

# Prevalence and Determinants of Comorbid Diabetes and Hypertension in Nepal: Evidence from NCD Risk Factors STEPS Survey Nepal 2013

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## ABSTRACT

**Background:** Despite being preventable disease, diabetes and hypertension fall among top 10 leading causes of death globally. Diabetes and hypertension are independent risk factor for cardiovascular disease, and the risk is markedly increased by their co-occurrence. This study attempted to find out the prevalence of comorbid diabetes and hypertension in Nepal.

**Methods:** A cross-sectional survey was conducted among 4,200 Nepalese adults selected through multistage cluster sampling. Out of 4,200 respondents of larger study, this article includes the analysis of 3,772 respondents who granted permission for physical and biochemical measurement. Nepali version of WHO NCD STEPS instrument version 2.2 was used for data collection. In order to obtain national estimates sample weight was used. Chi-square test and multivariable binary logistic regression were used to assess the association of socio-economic predictors with comorbid conditions after adjusting effect of clusters and strata.

**Results:** The overall prevalence of comorbid diabetes and hypertension was found to be 2% in Nepal. Considering age group 15 to 29 years as reference, people in age group 45-69 and 30 to 44 years were found to have 33 folds (AOR=33.06, 95%CI=5.90-185.35) and 6 folds (AOR=6.36, 95%CI=1.08-37.43) higher odds of developing comorbid condition of diabetes and hypertension.

**Conclusions:** Prevalence of comorbid diabetes and hypertension seem to be high in people of 45-69 years of age. Age and level of education seem to be associated with comorbid diabetes and hypertension.

**Keywords:** Diabetes; ecological region; hypertension; rural; urban.

## INTRODUCTION

The number of people with diabetes and hypertension is increasing globally.<sup>1,2</sup> Despite being preventable disease, diabetes and hypertension fall among top 10 leading causes of death globally.<sup>3</sup> Raised blood pressure is estimated to claim 7.5 million deaths attributing 12.8% of all deaths worldwide.<sup>2</sup> In 2012, an estimated 1.5 million deaths were directly caused by diabetes with more than 80% of diabetes deaths occurring in low- and

middle-income countries.<sup>4</sup>

The prevalence of diabetes has increased from 7.5 % in 2010 to 8.2% in 2014 in Nepal.<sup>5-7</sup> The prevalence of hypertension increased from 22.9 % in 2010 23.3 % in 2014.<sup>8,9</sup> Diabetes is an independent risk factor for cardiovascular disease, and the risk is markedly increased in the presence of hypertension.<sup>10-15</sup> Considering gravity of the lethal combination of diabetes and hypertension, we carried out this study

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to determine the prevalence and determinants of comorbid diabetes and hypertension in Nepal.

## METHODS

The Cross-sectional study was carried out among 4,200 Nepalese adults of age 15 to 69 years selected through multistage cluster sampling method. Seventy out of 921 Ilakas of Nepal which represented Mountain (5 Ilakas), Hill (30 Ilakas) and Tarai (35 Ilakas) were selected as Primary Sampling Unit (PSU). Three wards from each cluster were selected using Probability Proportionate to Size (PPS) method with total of 210 wards and 20 households were selected from each ward using systematic sampling method. One participant from the eligible candidates (15-69 years) in households was selected through the Kish method.<sup>16</sup> Out of 4,200 respondents of larger study, 4,130 (98.3%) granted permission for physical measurement and 3,772 (89.8%) granted permission for biochemical measurement.

The survey was conducted using the WHO NCD STEPS instrument version 2.2, of which STEP I deals with behavioural risk factors, STEP II deals with physical measurements, and STEP III deals with biochemical measurements.<sup>17</sup>

For the purpose of this study, Hypertension was defined as systolic blood pressure  $\geq 140$  mmHg and/or diastolic blood pressure  $\geq 90$  mmHg. Diabetes mellitus was defined as plasma venous value of blood glucose  $\geq 126$ mg/dl or including those in medication.

eSTEPS software was used to design and program the data collection tools in the Personal Digital Assistants (PDA). The datasets from every individual PDA were then transferred to SPSS 16.0 and merged into a single SPSS file. Data cleaning and editing was done in the SPSS. In order to obtain national estimates sample weight was used. The weight was calculated adjusting the probability of selections of Primary Sampling Unit (PSU), Secondary Sampling Unit (SSU), Tertiary Sampling Unit (TSU), individual respondents and non-response given the study used multistage sampling. Firstly, the probabilities of selections at individual level was calculated and multiplied in order to get a final probability. Finally, inverse of selection probability was used as

sample weight. Chi-square test and multivariable binary logistic regression were used to assess the association of different factors with comorbid diabetes and hypertension after adjusting effect of clusters and strata. Analysis was done with STATA version 13 and 95% of Confidence Intervals (CI) were calculated for odds ratio. The detail description of methodology is available elsewhere.<sup>18</sup>

The study was approved by the Ethical Review Board of the Nepal Health Research Council. Formal permission was taken from the concerned authorities in the selected districts, VDCs and municipalities. An informed written consent was obtained from all the research participants.

## RESULTS

The overall prevalence of comorbid diabetes and hypertension was found to be 2% (95% CI=1.55-2.67) in Nepal. Detail findings about the prevalence of hypertension and diabetes are published elsewhere.<sup>18</sup> Significant differences in prevalence of comorbid diabetes and hypertension was noted in case of age group. Prevalence of comorbid hypertension and diabetes was found to be maximum in age group 45 to 69 (5.52%, 95% CI=4.17-72.8) which was more than three folds higher than that of age group 30 to 44 years (1.56%, 95% CI=0.92-2.63). Prevalence was more in males (2.52%, 95% CI=1.76-3.57) compared to female (1.59%, 95% CI=1.16-2.17) and more in Hills (2.04, 95% CI=1.24-3.33) and Tarai region (2.25, 95% CI=1.66-3.04) compared to Mountain (0.27, 95% CI=0.04-1.73). Prevalence in urban areas was 2.88% (95% CI=1.85-4.48) while it was 1.83% in rural areas (95% CI=1.31-2.55). Regarding level of education, prevalence was 2.52% (95% CI=1.43-4.42) in those who had education higher than secondary level followed by those who had primary level education with 2.28% (95% CI=1.49-3.48). Divorce/widow/separated (3.3%, 95% CI=1.61-6.62) and currently married (2.43%, 95% CI=1.83-3.22) seem to be more affected compared to those who were never married (0.15%, 95% CI=0.028-0.78). Prevalence was found to be 3.21% (95% CI=1.34-7.52) in relatively advantaged janajati, 2.15% (95% CI=1.43-3.22) in upper caste group, 2.04% (95% CI=0.99-4.13) in dalit, 2.02% (95% CI=0.68-5.84) in religious minorities, 1.9% (95% CI=1.22-2.96) in

disadvantaged Janajati and 0.92% (95% CI=0.43-1.96) in disadvantaged non-dalit Tarai Caste group. (Table 1)

**Table 1. Prevalence and distribution of comorbid diabetes and hypertension in Nepal.**

	Weighted Total	Comorbid diabetes and hypertension			p
		N	%	95% CI	
<b>Age group</b>					
15-29	852	0.25	0.06	0.99	<0.001
30-44	1417	1.56	0.92	2.63	
45-69	1488	5.52	4.17	72.8	
<b>Gender</b>					
Men	1190	2.51	1.76	3.57	0.024
Women	2567	1.59	1.16	2.17	
<b>Ecological zone</b>					
Hill	1579	2.04	1.24	3.33	0.164
Mountain	264	0.27	0.04	1.73	
Tarai	1914	2.25	1.66	3.04	
<b>Place of residence</b>					
Rural	3045	1.83	1.31	2.55	0.105
Urban	712	2.88	1.85	4.48	
<b>Level of education</b>					
No formal schooling	1669	1.59	1.07	2.34	0.515
Primary	924	2.28	1.49	3.48	
Secondary	713	1.98	1.19	3.26	
Higher education	451	2.52	1.43	4.42	
<b>Marital status*</b>					
Never married	299	0.15	0.028	0.78	<0.001
Currently married	3250	2.43	1.83	3.22	
Divorce/Widow/Separated	207	3.3	1.61	6.62	
<b>Caste/ethnicity</b>					
Dalit	321	2.04	0.99	4.13	0.437
Disadvantaged Janajatis	1171	1.9	1.22	2.93	
Disadvantaged non Dalit Tarai caste groups	296	0.92	0.43	1.96	
Religious minorities	46	2.02	0.68	5.84	
Relatively advantaged Janajatis	291	3.21	1.34	7.52	
Upper caste groups	1632	2.15	1.43	3.22	

Total 3757 2.04 1.55 2.67

\*missing =1

Considering age group 15 to 29 years as reference, people in age group 45-69 and 30 to 44 years were found to have 33 folds (AOR=33.06, 95% CI=5.90-185.35) and 6 folds (AOR=6.36, 95% CI=1.08-37.43) higher odds of developing comorbid condition of diabetes and hypertension. Compared to those who did not have any formal education, those who had completed primary education (AOR=2.86, 95% CI=1.52-5.36), secondary level education (AOR=3.96, 95% CI=2.05-7.66) and higher education (AOR=7.61, 95% CI=3.59-16.16) were found to have greater odds of developing comorbid diabetes and hypertension. Considering dalit as a reference group, disadvantaged non-dalit Tarai caste groups (AOR=0.26, 95% CI=0.09-0.80) were found to have lower chance of developing the comorbid condition while other ethnic group did not have any significant association. (Table 2)

**Table 2. Determinants of comorbid diabetes and hypertension in Nepal.**

	Adjusted Odds Ratio	95% Conf. Interval		p
<b>Age group</b>				
15-29	1			
30-44	6.36	1.08	37.43	0.04
45-69	33.06	5.90	185.35	<0.001
<b>Gender</b>				
Men	1			
Women	1.15	0.74	1.80	0.53
<b>Ecological zone</b>				
Hill	1			
Mountain	0.18	0.02	1.54	0.12
Tarai	1.66	0.89	3.12	0.11
<b>Place of residence</b>				
Rural	1			
Urban	1.19	0.59	2.40	0.63
<b>Level of education</b>				
No formal schooling	1			
Primary	2.86	1.52	5.36	<0.001
Secondary	3.96	2.05	7.66	<0.001
Higher education	7.61	3.59	16.16	<0.001

<b>Marital status</b>				
Never married	1			
Currently married	3.71	0.35	39.07	0.27
Divorce/Widow/ Separated	4.06	0.29	57.75	0.30
<b>Caste/ethnicity</b>				
Dalit	1			
Disadvantaged Janajatis	0.68	0.28	1.63	0.38
Disadvantaged non-Dalit Tarai caste groups	0.26	0.09	0.80	0.02
Religious minorities	0.50	0.11	2.41	0.39
Relatively advantaged Janajatis	0.77	0.22	2.74	0.69
Upper caste groups	0.57	0.24	1.36	0.21

## DISCUSSION

This is the first community based prevalence study in Nepal which presents findings of comorbid diabetes and hypertension among the 15-69 years age group. Prevalence of comorbid condition of diabetes and hypertension in our study seem to be lower than prevalence found in United States of America.<sup>19</sup> This is usual as the prevalence of diabetes alone and hypertension alone that share most of the risk factors of comorbid diabetes and hypertension are also more prevalent in United States of America compared to Nepal.<sup>7, 18, 20, 21</sup>

In previous study in Australia, hypertension was found to be one of the most common comorbid condition occurring in diabetic people with around 50% of diabetic population having hypertension.<sup>22</sup> In similar study done in China, 24.3% of patients with essential hypertension were found to have diabetes while prevalence of hypertension in diabetes patient was found to be 25.6% in India.<sup>23</sup> <sup>24</sup>Diabetes tends to increase the total amount of fluid in the body, which tends to raise blood pressure which is further complicated by increased arterial stiffness. Owing to sharing of some most common risk factors and physiological traits, hypertension is twice more common in diabetic patients than non diabetic.<sup>25, 26</sup>

Comorbid condition of diabetes and hypertension seems more common with increasing age. However, due to wide confidence interval, some caution need to be taken in interpretation of this finding. This association of comorbid diabetes and hypertension might be because diabetes alone and hypertension alone are also more common with increasing age and these conditions tend to co-occur increasing the likelihood of comorbid diabetes and hypertension.<sup>7, 23, 24</sup>

Studies in some other countries have shown that co-occurrence of diabetes and hypertension enhances the development of macro-vascular and micro-vascular diseases.<sup>28-31</sup> People with both diabetes and hypertension tend to have approximately twice the risk of cardiovascular disease as non-diabetic people with hypertension. Previous studies have also found that hypertensive diabetic patients are also at increased risk for diabetes-specific complications including retinopathy and nephropathy.<sup>25, 26</sup> So, even if the prevalence of comorbid condition seems to be less, it deserves attention because of the seriousness of its consequences.

In contradiction to the findings in Cameroon where education had no significant association with the condition, individuals with higher education level in our study were found to be at more risk of developing the condition.<sup>10</sup> Education might have served as proxy of higher social standing, better income and more luxurious life thus with limited physical activity which has been shown to increase the risk of diabetes alone, hypertension alone or comorbid condition of diabetes and hypertension.

Among different ethnic groups, relatively lower odds of developing the condition were found in case of disadvantaged non-dalit Tarai caste groups. This might have resulted due to the difference in lifestyle and dietary practices of disadvantaged non dalit Tarai caste group with other ethnic groups in Nepal.

Since the study was a cross-sectional study, it does not give the idea whether diabetes occurred before hypertension or hypertension occurred before diabetes in the respondents and demands

prospective study. Because of lower sample size, confidence interval of odds ratio seem to be wide which permits interpretation of odds ratio with some precaution. Large scale studies with grater sample size are needed to further increase the precision of the study. Despite these limitations, this population based study provides first baseline information about prevalence of comorbid diabetes and hypertension in Nepal.

## CONCLUSIONS

Prevalence of comorbid diabetes and hypertension seem to be high in people of 45-69 years of age. Level of education also seem to be associated with comorbid diabetes and hypertension. Although the prevalence seem to be high in higher age group, interventions intended to control the condition need to target early stage of life as lifestyles that increase the likelihood of disease are ingrained in earlier stage of life.

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