuwaja AK, Kadir MM (2010) Gender differences and clustering pattern of behavioural risk factors for chronic non-communicable diseases: community-based study from a developing country. Chronic Illn 6: 163-170.

6. Gluckman PD, Hanson MA, Bateson P, Beedle AS, Law CM, et al. (2009) Towards a new developmental synthesis: adaptive developmental plasticity and human disease. Lancet 373: 1654-1657.

7. Godfrey KM, Gluckman PD, Hanson MA (2010) Developmental origins of metabolic disease: life course and intergenerational perspectives. Trends Endocrinol Metab 21: 199-205.

8. DeVon HA, Ryan CJ, Ochs AL, Shapiro M (2008) Symptoms across the continuum of acute coronary syndromes: differences between women and men. Am J Crit Care 17: 14-24; quiz 25.

9. Ministry of Health, New ERA, ICF (2012) Nepal Demographic and Health Survey 2011. Kathmandu,Nepal: Ministry of Health, Nepal.

10. Peters SAE, Woodward M, Jha V, Kennedy S, Norton R (2016) Women's health: a new global agenda. BMJ Global Health 1: e000080.

11. Bista B, Mehata S, Aryal KK, Thapa P, Pandey AR, et al. (2015) Socio-demographic Predictors of Tobacco Use among Women of Nepal: Evidence from Non Communicable Disease Risk Factors STEPS Survey Nepal 2013. J Nepal Health Res Counc 13: 14-19.

12. Das R, Baidya S (2014) Prevalence of tobacco use among rural women of Mohanpur block, West Tripura district. Al Ameen J Med Sc i 7: 270-274.

13. Xi B, Liang Y, Liu Y, Yan Y, Zhao M, et al. (2016) Tobacco use and second-hand smoke exposure in young adolescents aged 12–15 years: data from 68 low-income and middle-income countries. The Lancet Global Health 4: e795-e805.

14. Andres RL, Day M-C (2000) Perinatal complications associated with maternal tobacco use. Seminars in Neonatology 5: 231-241.

15. Hodge FS, Casken J (1999) Characteristics of American Indian women cigarette smokers: prevalence and cessation status. Health Care Women Int 20: 455-469.

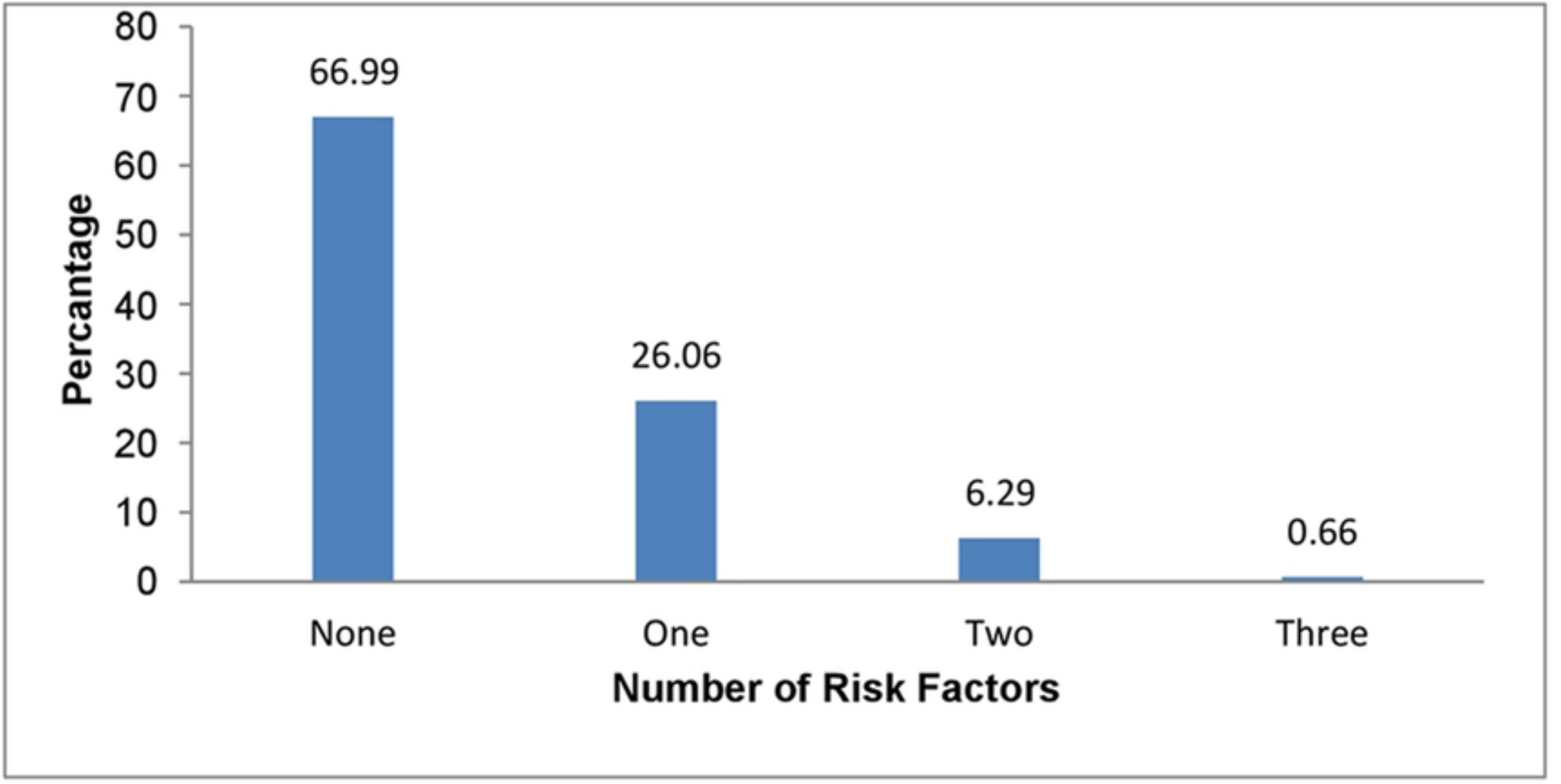
16. Doherty EW, Doherty WJ (1998) Smoke gets in your eyes: Cigarette smoking and divorce in a national sample of American adults. Families, Systems, & Health 16: 393.

17. McKee SA, Maciejewski PK, Falba T, Mazure CM (2003) Sex differences in the effects of stressful life events on changes in smoking status. Addiction 98: 847-855.

18. Aryal UR, Bhatta DN, Shrestha N, Gautam A (2015) Assessment of nicotine dependence among smokers in Nepal: a community based cross-sectional study. Tobacco induced diseases 13: 26-26.
19. Hiscock R, Bauld L, Amos A, Fidler JA, Munafo M (2012) Socioeconomic status and smoking: a review. Ann N Y Acad Sci 1248: 107-123.
20. G.Emmanuel Guindon A-MP, David Boisclair Higher tobacco prices and taxes in South-East Asia:An effective tool to reduce tobacco use,save lives and generate revenue. The World Bank.
21. Jha P, Chaloupka FJ (2000) Tobacco control in developing countries: Oxford University Press.
22. Ministry of Health, New ERA, ICF (2017) Nepal Demographic and Health Survey 2016. Kathmandu,Nepal: Ministry of Health, Nepal.
23. Flegal KM, Troiano RP, Pamuk ER, Kuczmarski RJ, Campbell SM (1995) The influence of smoking cessation on the prevalence of overweight in the United States. N Engl J Med 333: 1165-1170.
24. Teachman J (2016) Body Weight, Marital Status, and Changes in Marital Status. J Fam Issues 37: 74-96.
25. Umberson D, Liu H, Powers D (2009) Marital status, marital transitions, and body weight. J Health Soc Behav 50: 327-343.
26. Ministry of Health, New ERA, ICF (2007) Nepal Demographic and Health Survey 2006. Kathmandu,Nepal: Ministry of Health, Nepal.
27. Godfrey KM, Reynolds RM, Prescott SL, Nyirenda M, Jaddoe VWV, et al. (2017) Influence of maternal obesity on the long-term health of offspring. The Lancet Diabetes & Endocrinology 5: 53-64.
28. Fleming TP, Watkins AJ, Velazquez MA, Mathers JC, Prentice AM, et al. (2018) Origins of lifetime health around the time of conception: causes and consequences. The Lancet 391: 1842-1852.
29. Athukorala C, Rumbold AR, Willson KJ, Crowther CA (2010) The risk of adverse pregnancy outcomes in women who are overweight or obese. BMC Pregnancy and Childbirth 10: 56.
30. Ayensu J, Annan RA, Edusei A, Badu E (2016) Impact of maternal weight on pregnancy outcomes: a systematic review. Nutrition & Food Science 46: 542-556.
31. Aryal KK, Mehata S, Neupane S, Vaidya A, Dhimal M, et al. (2015) The Burden and Determinants of Non Communicable Diseases Risk Factors in Nepal: Findings from a Nationwide STEPS Survey. PLOS ONE 10: e0134834.
32. Yoon SS, Carroll MD, Fryar CD (2015) Hypertension Prevalence and Control Among Adults: United States, 2011-2014. NCHS Data Brief: 1-8.
33. Khanam MA, Lindeboom W, Razzaque A, Niessen L, Milton AH (2015) Prevalence and determinants of pre-hypertension and hypertension among the adults in rural Bangladesh: findings from a community-based study. BMC public health 15: 203-203.

426 34. Barreto SM, Passos VMA, Firmo JOA, Guerra HL, Vidigal PG, et al. (2001) Hypertension
427 and clustering of cardiovascular risk factors in a community in Southeast Brazil: the Bambuí
428 Health and Ageing Study. Arquivos Brasileiros de Cardiologia 77: 576-581.
429 35. Ahmed SM, Hadi A, Razzaque A, Ashraf A, Juvekar S, et al. (2009) Clustering of chronic
430 non-communicable disease risk factors among selected Asian populations: levels and
431 determinants. Global health action 2: 1986.
432 36. Nepal Health Research Council (NHRC), Ministry of Health and Population(MoHP),
433 Monitoring Evaluation and Operational Research (MEOR) (2019) Nepal Burden of Disease
434 2017: A Country Report based on the Global Burden of Disease 2017 Study. Kathmandu, Nepal:
435 NHRC, MoHP and MEOR.
436 37. Ajay Mahal AK, Michael Engelgau (2010) The Economic Implications of Non-
437 Communicable Disease for India. Washington Dc: The world bank.
438 38. Pelzom D, Isaakidis P, Oo MM, Gurung MS, Yangchen P (2017) Alarming prevalence and
439 clustering of modifiable noncommunicable disease risk factors among adults in Bhutan: a
440 nationwide cross-sectional community survey. BMC Public Health 17: 975.
441 39. Bradbury KE, Guo W, Cairns BJ, Armstrong MEG, Key TJ (2017) Association between
442 physical activity and body fat percentage, with adjustment for BMI: a large cross-sectional
443 analysis of UK Biobank. BMJ Open 7: e011843.

444


80
70
60
50
40
30
20
10
0
Percantage
66.99
26.06
6.29
0.66
None
One
Two
Three
Number of Risk Factors

Figure