

EXISTENCE OF RULE OF HALVES IN HYPERTENSION: AN EXPLORATORY ANALYSIS IN AN INDIAN VILLAGE

Nafis Faizi¹, Anees Ahmad¹, Najam Khalique¹, Mohammad Salman Shah¹, Mohammad Shibly Khan¹, and Mohd Maroof¹

Department of Community Medicine, JN Medical College and Hospital, AMU, Aligarh, India

Corresponding author: Nafis Faizi (MD, MPH). Assistant Professor in Community Medicine, J N Medical College, Aligarh Muslim University (AMU), India. ORCID ID: <http://www.orcid.org/0000-0002-4634-6790>.+91-98971-07815.

E-mail: nafisfaizi.cn@amu.ac.in

ABSTRACT

Introduction: India is a country in transition, the population is graying and the non communicable diseases are rising. In the rural areas of India, the detection of hypertension is poor because of limited healthcare facilities and poor awareness among the people. In one such village, Mirzapur, adopted by the Aligarh Muslim University, there is a planned project to control hypertension in the villages through some innovative approaches. This study was the assessment phase of this project for mass management of hypertension to steer and guide the next phase of the project. **Aim:** The main objectives of this study were: to determine the prevalence of hypertension in residents ≥ 40 years in Mirzapur village, Aligarh, and, to assess the presence of rule of halves in hypertension. **Results and Discussion:** The present study in residents more than 40 years of age in the Mirzapur village in Aligarh found that the prevalence of hypertension in the study population was 41.9%, with a higher prevalence in older age groups. The mean blood pressure of the study population was found to be 100.03 ± 13.17 mm Hg. The high prevalence reported in the present study reflects and reaffirms the increasing trend of hypertension in not only the urban, but also rural India, at least in the older age group. The problem of hypertension, due to its silent and asymptomatic nature, frequently depicts a rule of halves in places with weaker health system and an equally weaker health awareness and information among populations and the same is true for this village. **Conclusion:** There is an urgent need to conduct similar researches in other adopted villages of the country for the sake of inclusive development to find the exact burden of this silent and asymptomatic killer. More importantly, there is a need to find innovative solutions to combat the problem of hypertension detection and management.

Key words: village, hypertension, rule of halves, inclusive, development, India.

1. INTRODUCTION

India is a country in transition. The demographic transition with graying of population and the shift to sedentary behavior is causing the so-called New World Syndrome in the urban areas of India. The major marker for this shift is the increasing prevalence of non-communicable diseases. Non-communicable diseases, or NCDs, are by far the leading cause of death in the world, representing 63% of all annual deaths (1), killing more than 38 million people each year, of which, 80% occur in low- and middle-income countries (2), which also have the unfinished business of communicable diseases, creating a double burden on these countries. Cardiovascular diseases account for most NCD deaths, or 17.5 million people annually, followed by cancers (8.2 million), respiratory diseases (4 million), and diabetes (1.5 million) (2). These 4 diseases account for 80% of all NCD deaths.

Among all the contributors to cardiovascular mortality, complications of hypertension account for 9.4 million deaths worldwide every year (3). Hypertension is the commonest cardiovascular disorder and a major public health problem across the world. Hypertension is usually essential or primary, silent and asymptomatic; making it one of the worst risk factor for a number of non-communicable diseases. Apart from the fact that hypertension is a silent and invisible killer, it has significant social cost to the problem, with money spent on their complications accounting for one-fifths of total health expenditure (4). Also, there are evidences of significant health and economic benefits of screening and adequate management of hypertension (4). Hypertension has silent and asymptomatic nature; therefore, adheres to 'rule of halves'. Most of the hypertensives are unaware of their hypertensive status, most of those who are diagnosed

are untreated. Of those who are treated, most of them are inadequately treated. The rule of halves was coined in 1970s in the America (5), was reported in Scotland in the 1990s (6), and has been reported previously from parts of India (7).

In the rural areas of India, the detection of hypertension is poorer because of limited health care facilities and poor awareness among the people. In one such village, Mirzapur, adopted by the Aligarh Muslim University, there is a planned project to control hypertension in the villages through some innovative approaches. This study was the assessment phase of this project for mass management of hypertension to steer and guide the next phase of the project. The main objectives of this study were: to determine the prevalence of hypertension in residents ≥ 40 years in Mirzapur village, Aligarh, and, to assess the presence of rule of halves in hypertension.

2. MATERIALS AND METHODS

2.1. Study Design & Setting

The study had a cross sectional study design, conducted in the month of December, 2015, to estimate prevalence of hypertension and to determine whether the rule of halves was present. The study design was chosen for its appropriateness to the research objectives as well as to estimate baseline data and generate hypothesis for the next phase of the project- that includes management of hypertension in the rural areas.

2.2. Study Setting

The present study was conducted at Mirzapur, a village in Tehsil Koil, Aligarh District, Uttar Pradesh. It is about 6-7 kilometers from J.N. Medical College, Aligarh Muslim University, Aligarh. The village Mirzapur is one of the five villages adopted by the Aligarh Muslim University for inclusive development. Uttar Pradesh (UP) is the most populous state of India and Aligarh is one of its largest cities, located in western UP, about 150 kilometers from Delhi. Aligarh is the 55th largest city in India, according to the 2011 census and has about 1199 villages (8). The Koil Tehsil in Aligarh is centrally located and has about 387 villages, one of which is Mirzapur with a population of 1457, where this study was done (8).

2.3. Study Population and tools

The study population comprised of all the residents of the village ≥ 40 years of age, on the day of survey after prior consent. The survey was conducted in the month of December, 2015. The residents who were not present at their houses during the survey were contacted again for two consecutive days.

The study tools included a questionnaire, and an automated blood pressure instrument. The questionnaire was designed for the survey purposes and after pilot testing, necessary changes were made for the purposes of brevity, reliability & feasibility. The automatic blood pressure monitors that were used for the survey were Omron Model HEM-8712, an arm circumference based monitor with a cuff size of 22-32 cm. The instrument was calibrated and validated calibrated on the morning of each day of the survey. The blood pressure was taken in the right arm, in the sitting position and hypertension was diagnosed if the systolic blood pressure was ≥ 140 mm Hg and/or a diastolic blood

pressure ≥ 90 mm Hg on an average of two readings on three consecutive visits for 3 days, based on the National Rural Health Mission (NRHM guidelines) (9). A two day training on the study tools and data entry was given to the two data collection teams, each comprising of a resident Doctor and a medico-social worker.

2.4. Data Management and Ethical Considerations

The data entry was done in both SPSS version 20 and MS-Excel. The data entry and checking was done before the analysis. The prevalence was measured in percentages and proportions and means \pm Standard Deviations (SD). Counseling, health education and relevant advices were offered to all the participants. The data collectors were trained Doctors who were trained for the research as well as retrained for adherence to the national guidelines for management of hypertension, for the treatment advices. Those who need specialized care due to any medical reason were counseled to visit the JN Medical College, Aligarh. The study did not involve or consider any funding or intervention from companies/organizations with any conflict of interest.

3. RESULTS

A total of 160 subjects of age more than 40 years were included into the study. About 63.1% of the subjects were females. The mean age of the study subjects was 54.08 \pm 11.52 years [C.I. 52.28-55.87]. About 23.8% of the populations were between 40-49 years of age, whereas equal number of participants were from 50-59 and ≥ 60 years age (38.1%). The predominant occupation of the participants was homemaking, presumably due to higher proportion of females subjects. The other occupations were either farming/labour (26.9%), followed by businessmen & service (22.5%).

Variable	N (160)	Mean \pm SD/ %	95 % CI
Age Group	160	54.08 \pm 11.52	52.28-55.87
40-49	38	23.8 %	17.79-30.94
50-59	61	38.1 %	30.96-45.85
≥ 60	61	38.1 %	30.96-45.85
Sex			
Male	59	36.9 %	29.78-44.58
Female	101	63.1 %	55.42-70.22
Occupation			
Labourer/Farmer	43	26.9 %	20.59-34.25
Business & Service	36	22.5 %	16.69-29.60
Homemaker	79	49.4 %	41.73-57.85

Table 1. Descriptive Statistics of the Sample

The descriptive statistics of the sample is shown in Table 1.

The prevalence of hypertension in the study population was found to be 41.9% (67/160). The prevalence of hypertension was highest in the ≥ 60 years (28.9%), followed by the 50-59 years age group and the lowest in the 40-49 years group. The increasing trend of prevalence with age was found to be statistically significant ($\chi^2 = 8.271$, $df = 2$, $p = 0.016$). Although females were found to have a higher prevalence of hypertension (42.6% versus 40.7%), it was not statistically significant ($\chi^2 = 0.055$, $df = 1$, $p = 0.815$) (Table 2).

The mean blood pressure of the study population was found to be 100.03 \pm 13.17 mm Hg [97.98-102.09], while the mean systolic and mean diastolic blood pressure was observed to be 131.34 \pm 20.12 mm Hg [C.I. 128.21-134.47] and

Characteristic	Hypertensive		Normotensive	
	n	%	n	%
Age Group (years)				
40-49	11	28.9	27	71.1
50-59	22	36.1	39	63.9
≥ 60	34	55.7	27	44.3
Total	67	41.9	93	58.1
Test Results	$\chi^2 = 8.271, df = 2, p = 0.016$			
Sex				
Male	24	40.7	35	59.3
Female	43	42.6	58	57.4
Total	67	41.9	93	58.1
Test Results	$\chi^2 = 0.055, df = 1, p = 0.815$			

Table 2. Prevalence of hypertension in the study population

84.38±11.61 mm Hg [C.I. 82.56-86.19] respectively. There was no significant difference between these three parameters (i.e. mean blood pressure, mean systolic and diastolic blood pressure) among the different age groups (Table 3). The mean blood pressure among males and females was observed to be 99.43±10.20 mm Hg [C.I. 96.77-102.09] and 100.39±14.67 mm Hg [97.49-103.28] respectively without any statistically significant difference. Likewise, no significant difference was observed between the mean systolic blood pressure and mean diastolic pressure among male and fe-

tients who were known hypertensives were on treatment (26/27). Among those who were on treatment, only 42.3 % (11/26) had a controlled blood pressure and 57.7 % (15/26) had uncontrolled blood pressure at the time of the study.

4. DISCUSSION

The present study in residents more than 40 years of age in the Mirzapur village in Aligarh found that the prevalence of hypertension in the study population was 41.9%, with a higher prevalence in older age groups. The mean blood pressure of the study population was found to be 100.03±13.17 mm Hg. The high prevalence reported in the present study reflects and reaffirms the increasing trend of hypertension in not only the urban, but also rural India, at least in the older age group. The prevalence of hypertension in India shows an increasing trend from 6.6 % to 36.4 %, from 1988 to 2003 (10). In several other studies conducted across India, a high prevalence of hypertension has been reported, like 33.3% in adults ≥ 30 years rural Assam (11), 54.5% in middle aged adults (40-64 years) in urban Kerala (12) and, 60.8% among tea garden workers aged 30 years or more, in Assam (13). A multicentric study by hypertension study group also reported a prevalence of 55 % in Bangladesh and India in elderly age group (≥60 years) (14).

However, quite a few studies report a lower prevalence

Characteristic	MBP		SBP		DBP	
	Mean± SD	CI	Mean± SD	CI	Mean± SD	CI
Age Group (years)						
40-49	98.58±12.65	94.42-102.74	129.95±18.71	123.79-136.09	82.89±10.85	79.33-86.46
50-59	100.12±11.99	97.05-103.19	128.6±16.15	124.52-132.79	85.85±11.48	82.91-88.79
≥ 60	100.85±14.67	97.09-104.61	134.88±23.98	128.74-141.03	83.84±12.19	80.71-86.96
Total	100.03±13.17	97.98-102.09	131.34±20.12	128.21-134.47	84.38±11.61	82.56-86.19
Test Results	F= 0.348, df= 2, p= 0.707		F= 1.592, df= 2, p= 0.207		F= 0.868, df= 2, p= 0.422	
Sex						
Male	99.43±10.20	96.77-102.09	129.41±15.00	125.49-133.32	84.44±9.72	81.91-86.97
Female	100.39±14.67	97.49-103.28	128.01±22.58	128.01-136.92	84.35±12.62	81.86-86.84
Total	100.03±13.17	97.98-102.09	131.34±20.12	128.19-134.48	84.38±11.60	82.57-86.19
Test Results	t= -0.442, df= 158, p= 0.659		t= -0.927, df= 158, p= 0.355		t= 0.049, df= 158, p= 0.961	

Table 3. Distribution of Mean Blood Pressure, SBP & DBP among study population (N=160).

male subjects (p>0.05). (Table 3). As far as the awareness, treatment and control status is concerned, the overall hypertension prevalence of 41.9% (67/160) comprised of 40.3 % (27/67) known and 59.7 % (40/67) unaware and newly diagnosed cases of hypertension (Figure 1). Most of the pa-

than the present study, probably due to a younger age group of patients in their study. For instance, about 20% men and 22% women were found to be hypertensive in a study among rural population in the age group 20-79 years (15), a prevalence of 18.3% was reported from rural areas of Devnagere district, in a population of >18 years age (16), and about 14.5% were hypertensive in rural Lucknow in the age group >20 years (17).

The substantial prevalence of the hypertension in rural areas, as found in this study is a big problem, but the presence of rule of halves in hypertension is an even bigger concern. The problem of hypertension, due to its silent and asymptomatic nature, frequently depicts a rule of halves in places with weaker health system and an equally weaker health awareness and information among populations. In the present study also, a high prevalence of hypertension (59.7 %) was found in people who had no prior idea about their hypertension status reflecting the fact that more than half of the hypertensives are unknown and undiagnosed hypertensives. Further, in the present study, among the

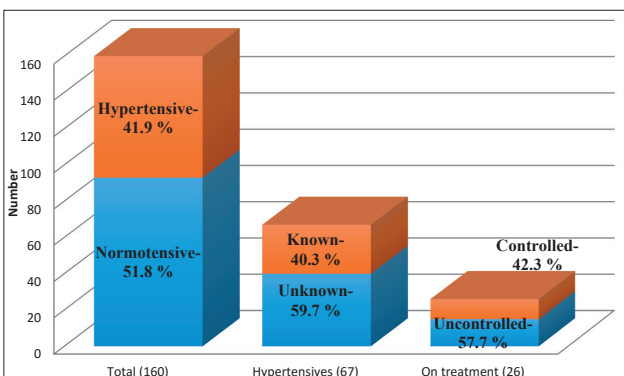


Figure 1. Awareness, Treatment and Control of Hypertension among study population (N=160).

known hypertensives, most of them were seeking treatment (26/27) but only 42.3% (11/26) had a controlled hypertension and others has a raised blood pressure reflecting a poor compliance or monitoring of blood pressure, which is a vital part of hypertension management. Although, most of the hypertensives were seeking treatment as opposed to the classical rule of halves in hypertension, but more than half of those on treatment did not have a controlled blood pressure. The results of the study show that the rule of halves, which was coined in 1970s in America (5), reported in 1990s in Scotland (6) and in early 2000s in India (7), is still present in rural India, as the results of the present study suggest.

The present study was conducted in the village of Mirzapur, one of the villages adopted for inclusive development by Aligarh Muslim University, similar to the adoptions by other higher education institutes in the country (18). The high prevalence of hypertension, augmented by the prevalence of rural of halves does not augur well for the future of the rural areas in particular and India in general. In the adopted villages of the country, measurement and determinants of health status is important for proper intervention and policy, and; due to the increasing elderly population, assessment of hypertension and other non-communicable diseases should be a priority. The present study was done for the assessment of the hypertension prevalence in order to design a cost-effective intervention at mass level in the next phase of the project. We believe that assessment and intervention for hypertension in villages is important because of three reasons: a) one, because the prevalence of hypertension is increasing due to demographic and nutritional transition of the country; b) two, because hypertension is predominantly silent and asymptomatic and remains unnoticed, until it manifests in complicated forms, when it becomes unaffordable to treat or fatal, and c) three, because it is often linked with the behavioral and sedentary lifestyle, which is increasing in India, due to the advent of the 'New World syndrome', and is likely to create an enormous socioeconomic and public health burden of non-communicable diseases (19).

5. CONCLUSION

The study was aimed at assessment of hypertension and rule of halves and found a high prevalence of hypertension and the presence of rule of halves of hypertension. The current situation and the rising prevalence of non-communicable diseases, in general should be countered through cost effective measures. There is a need to conduct similar researches in the other adopted villages under the village adoption schemes by the higher institutes and the parliamentarians. There is also a need to identify, find and conduct innovative interventional researches to combat the problem of hypertension, which is a leading risk factor for cardiovascular diseases.

- **Acknowledgements:** We acknowledge the support and encouragement of Gen (Retd) Zameeruddin Shah, Vice Chancellor, Aligarh Muslim University and Brig (Retd) S. Ahmad Ali for taking up this task of inclusive development of Mirzapur and supporting this study. We are also indebted to Prof. Tahir Hussain, University of Houston and Professor M. Maqbool Haq,

Oncologist, USA for their personal interest and support in this phase of the project.

- **Author's Contributions:** Nafis Faizi and Anees Ahmad made substantial contribution to conception, design, drafting the article and critical revision for important intellectual content. Mohammad Shibly Khan and Mohd Maroof made substantial contribution to acquisition of data, analysis and interpretation of data and critical revision for important intellectual content. Mohammad Salma Shah and Najam Khaliq made substantial contribution to conception and design. All the authors approved the final version to be published.
- **Funding and Financial Disclosure:** None.
- **Conflict of interest:** None Declared.

REFERENCES

1. World Health Organization (WHO). 10 Facts on Non Communicable Diseases. Available from: http://www.who.int/features/factfiles/non-communicable_diseases/en/. Accessed on 06.02.2016.
2. World Health Organization (WHO). Non Communicable Diseases. Available from: <http://www.who.int/mediacentre/factsheets/fs355/en/>. Accessed on 06.02.2016.
3. Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*. 2012; 380 (9859): 2224-60.
4. World Health Organization (WHO) Campaigns . Available from: http://www.who.int/campaigns/world-health-day/2013/campaign_essentials/en/index1.html
5. Wilber JA, Barrow JG. Hypertension-A community Problem. *Am J Med*. 1972; 52: 653-63.
6. Smith WC, Lee AJ, Crombie IK, Tunstall-Pedoe H. Control of blood pressure in Scotland: the rule of halves. *BMJ*. 1990; 300(6730): 981-3.
7. Deepa R, Shanthirani CS, Pradeepa R, Mohan V. Is the 'Rule of Halves' in Hypertension Still Valid? - Evidence from the Chennai Urban Population Study. *J Assoc Phy India*. 2003; 51: 153-7.
8. District Census Handbook Aligarh. Directorate of Census Operations, Uttar Pradesh., Census of India 2011. Available from: http://www.censusindia.gov.in/2011census/dchb/0912_PART_B_DCHB_ALIGARH.pdf. Accessed on 06.02.2016.
9. Hypertension. National Rural Health Mission [Internet]. Available from: <http://nrhm.gov.in/images/pdf/guidelines/nrhm-guidelines/stg/hypertension.pdf>. Accessed on 06.02.2016.
10. Ibrahim M, Damasceno A. Hypertension in developing countries. *Lancet*. 2012; 380: 611-9.
11. Hazarika NC, Narain K, Biswas D, Kalita HC, Mahanta J. Hypertension in the native rural population of Assam. *Natl Med J India*. 2004; 17(6): 300-4.
12. Zachariah MG, Thankappan KR, Alex SC, Sarma PS, Vasan RS. Prevalence, correlates, awareness, treatment, and control of hypertension in a middle-aged urban population in Kerala. *Indian Heart J*. 2003 May-Jun; 55(3): 245-51.
13. Hazarika NC, Biswas D, Narain K, Kalita HC, Mahanta J. Hypertension and its risk factors in tea garden workers of Assam. *Natl Med J India*. 2002; 15(2): 63-8.
14. Hypertension study Group. Prevalence, Awareness, treatment and control of hypertension among elderly in Bangladesh and India: a multicentric study. *Bulletin of WHO*. 2001; 79(6): 490-500.
15. Kinra S, Bowen LJ, Lyngdoh T, et al. Sociodemographic patterning of non-communicable disease risk factors in rural India: a cross sectional study. *BMJ*. 2010 Sep 27; 341: c4974.
16. Yuvaraj BY, Nagendra Gowda MR, Umakantha AG. Prevalence, Awareness, Treatment, and Control of Hypertension in Rural Areas of Dava-nagere. *Indian J Community Med*. 2010; 35(1): 138-141.
17. Midha T, Idris MZ, Saran RK, Srivastav AK, Singh AK. Prevalence and determinants of hypertension in the urban and rural population of a north Indian district. *East African journal of public health*. 2009 Dec;6(3): 268-73.
18. Press Releases. Education will be the single biggest transformative factor in catapulting India into the league of developed nations, says president. Available from: <http://www.presidentofindia.nic.in/press-release-detail.htm?1184>. Accessed on 06.02.2016.
19. WHO. Obesity: Preventing and Managing a Global Epidemic. Report of a WHO Consultation. WHO Technical Report Series No. 894. Geneva: World Health Organization, 2000.