Determinant of Stroke among Adult Patients with Hypertension in Ayder Comprehensive Specialized Hospital, Tigray, Ethiopia, 2018: A Case Control Study

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Haftea Hagos mekonen
Adigrat University

hafteahagos2@gmail.com
Corresponding Author

Mulugeta Molla Brhanu
St. Paul’s Hospital, Millennium Medical College

Tilahun Belete Mossie
Bahirdar University

Hagos Tsegabrhon Gebreslassie
Mekelle University

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Abstract

Background: Stroke is a chronic non-communicable disease results from infraction or spontaneous hemorrhage in the brain. The burden of stroke is increasing in alarming rate globally. In 2013 there were 6.5 million stroke deaths, 113 million disability-adjusted life years due to stroke from this, 75.2% of all stroke mortality and 81.0% of stroke-related disability-adjusted life years are from the developing countries. In Ethiopia, 7% of total deaths are attributed by stroke. This study aims to assess the determinants of stroke among patients with hypertension in Ayder Comprehensive Specialized Hospital, Mekelle, Tigray, Ethiopia, in 2018.

Methods: Hospital-based case-control study was conducted from February to April 2018. Cases were adult hypertensive patients with stroke and controls were adult hypertensive patients without stroke. Using a systematic random sampling technique 89 case and 356 controls were included in this study. Record review, physical measurement and interview techniques were used to collect data. Data was entered and analyzed by using SPSS version 23. Variables with a p-value less than 0.25 in bivariate logistic regression were selected for multivariable logistic regression. The adjusted odds ratio and 95% confidence interval were used to determine the association. P-value <0.05 was used to declare statistical significance in multivariable analysis.

Result: The mean age of cases were 56.3 years (SD±13.53 years) and 51.9 years (SD±12.67 years) for controls. Majority 59 (66.3%) of the case and around one third 106 (30%) of controls were non-adherent to medication. Lost to follow up (AOR=2.474, 95%CI: 1.368-4.929), alcohol drinking (AOR=2.440, 95%CI: 1.291-4.613), use of salty diet (AOR=3.249, 95%CI: (1.544-6.837), medication non-adherence (AOR=3.967, 95%CI: 2.256-6.973), uncontrolled systolic blood pressure, (AOR=3.196, 95%CI: 1.60-6.382), uncontrolled diastolic blood pressure (AOR=2.204, 95%CI: 1.130-4.297) and high cholesterol level(AOR=2.413, 95%CI: 1.319-4.414) were found to be significant determinants.

Conclusion: Alcohol consumption, lost to follow up, salty diet, high cholesterol level and uncontrolled systolic and diastolic blood pressure were significantly associated with stroke so, health education on lifestyle practices and hypertension-related complications in each follow-up visit through health professionals are very essential to avert the problem.

Keywords: Stroke, Hypertension, determinant, Mekelle, Ethiopia
Background

Stroke is a chronic non-communicable disease causes sudden global focal neurological deficit resulting from infraction or spontaneous hemorrhage in the brain[1]. The incidence of stroke on the past four decades (1970-2010) showed, 100% increases in low and middle-income countries but it decreases by 42% in developed countries[2]. In 2013, there were 6.5 million stroke deaths, 113 million disability-adjusted life years due to stroke. Of all, 75.2% of stroke mortality and 81.0% of stroke-related disability- adjusted life years were in developing countries[3].

In addition to the health consequence cardiovascular disease and stroke has a major impact in economic development. World Economic Forum and WHO forecasts above 7 trillion American dollar over the period 2011-2025 in low and middle-income countries (LMIC)[4].

The American heart association plans to reduce disease and deaths from stroke by 20 percent in 2020 by focusing on seven key health factors and behaviors that decreases risk for stroke, those are not-smoking, physical activity, healthy diet, body weight, and control of cholesterol, blood pressure, and blood sugar[5].

Different studies in different parts of the world stated the common determinant of stroke: age, sex, and smoking, low physical exercise, obesity, alcohol, anti-hypertensive medication non-adherence, uncontrolled blood pressure, being diabetic, and cholesterol level (10)[4, 6-9] But the above factors are different across the studies.

In 2015/16-2019/20 the Ethiopian health sector development program projects to decrease by 12.5% premature mortality from NCDs[10]. In Ethiopia, currently stroke is one of the greatest public health problem, accounts 7% of total deaths[11]. Study in Mekelle, Ethiopia showed that stroke was the third common cause of medical intensive care unit admission (15.2%) and the first cause of death which accounts 17% of all death in medical intensive care unit[12]. Similarly hypertension is responsible for 66.2% of all strokes admission and 38% of all stroke were on anti-hypertensive treatment[13].

In Ethiopia although, admission of stroke patients to the hospitals due to hypertension is increased from time to time, there are limited findings which aim to explore those determinants.

Therefore, this study aims to assess the determinants of stroke among hypertensive patients at Ayder
Methods

Study setting

Ayder Comprehensive Specialized Hospital is found in Mekelle, Tigray regional state, Ethiopia. Mekelle is found at 783 Km north of Addis Ababa. Mekelle has total population 586,897. Mekelle city has nine governmental health centers, one referral Hospital and one military Hospital and two general hospitals. Ayder Comprehensive Specialized Hospital begins its referral and non-referral services in 2008 to the 9 million populations in its catchment areas of the Tigray, Afar and parts of the Amhara regional states in Ethiopia[14].

Ayder Comprehensive Specialized Hospital has capacity of about 500 beds in four major departments and other specialty units. Patient flow of ACSH is above170, 000 per year. The hospital provides hypertensive service in cardiac unit and stroke service in neurology unit. Medical ward, medical ICU, cardiac unit and diabetic unit were the study units[14].

Study design and period

A case-control study was conducted in Ayder comprehensive specialized Hospital, Tigray from February to April 2018.

Population and sampling

Cases were all sampled adult hypertensive patients with stroke diagnosed by the neurologist (consultant internist) or confirmed by brain imaging (CT-scan) or MRI. Controls were all sampled adult hypertensive patients without clinical evidence of stroke and without a history of stroke at ACSH during the data collection period. Cases with less than three follow-ups for hypertension treatment before first stroke occurrence and controls with less than three follow-ups for hypertension treatment were excluded. Pregnant mothers were also excluded from both cases and controls. The sample size was calculated using Epi Info version 7 statistical software using the following assumptions: a proportion of 10.7% and 24.1% of greater alcohol consumption was considered for controls and cases respectively[7] at 95% CI, 80% power. The case to control ratio was 1:4. Using those information 81 cases and 324 controls were selected but after adding 10% non-response rate the total sample
becomes 445 of which 89 were cases and 356 were controls. Finally eligible cases and controls recruited using systematic sampling technique.

**Data Collection Procedure**

Record review of hypertensive and stroke patients was conducted to identify cases and controls. Information on socio-demographic data and behavioral risk factors for stroke was obtained from the patient or close relative (for unconscious cases) by interview.

Medical history like clinical duration of hypertension, type of stroke, the presence of stroke, and complication other than stroke was taken from the patient record. Height, weight, blood pressure, total cholesterol level and fasting blood sugar were taken during data collection.

During data collection data collector measures weight, height, blood pressure, as follows. Weight was measured in light closing and without shoes by calibrated UNICEF Seca digital weighing scale. Stadiometer in centimeter in erect position at a precision of 0.1cm without shoes was used to measure height. Mercury sphygmomanometer was used to measure blood pressure average of two measurements 5 minutes apart was recorded for those who we take BP during the data collection.

**Assessment and definition of variables**

**Outcome variable:** Stroke

**Independent variables**

**Scio demographic included:** age, sex, marital status, occupation, residency and educational status.

**Behavioral factors included:** Physical exercise, Smoking, alcohol, frequency of fellow up, salty diet, fatty food use, loss to fellow up, medication adherence

physical exercise physically active- if patients make regular physical activities 30 minutes and above, 5 days and above per week physically inactive- if patient is make physical exercise less than 30 minutes per week or less than 5 days per week[15]. Medication adherence was assessed using Morisky medication adherence score to anti-hypertensive medications having eight questions each with yes=0 and No=1, adherent if they score 7-8 and non-adherent if they score <=6[16].

Alcohol drinker- a person who drinks 10.5 unites of alcohol and above per week[15].

**Physical measurements and clinical factors:** Fasting blood glucose (FBG), cholesterol level,
blood pressure control, body mass index (BMI) and comorbidities. Normal FBG <126 mg/dl, raised FBG >=126 mg/dl[7].

Cholesterol level: normal if less than 200 and high cholesterol level 200 and above, BMI: underweight(less than 18.5), normal (18.5-24.9), over weight (25-29.9) and obese (30 and above).
Systolic blood pressure: controlled(<140) and uncontrolled (>=140), diastolic blood pressure: controlled (<90) and uncontrolled(>=90)[17]. Comorbidities: yes if patient has any known medical disease.

**Data analysis and management**

Data were cleaned, coded, entered and analyzed using SPSS version 23. Summary statistics: frequencies tables and graphs were used to present for categorical variables and mean, median for continuous variables in both cases and controls.

First bivariate logistic regression was done to assess the association between each independent variable and the dependent variable. Variable with a P-value < 0.25 significance level in bivariate logistic regression was taken to multivariable logistic regression. Finally multivariable logistic regression was used to assess the association between independent variables with the dependent variable and to control confounding variables. Adjusted odds ratio and P-value <0.05 and with 95% CI was used to declare statistical significance.

**Results**

**Socio-demographic characteristics:**

All 445 selected participants (89 cases and 356 controls) were participated in the study and the response rate was 100%. The mean age of cases was 56.3 years (SD±13.53 years) and 51.9 years (SD±12.67 years) for controls.

The majority of subjects were married; 64 % in cases and 66% in controls. Thirty (33.3%) of the cases and 117(32.9%) of controls were self-employee (Table 1).

**Behavioral factors of the respondents**

Out of 89 cases and 356 controls 32(36%) of cases and 49(13.8%) controls were current alcohol drinkers. Twenty two (24.7%) cases and 28(7.9%) of controls of were not reduce salt in their diet. In
this study 66.3% of the cases and 29.8% of controls were non-adherent to medication. Sixty three (70.8%) and 245 (68.8%) controls were not on regular exercise. 36% of cases and 12.9 of controls had lost to follow up. Fifty two (58.4%) of cases and 215 (60.4%) of controls had every two months regular follow up (Table 2).

**Biological, physical measurements and Clinical Characteristics of the respondents**

Among the study participants, 13 (14.6%) of cases and 60 (16.9%) of controls were overweight. The clinical characteristics of patients showed that 5 (5.6%) of cases and 25 (7%) of controls of the participants had a family history of stroke (Table 3). The mean of the clinical duration of hypertension was 4.65 ± 3.3 years for cases and 3.94 ± 3.18 years for controls. The mean of total cholesterol was 198 ± 34 among cases and 182 ± 27 for controls. The mean systolic blood pressure was 150 ± 14 in case and 145 ± 17 in controls. The mean diastolic blood pressure was 92 ± 7 in case and 90 ± 9 in controls.

**Types of stroke and method used to diagnosis**

The type of stroke (ischemic or hemorrhagic) and the tool by what they identified could be diagnosed was from the patients chart. Out of 89 cases 29 were ischemic stroke cases and 60 were hemorrhagic stroke. From all stroke 80% were diagnosed by CT scan, 4.5% by MRI and 15.7% clinically.

**Bivariate and multivariable logistic regression for factors associated with stroke among hypertensive patients**

The bivariate analysis result reveals that age, lost to follow up, alcohol drinkers after he/she know their hypertensive status, use of salty diet, use of fatty diet; medication non non-adherence, high cholesterol level, and uncontrolled systolic and diastolic blood pressure were found be significant predictors of stroke (annex 1).

Multivariable logistic regression lost to follow up (AOR = 2.474, 95% CI: 1.368-4.929), alcohol drinkers after he/she know their hypertensive status (AOR = 2.440, 95% CI: 1.291-4.613), use of salty diet (AOR = 3.249, 95% CI: 1.544-6.837), medication non-adherence (AOR = 3.967, 95% CI: 2.256-6.973), high cholesterol level (AOR = 2.413, 95% CI: 1.319-4.414), uncontrolled systolic (AOR = 3.196, 95% CI: 1.60-6.382) and diastolic blood pressure (AOR = 2.204, 95% CI: 1.130-4.297) were found be significant
predictors of stroke (Table 4).

Discussion

This case-control study aimed to identify determinant of stroke among hypertensive patients in Ayder comprehensive specialized hospital, Tigray, north Ethiopia. Lost to follow up, current alcohol drinking, eating salty foods, medication non-adherence, high cholesterol level, uncontrolled systolic and diastolic blood pressure were determinants of stroke.

In this study, patients who had history of lost to follow up were 2.5 times more likely to be at high risk for stroke than their counterparts (AOR=2.474, 95% CI: 1.368-4.929). This finding is in agreement with a study conducted in Gaza Strip, Germany[18]. This similarity might be due to missing their routine medications and lifestyle modification counseling leads to uncontrolled hypertension.

Hypertensive patients, who were alcohol drinkers, were 2.44 times more likely to be at high risk for stroke (AOR=2.440, 95%CI: 1.291-4.613). This finding is in line with a study conducted in Nigeria[7] and in 32 countries (INTERSTROKE)[6]. This similarity might be due to alcohol has direct impact on raising blood pressure.

Hypertensive patients who did not reduce salt in diet were around 3.2 times more likely to be at high risk for stroke (AOR=3.249, 95%CI: 1.544-6.837). This is similar with a study done in 32 countries (INTERSTROKE)[6]. It is due to the fact salt have an impact on raising blood pressure on circulation then can cause stroke.

In this study medication none-adhered were 4 times (AOR=3.967, 95%CI: 2.256-6.973) more likely to be at high risk for stroke than the medication adherent patient. This finding is in line with a study done in Dhaka, Bangladesh[19]. and Gaza Strip, Germany[18].

Patients with high cholesterol level were 2.4 times (AOR=2.413, 95% CI: 1.319-4.414) more likely to be at high risk for stroke than patients with low cholesterol level. This finding is consistent with a study conducted in Nigeria[7] and Tanzania [20]. low high-density lipoprotein (HDL) (OR = 6.84, P < 0.001.[21] dyslipidemia (odds ratio, 1.52; 95% CI, 1.24 to 1.87) [22] low high-density lipoprotein cholesterol (OR, 1.81; 95% CI, 1.37-2.40)[23] This might due to cholesterol have a direct impact on block blood circulation and can cause stroke. But study Erbil reveals that there was no statistically
significant difference between the groups with and without stroke with respect to Cholesterol variation(9)[8]. This might be due to sample size, study design. The major reasons for these contradictions may be inadequate control for potential confounders or lack of data on total and type-specific stroke since different associations may exist between total cholesterol and total stroke and between total cholesterol and type-specific stroke risk.

Result of this study showed that uncontrolled systolic blood pressure is 3.2 times more likely at high risk for the development of stroke(AOR=3.196, 95%CI: 1.60-6.382) and uncontrolled diastolic blood pressure were 2.2 times more likely for the development of stroke (AOR=2.204, 95%CI: 1.130-4.297) this in lines with a study done in Puget(OR, 1.43; 95% CI, 1.17-1.75)[23]. This might be related to the fact that uncontrolled blood pressure cause hemorrhage in the brain.

Limitations
Control subjects were not recruited from general population, so selection bias of control subjects may also have affected the findings of this study. Blood pressure measurements were taken from patient’s record review hence no information was available on how BP was measured for the previous two measurements. A case control study design was used which does not allow for temporal relationship to be established.

Conclusions
Among hypertensive patients, alcohol consumption, lost to follow up, salty diet, and high cholesterol level, uncontrolled systolic and diastolic blood pressure found to be associated with stroke. Therefore, further intervention and prevention mechanism shall focus on these determinants.

Abbreviations
ACSH: Ayder Comprehensive Specialized Hospital, AOR: Adjusted Odds Ratio, BMI: Body Mass Index, CI: Confidence Interval, CT: Computed Topography scan, DM: Diabetes Mellitus, ECSA: Ethiopian Central Statistical Agency, EDHS: Ethiopian Demographic Health Survey, MRI: Magnetic Resonance Imaging, NGO: Non-Governmental Organizations, OPD: Out Patient Department, OR: Odds Ratio, SPSS: Statistical Package for the Social Science, SSA: Sub Saharan Africa, WHO: World Health Organization.

Declarations
Ethics approval and consent to participate

Ethical clearance was obtained from Mekelle University, College of health science institutional review board (IRB). Official permission was obtained from ACSH chief executive director and study participants were informed about the purpose of the study. The information was collected after obtaining written informed consent from participant (relatives for patients who were critically ill). The respondents were informed as they have the right to refuse or discontinue participation at any time if unwanted. The information was recorded anonymously and confidentiality and beneficence was assured throughout the study period.

Consent for publication

Not applicable

Availability of data and material

English version questionnaires, tables are included in supplementary additional files.

Dataset is available from the corresponding author on reasonable request.

Competing interests

We declare that there is no competing interests.

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Authors’ contributions

HH conception of research idea, study design, coordinated data collection, made analysis and interpreted findings, and drafted the manuscript. MM, TB, HT contributed in design, analysis, interpretation of the findings, and reviewed the manuscript. All authors read and approved the final version of the manuscript.

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Tables

Table 1: Socio demographic characteristics of hypertensive patients who were attending ACSH, Ethiopia (n=445), 2018

| Variables            | Control | Cases |
|----------------------|---------|-------|
|                      | Frequency | Percentage% | Frequency | Percentage% |
| Sex                  |          |        |          |        |
| Male                 | 170      | 47.8   | 46       | 51.7   |
| female               | 186      | 52.2   | 43       | 48.3   |
| Age                  |          |        |          |        |
| <45                  | 116      | 32.6   | 23       | 25.8   |
| 45-65                | 185      | 52     | 39       | 43.8   |
| >65                  | 55       | 15.4   | 27       | 30.3   |
| Religion             |          |        |          |        |
| Orthodox Christian   | 278      | 78.1   | 69       | 77.5   |
| Muslim               | 61       | 17.1   | 17       | 19.1   |
| Other                | 17       | 4.8    | 3        | 3.4    |
| Ethnicity            |          |        |          |        |
| Tigray               | 316      | 88.8   | 81       | 91     |
| Amhara               | 22       | 6.2    | 4        | 4.5    |
| Afar                 | 15       | 4.2    | 4        | 4.5    |
| Other                | 17       | 0.8    |          |        |
| Marital status       |          |        |          |        |
| Married              | 235      | 66     | 57       | 64     |
| Single               | 64       | 18     | 16       | 18     |
| Divorce              | 25       | 7      | 6        | 6.7    |
| widowed              | 32       | 9      | 10       | 11.2   |
| Educational status   |          |        |          |        |
| No formal education  | 138      | 38.8   | 31       | 34.8   |
| Primary school       | 65       | 18.3   | 25       | 29.2   |
| Secondary school     | 42       | 11.8   | 9        | 10.1   |
| diploma              | 29       | 8.1    | 6        | 6.7    |
| University and above | 82       | 23     | 17       | 19.1   |
| Occupation           |          |        |          |        |
| Farmer               | 73       | 20.5   | 15       | 16.9   |
| Household            | 27       | 7.6    | 5        | 5.6    |
| Governmental employee| 100      | 28.1   | 20       | 22.5   |
| Non-Governmental employee| 32 | 9 | 15 | 16.9 |
| Self-employee        | 117      | 32.9   | 30       | 33.7   |
| Other                | 7        | 2      | 4        | 4.5    |
| Residency            |          |        |          |        |
| Rural                | 85       | 23.9   | 21       | 24.7   |
| urban                | 271      | 76.1   | 67       | 75.3   |

Table 2: Behavioral determinants of hypertensive patients who were attending ACSH, Ethiopia (n=445), 2018
Table 3: Clinical and anthropometric measurements of hypertensive patients who were attending ACSH, Ethiopia (n=445), 2018

| Variable                                | Controls (cases and controls) | Cases (cases and controls) |
|-----------------------------------------|-------------------------------|----------------------------|
|                                         | Frequency                     | Percentage%                |
| Duration of diagnosis HTN               |                               |                           |
| <4year                                  | 249                           | 69.9                      |
| >=4year                                 | 107                           | 30.1                      |
| Cholesterol level                       |                               |                           |
| Normal                                  | 282                           | 79.2                      |
| High level                              | 74                            | 20.8                      |
| Blood glucose level                     |                               |                           |
| Normal                                  | 304                           | 85.4                      |
| High level                              | 52                            | 14.6                      |
| BMI                                      |                               |                           |
| 18.5-24.9                               | 288                           | 80.9                      |
| 25-29.9                                 | 60                            | 16.9                      |
| >=30                                     | 8                             | 2.2                       |
| Systolic BP                             |                               |                           |
| Controlled                              | 156                           | 43.8                      |
| Uncontrolled                            | 200                           | 56.2                      |
| Diastolic BP                            |                               |                           |
| Controlled                              | 163                           | 45.8                      |
| Uncontrolled                            | 193                           | 54.2                      |
| Comorbidities                           |                               |                           |
| yes                                     | 67                            | 19.5                      |
| No                                      | 277                           | 80.5                      |
| Family history of stroke                |                               |                           |
| Yes                                     | 25                            | 7                         |
| No                                      | 331                           | 93                        |

Table 4: Bivariate and multivariable logistic regression for determinant of stroke in ACSH, Ethiopia, 2018 (n=445)
| Variables                        | Cases% | Controls% | COR (95%CI)                     | P-value | AOR(95%CI) | P-value* |
|---------------------------------|--------|-----------|---------------------------------|---------|------------|---------|
| **Sex category**                |        |           |                                 |         |            |         |
| Male                            | 46(51.7%) | 170(47.8%) | 1.063(0.604-1.871)              | 0.832   | 1.779(1.339-2.311) | 0.074   |
| Female                          | 43(48.3%) | 186(52.2%) | 1.779(1.339-2.311)              | 0.074   | 1.779(1.339-2.311) | 0.074   |
| **Age category**                |        |           |                                 |         |            |         |
| <45 years                       | 23(25.8%) | 116(32.6%) | 1.063(0.604-1.871)              | 0.832   | 1.063(0.604-1.871) | 0.074   |
| 45-65 years                     | 39(43.8%) | 185(52.2%) | 2.476(1.303-4.705)              | 0.006   | 2.476(1.303-4.705) | 0.006   |
| >65 years                       | 27(30.3%) | 55(15.4%)  | 2.476(1.303-4.705)              | 0.006   | 2.476(1.303-4.705) | 0.006   |

P-value=p-value in bivariate logistic regression, P-value*=p-value in multivariable logistic regression

COR: crude odds ratio, AOR: adjusted odds ratio, CI: confidence interval, *: statically significant

**ANEX 1**

**Table 5: Bivariate and multivariable logistic regression for determinant of stroke in ACSH, Ethiopia, 2018 (n=445)**

| Variables                        | Cases and Controls(n=445) | COR (95%CI) | P-value+ | AOR(95%CI) | P-value |
|---------------------------------|---------------------------|-------------|----------|------------|---------|
| **Sex category**                |                           |             |          |            |         |
| Male                            | 46(51.7%)                 | 170(47.8%)  | 1.063(0.604-1.871) | 0.832   | 1.779(1.339-2.311) | 0.074   |
| Female                          | 43(48.3%)                 | 186(52.2%)  | 1.779(1.339-2.311) | 0.074   | 1.779(1.339-2.311) | 0.074   |
| **Age category**                |                           |             |          |            |         |
| <45 years                       | 23(25.8%)                 | 116(32.6%)  | 1.063(0.604-1.871) | 0.832   | 1.063(0.604-1.871) | 0.074   |
| 45-65 years                     | 39(43.8%)                 | 185(52.2%)  | 2.476(1.303-4.705) | 0.006   | 2.476(1.303-4.705) | 0.006   |
| >65 years                       | 27(30.3%)                 | 55(15.4%)   | 2.476(1.303-4.705) | 0.006   | 2.476(1.303-4.705) | 0.006   |

P-value=p-value in bivariate logistic regression, P-value*=p-value in multivariable logistic regression

COR: crude odds ratio, AOR: adjusted odds ratio, CI: confidence interval, *: statically significant
| Marital status | 57(64%) | 235(66%) | 1 | 0.934 |
|----------------|---------|----------|---|------|
| Married        | 57       | 235      | 1 | 0.934 |
| Single         | 16(18%)  | 64(18%)  | 1 | 0.924 |
| Divorced       | 6(7%)    | 25(7%)   | 1 | 0.982 |
| Widowed        | 10(11.2%)| 32(9%)   | 1 | 0.517 |

| Educational status | 31(34.8%) | 138(38.8%) | 1.084(0.565-2.079) | 0.809 |
|--------------------|-----------|------------|---------------------|------|
| No formal education| 25(29.2%) | 65(18.3%)  | 1.929(0.965-3.857)  | 0.942 |
| Primary school    | 9(10.1%)  | 42(11.8%)  | 3.857               | 0.997 |
| High school       | 6(7.6%)   | 29(8.1%)   |                     |      |
| Diploma           | 17(19.1%) | 82(23%)    |                     |      |
| University and above | 138       | 65(18.3%)  | 1.034(0.425-2.516)  | 0.998 |
|                   |           | 42(11.8%)  | 0.998(0.359-2.775)  |      |

| Occupation         | 15(16.9%) | 73(20.5%) | 1 | 0.190 |
|--------------------|-----------|----------|---|------|
| Farmer             | 15(16.9%) | 73(20.5%) | 1 |      |
| House wife         | 5(5.6%)   | 27(7.6%)  | 1 |      |
| Governmental employee | 20(22.5%) | 100(28.1%) | 1 |      |
| Non-governmental employee | 15(16.9%) | 32(9%) | 1 |      |
| Self-employee      | 30(33.7%) | 117(32.9%) | 1 |      |
| Other              | 4(4.5%)   | 7(2%)     | 1 |      |

| Residency | 21(23.6%) | 85(23.9%) | 1 | 0.956 |
|------------|-----------|----------|---|------|
| Rural      | 21(23.6%) | 85(23.9%) | 1 |      |
| Urban      | 68(76.4%) | 271(76.1%) | 1 |      |

| Family history of stroke | 5(5.6%) | 25(7%) | .788(0.293-2.120) | 0.637 |
|--------------------------|---------|-------|------------------|------|
| Yes                      |         |       |                  |      |
| No                       | 84(94.4%) | 331(93%) | 1 |      |

| Clinical duration of hypertension | 53(59.6%) | 249(69.9%) | 1 | 0.062 |
|-----------------------------------|-----------|----------|---|------|
| <4years                           | 53(59.6%) | 249(69.9%) | 1 |      |
| >=4years                          | 36(40.4%) | 107(30.1%) | 1 |      |

| Frequency of follow up | 21(23.6%) | 85(23.9%) | 1 | 0.874 |
|------------------------|-----------|----------|---|------|
| Every 1month           | 21(23.6%) | 85(23.9%) | 1 |      |
| Every 2month           | 52(58.4%) | 215(60.4%) | 1 |      |
| Every 3month           | 16(18%)   | 56(15.7%) | 1 |      |

| Have you ever lost to follow up | 32(36%) | 46(12.9%) | 3.783(2.222-6.442)* | 0.000 |
|---------------------------------|---------|----------|---------------------|------|
| Yes                             | 32(36%) | 46(12.9%) | 3.783(2.222-6.442)* |      |
| No                              | 57(64%) | 310(87.1%) | 1 | 0.000 |

| Ever alcohol drink | 67(75.3%) | 255(71.6%) | 1.206(.707-2.057) | 1 |
|-------------------|-----------|-----------|------------------|---|
| Yes               | 67(75.3%) | 255(71.6%) | 1.206(.707-2.057) | 1 |
| No                | 22(24.7%) | 101(28.4)  | 1 | 1 |

| Have you drink alcohol after you diagnosed | 32(36%) | 49(13.8%) | 3.517(2.075-5.961)* | 0.000 |
|--------------------------------------------|---------|----------|---------------------|------|
| Yes                                        | 32(36%) | 49(13.8%) | 3.517(2.075-5.961)* |      |
| No                                         | 57(64%) | 307(86.2%) | 1 | 0.000 |

| Do you reduce salt in diet | 67(75.3%) | 328(92.1%) | 1 | 1 |
|---------------------------|-----------|-----------|---|---|
|                          | Yes       | No        | P-value | AOR       | CI         |
|--------------------------|-----------|-----------|---------|-----------|------------|
| Do you eat fatty foods?  |            |           |         |           |            |
| Yes                      | 27(30.3%) | 71(19.9%) | 0.036   | 1.388(2.733-2.63) | 1           |
| No                       | 62(69.7%) | 285(80.1%) | 1       |            |            |
| Regular exercise         |            |           |         |           |            |
| Active                   | 26(29.2%) | 111(31.2%) | 1.098(0.66-1.826) | 0.719       |
| Inactive                 | 63(70.8%) | 245(68.8%) | 1       |            |            |
| Comorbidities            |            |           |         |           |            |
| Yes                      | 22(24.7%) | 67(19.5%)  | 1.358(0.783-2.354) | 0.277       |
| No                       | 67(75.3%) | 277(80.5)  | 1       |            |            |
| Medication adherence     |            |           |         |           |            |
| No adherent              | 59(66.3%) | 106(29.8%) | 4.638(2.828-7.607) | 0.000       |
| Adherent                 | 30(33.7%) | 250(70.2%) | 1       |            |            |
| Fasting blood sugar level|            |           |         |           |            |
| Normal                   | 75(84.3%) | 304(85.4%) | 1.091(0.574-2.074) | 0.790       |
| High level               | 14(15.7%) | 52(14.6%)  | 1       |            |            |
| BMI                      |            |           |         |           |            |
| Normal weight            | 74(83.1%) | 288(80.9%) | 0.843(0.439-1.618) | 0.608       |
| Over weight              | 13(14.6%) | 60(16.9%)  | 1       |            |            |
| Obesity                  | 2(2.2%)   | 8(2.2%)   | 0.973(0.202-4.679) | 0.973       |
| Cholesterol level        |            |           |         |           |            |
| Normal                   | 56(62.9%) | 282(79.2%) | 1       |            |            |
| High level               | 33(37.1%) | 74(20.8%)  | 4.560(2.313-8.989) | 0.002       |
| Systolic blood pressure  |            |           |         |           |            |
| Controlled               | 15(16.9%) | 156(43.8%) | 3.848(2.126-6.964) | 0.000       |
| Uncontrolled             | 74(83.1%) | 200(56.2%) | 1       |            |            |
| Diastolic blood pressure |            |           |         |           |            |
| Controlled               | 18(20.2%) | 163(45.8%) | 3.331(1.907-5.818) | 0.000       |
| Uncontrolled             | 71(79.8%) | 193(54.2%) | 1       |            |            |

P-value+=p-value in bivariate logistic regression, P-value++=p-value in multivariable logistic regression

COR: crude odds ratio, AOR: adjusted odds ratio, CI: confidence interval, *: statically significance

Supplementary Files
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