

## Knowledge about Hypertension among the Hypertensive and Normotensive Population

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### ABSTRACT

Hypertension is a chronic lifestyle-related condition in which the blood vessels have persistently elevated pressure leading to fatal health complications such as cardiovascular deaths, heart failure, stroke, brain hemorrhage, and renal failure. The present study aims to assess the level of knowledge about hypertension in the total study sample as well as to compare the level of knowledge about hypertension among the hypertensive and normotensive participants. The level of knowledge about hypertension was also compared across four patient age-groups and between men and women. The Hypertension Knowledge Schedule, consisting of 16 hypertension related knowledge questions, was developed and validated. The study sample comprised of 96 hypertensive and 104 normotensive participants recruited from an outpatient primary care facility and a community-based setting in Hyderabad, India. The results of the study indicated that the hypertensive participants had a significantly higher level of knowledge about hypertension as compared to their normotensive counterparts. Participants in the older age-groups and women were found to have significantly better knowledge about hypertension as compared to their younger counterparts and men. Overall, the level of knowledge about hypertension, among the total study sample was found to be inadequate. Health education to increase awareness about hypertension should be imparted in schools, colleges, workplaces and primary care facilities to facilitate the early diagnosis and treatment of this health condition.

**Keywords:** Hypertension Knowledge, Awareness, Prevalence, Age, Health Education

With non-communicable diseases such as hypertension reaching epidemic proportions in developing nations like India, life-threatening consequences are likely to dampen the economic, social, and health advancement of the nation. Hypertension is a condition in which the blood vessels have persistently elevated blood pressure and is defined as having a systolic blood pressure of 140 mm Hg or more and a diastolic blood pressure of 90 mm Hg or more.

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Received: November 5, 2018; Revision Received: November 27 2018; Accepted: December 4, 2018

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In recent times, there has been a transition to more refined and processed foods as well as to a more sedentary lifestyle pattern, leading to an increase in non-communicable diseases like hypertension afflicting even the youth of society in India. With an increasing number of youth in India in the age-group of 18 to 25 years, being diagnosed with pre-hypertension and hypertension, loss of productivity seems inevitable apart from the financial drain on individual and government budgets. This rings in alarm bells for the Indian health care system and calls for immediate preventive measures such as the initiation of preventive care clinics in primary health care facilities and the implementation of health education programs in schools, colleges, workplaces, and health care facilities.

An alarming trend in recent times is that hypertension is increasingly afflicting children in the age-group of 5 to 18 years with the parents of these children being unaware of their child's hypertensive status. The prevalence of childhood hypertension among children was found to be 3.5% with another 10% to 11% being diagnosed with elevated blood pressure (American Academy of Pediatrics, 2017). Childhood hypertension makes children susceptible to diabetes, cardiovascular, renal, and neurological problems as well as vascular aging. Hence, regular screening for hypertension among children needs to be done to reverse the trend of the rapid increase in the number of cases of childhood hypertension.

Anchala et al. (2014) have found that of the low proportion of hypertensive patients in India, who were aware of their hypertensive status, less than half were being treated for their condition and of those treated a meager one-fifth of the urban Indian and one-tenth of the rural Indian population had their hypertension under control.

Globally, the prevalence of high blood pressure was found to be around 40% in low and middle income countries and 35% in high income countries, and hypertension has been estimated to cause 7.5 million deaths which is about 12.8% of the total of all deaths annually (World Health Organization, 2018). Hypertension has been found to be responsible for at least 45% of deaths due to heart disease and 51% of deaths due to stroke worldwide (World Health Organization, 2013).

A population based health screening program conducted among 22.5 million adults in 2017, by the Union health ministry across 100 districts of India for common non-communicable diseases, found approximately one in every eight persons having high blood pressure (Kaul, 2018). A dismal finding of the screening was that a significant proportion of hypertensive adults were found to be unaware of their hypertensive status.

A recent cross-sectional, population based study conducted among 1.3 million Indians across 27 states in India between the years 2012 and 2014, has shown that the prevalence of hypertension was found to be 25% with the prevalence of the disease being modestly lower among rural and socio-economically disadvantaged groups as compared to the urban and affluent sections of society (Geldsetzer et al., 2018). According to the study by Geldsetzer et al. (2018), Kerala along with Haryana and Punjab were found to be the states with the highest rates of hypertension prevalence in the nation. Hypertension has been found to be directly responsible for 57% of all stroke deaths and 24% of all coronary heart disease (CHD) deaths in India (Anchala et al., 2014; Gupta and Gupta, 2017).

Recent studies have shown that the prevalence of hypertension in India ranges from 25% to 30% in urban areas and 10% to 20% in rural areas with the primary determinants of low

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hypertension treatment and control being low levels of education and socio-economic status as well as rural residence (Gupta & Gupta, 2017).

Among the urban populations in India who are exposed to the stress of modernization and acculturation, there has been a rapid increase in the prevalence of hypertension over the years and hypertension rates are now similar to that of the developed nations (Gupta & Gupta, 2009). In a meta-analysis conducted by Anchala, et al. (2014), 33% of urban and 25% of rural Indians were found to be hypertensive and among the hypertensives, only 25% of the rural and 42% of the urban Indians were found to be aware of their hypertensive status. This rings in alarm bells for the Indian health care system and individual families in particular, as hypertension is known to be a “silent killer”. The asymptomatic nature of the condition as well as the lack of knowledge among the general population about the pre-disposing factors of hypertension development spells adverse health, social and economic consequences for individuals and the nation alike.

Low levels of education associated with a lack of knowledge about the severity of hypertension and the importance of a healthy diet act as change barriers to optimal hypertension control (Witten, Vuuren, & Learmonth, 2013; Bourne, Lambert, & Steyn, 2002; Steyn, 2006; Steyn, Jooste, Fourie, Parry, & Rossouw, 1986). Low health literacy levels have been found to correlate with decreased treatment regimen compliance and increased mortality (Giuse, Koonce, Storrow, Kusnoor, & Ye, 2012; Desmedt & Valcke, 2004).

The prevalence of hypertension among men and women in the state of Telangana was found to be around 29% and 39% respectively with less than 10% of those with hypertension being aware of their hypertensive status (Ram, 2017). With the rampant increase in the number of cases of hypertension among children and youth in the state of Telangana, urgent preventive measures and large scale screening of children and adolescents are required to reverse the trend of this rapidly increasing epidemic.

Our current study has the following objectives: (1) To assess the level of knowledge about hypertension in the total study sample (2) To compare the levels of knowledge about hypertension among the hypertensive and normotensive participants (3) To compare the variations in hypertension knowledge levels across the various age groups and gender.

## **METHOD**

### *Participants*

The current study is a community based cross-sectional study that involved a purposive sampling method to recruit participants. The study was conducted in an outpatient primary care facility called “GYD Diagnostics and Reference Laboratories Pvt. Ltd” as well as in a community based setting wherein a total of 200 participants (96 hypertensives and 104 normotensives) were recruited. Of the 96 hypertensive participants, 48 were recruited from the clinic setting and 48 were recruited from the community-based setting. Of the 104 normotensive participants, 51 participants were recruited from the clinic setting and 53 participants were recruited from the community based setting. The necessary permission was obtained from the management of the primary care outpatient facility and informed consent was sought from all the participants through a written informed consent form prior to enrolling them for the study. The inclusion criteria indicated that participants must be in the age range of 22-66 years and the exclusion criteria were the presence of co-morbid conditions such as diabetes mellitus and history of prior psychological illness.

Of the 200 participants, 48% were hypertensive and 52% were normotensive participants. Among the total study sample, 53% were men and 47% were women. They were aged

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between 22 and 66 years ( $M = 49.18$ ). Of the total study sample, 75% were educated and 25% were uneducated participants. Among the hypertensive participants, 62.5% had a family history of hypertension whereas only 44.7% of the normotensive participants had a family history of hypertension. Among the hypertensive participants, 97% were married and among the normotensive participants, 73% were married in the study sample.

### *Measures*

***Hypertension Knowledge Schedule (HKS)*** This schedule comprising of 16 hypertension knowledge questions was developed by the authors. Initially a list of 100 hypertension knowledge questions was identified by the investigators from standard medical books. Three practicing general physicians with an expertise in hypertension management were asked to tick those questions in the list that were essential to hypertension prevention and management. The inclusion criteria were that they should be attached to a corporate hospital as general practitioners and should be specialized in hypertension management. Thirty questions were identified as essential to hypertension prevention and management by the three general practitioners. These 30 items were then evaluated to establish their content validity. Four practicing general physicians independent of those three general physicians who identified 30 out of the 100 hypertension related questions were given the list of 30 questions with the instruction that they should select those hypertension knowledge related questions which are relevant for effective hypertension prevention and management. Additionally they had to identify those questions about hypertension that were inconsequential for effective hypertension prevention and management. Applying Lawshe's (1975) criterion, hypertension knowledge questions having a content validity ratio of 0.99 and above across the four practicing general physicians were retained to be included in the final schedule. The Hypertension Knowledge Schedule (HKS) was then found to comprise of 16 hypertension related knowledge questions.

Exploratory Factor Analysis was then conducted in order to establish the construct validity of the schedule and identify factors by applying the principal component analysis with varimax rotation. The assumptions for conducting the principal components analysis were met by the data. The covariance values of all the items were above .50 and the communality values of the items were above 0.3. Two criteria were employed for identifying the factors 1) the scree plot and 2) Kaiser's eigenvalue  $> 1$ . Four factors were identified which accounted for 52% of the variance. For factor loadings, we used the criterion of above 0.3. The first factor accounted for 18% of the variance and was labeled "theoretical knowledge" as it comprised of items that tapped the theoretical knowledge of a person regarding high BP and was related to knowledge concerning the normal BP reading and the duration of high BP. The second factor that emerged explained 15% of the variance and was labeled "essential knowledge" which contained questions that tapped the essential knowledge that a person needs to have about high BP for its effective management and was related to the causes, organ damage and consequences of high BP. The third factor that emerged accounted for 10% of the variance and was labeled "lifestyle knowledge" as it comprised of items that tapped the knowledge of lifestyle related modifications in BP control and was related to knowledge regarding the habits to be followed, habits to be avoided, lifestyle changes, food desirable and to be avoided for effective BP control and management. The fourth factor explained 9% of the variance and was named "functional knowledge" as it comprised of items that tapped the functional knowledge required for the effective management of high BP and was related to knowledge regarding the sustained use of the BP medication even when the BP comes under control, symptoms of high BP, monitoring of high BP, the necessity of informing the doctor about high BP before surgery, steps to be taken for uncontrolled BP and measures to be taken

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if a hypertensive patient forgets to take the BP medication on a particular day. The internal consistency of this schedule was high with Cronbach's  $\alpha = 0.71$  for this sample. The reliability coefficients for the Factors 1, 2, 3 & 4 were found to be .60, .62, .53 and .51 respectively. As the items had loaded above .30 in their respective factors, the presence of convergent validity was demonstrated. None of the factors were correlated with each other demonstrating the discriminant validity of the scale ( $r = 0$ ).

This schedule was administered individually to the participants and the responses were audio-recorded and transcribed verbatim. To assess the level of knowledge of the participants on each of the hypertension knowledge questions, each question was rated by three medical experts on a scale of 0-5 (ranging from 0= No Knowledge, 1= Faint Understanding, 2= Some Understanding, 3= Fair Understanding, 4= Good Understanding and 5= Excellent Understanding). The mean of the three expert's scores for each of the 16 items on a scale of 0-5 was the composite score of the patients understanding of that hypertension knowledge question. To calculate the total Hypertension Knowledge Score for each participant, the mean scores of the expert ratings across the 16 items were added together. Higher scores indicated better knowledge levels. Apart from the composite hypertension knowledge scores, total scores were computed individually for each of the four factors of theoretical, essential, lifestyle and functional knowledge. Demographic information was also recorded for all the participants.

### *Procedure*

The Hypertension Knowledge Schedule was individually administered to each participant. The data was collected over a 2 month period after obtaining permission from the management of the concerned primary care outpatient facility and seeking informed consent from participants before enrolling them. All the interviews were conducted individually to provide a conducive non-threatening environment in which participants could freely share their views and understanding of the condition of hypertension. The interviews with the participants were conducted in Hindi, Telugu, and English suiting the comfort level of the respondents and all of the interviews were audio-recorded using a dictaphone. The responses were then translated and back-translated by the primary investigator to enhance the reliability of the transcriptions. The responses were transcribed verbatim by the primary investigator. The responses to each of the 16 hypertension knowledge questions were then independently rated by three medical experts and the mean of the three expert ratings for each question comprised the scores of the participants on each hypertension knowledge question. The composite hypertension knowledge score for each participant comprised of the total of the mean scores of the three doctors added together across all the items in the schedule.

## **RESULTS**

The data were analyzed to find out the extent of knowledge about the condition of hypertension in the total study sample as well as to compare hypertension knowledge rates among the hypertensive and normotensive participants. Analyses were also aimed to determine the role of age and gender on total hypertension knowledge level in the study sample. The predictors of hypertension knowledge in the study sample were also identified. Mean, standard deviation, independent two samples  $t$  test, one-way between subjects ANOVA, simple and multiple regression analyses were used to analyze the results. MS-Excel and SPSS were used to perform the data analyses.

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### *Mean Hypertension Knowledge Scores among the Hypertensive, Normotensive and the Total Study Sample:*

Overall, the level of knowledge of the total study sample ranged from 11 to 63 ( $M = 45.98$ ,  $SD = 9.64$ ). This indicates that the level of knowledge about hypertension in the total study sample was found to be inadequate.

The mean hypertension knowledge levels across the four main domains of theoretical, essential, lifestyle-related and functional knowledge as well as the overall hypertension knowledge was compared among the hypertensive and normotensive participants as shown in Table 1. We computed five separate independent samples  $t$ -test to determine whether there were significant differences between the hypertensive and normotensive participants in the four main domains of theoretical, essential, lifestyle-related and functional knowledge as well as the overall hypertension knowledge. The mean scores of the total study sample relating to the four knowledge domains and the overall hypertension knowledge score were also computed. The results of the independent samples  $t$  test showed that the difference in the overall hypertension knowledge scores between the hypertensive ( $n = 96$ ,  $M = 48.64$ ,  $SD = 8.34$ ) and the normotensive participants ( $n = 104$ ,  $M = 43.51$ ,  $SD = 10.13$ ) was statistically significant,  $t(198) = -3.88$ ,  $p = 0.000$ , 95% CI [-7.72, -2.52],  $d = 0.55$ . Specifically our results suggest that the hypertensive participants in our study had significantly higher knowledge about the condition of hypertension as compared to their normotensive counterparts. This warrants the concern of health care providers as hypertension is an asymptomatic condition and a majority of those with hypertension are unaware of their hypertensive status.

Results of the independent samples  $t$ -test showed a statistically significant mean difference in the theoretical, essential and functional knowledge scores between the hypertensive and normotensive participants. Hypertensive participants had significantly higher theoretical hypertension knowledge scores ( $n = 96$ ,  $M = 5.93$ ,  $SD = 2.20$ ) than their normotensive counterparts ( $n = 104$ ,  $M = 5.00$ ,  $SD = 2.82$ ),  $t(198) = -2.57$ ,  $p = 0.011$ , 95% CI [-1.63, -0.21],  $d = 0.37$ . Similarly, hypertensive participants had significantly higher essential hypertension knowledge scores ( $n = 96$ ,  $M = 9.39$ ,  $SD = 2.39$ ) than the normotensive participants ( $n = 104$ ,  $M = 8.04$ ,  $SD = 2.95$ ),  $t(198) = -3.53$ ,  $p = 0.001$ , 95% CI [-2.10, -0.59],  $d = 0.50$ . Hypertensive participants were found to have significantly higher functional knowledge scores ( $n = 96$ ,  $M = 20.66$ ,  $SD = 5.24$ ) than the normotensive respondents ( $n = 104$ ,  $M = 18.32$ ,  $SD = 5.41$ ),  $t(198) = -3.10$ ,  $p = 0.002$ , 95% CI [-3.82, -0.85],  $d = 0.43$ . The results of the study showed that there was no statistically significant difference in the lifestyle related knowledge of the hypertensive ( $n = 96$ ,  $M = 16.04$ ,  $SD = 3.01$ ) and the normotensive participants ( $n = 104$ ,  $M = 15.50$ ,  $SD = 3.89$ ),  $t(198) = -1.09$ ,  $p = 0.27$ , 95% CI [-1.51, 0.43],  $d = 0.15$ .

**Table 1 Results of  $t$ -test and Descriptive Statistics for Theoretical, Essential, Lifestyle, Functional, and Total Hypertension Knowledge by Hypertensive Status**

Knowledge Domain	Whole Sample M SD	Hypertensive participants		Normotensive participants		$t$	$P$	95% CI	Cohen's $d$
		M	SD	M	SD				
Theoretical	5.45 2.58	5.93 2.20		5.00 2.82		- 2.57	0.05	[-1.63, - 0.21]	0.37
Essential	8.69 2.77	9.39 2.39		8.04 2.95		- 3.53	0.04	[-2.10, - 0.59]	0.50

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Knowledge Domain	Whole Sample M SD	Hypertensive participants		Normotensive participants		<i>t</i>	<i>P</i>	95% CI	Cohen's <i>d</i>
		M	SD	M	SD				
Lifestyle	15.76 3.50	16.04 3.01		15.50 3.89		- 1.09	0.07	[-1.51, 0.43]	0.15
Functional	19.45 5.44	20.66 5.24		18.32 5.41		- 3.10	0.002	[-3.82, 0.85]	0.43
Total	45.98 9.64	48.64 8.34		43.51 10.13		- 3.88	0.000	[-7.72, 2.52]	0.55

*Note.* M = Mean. SD = Standard Deviation.

### Variations across Age Groups in Overall and Domain-wise Hypertension Knowledge

The results of a one way ANOVA (Table 2) showed that there was a significant difference,  $F(3, 196) = 10.25, p = 0.000$  across the various age-groups on the total hypertension knowledge scores. Post-hoc comparisons using Tukey's HSD revealed that participants in the age-group of 33-43 years ( $M = 46.60, SD = 8.24$ ), 44-54 years ( $M = 46.36, SD = 11.16$ ), and 55-66 years ( $M = 48.49, SD = 7.91$ ) scored significantly higher ( $p < 0.01$ ) overall mean hypertension knowledge scores than those in the age-group of 22-32 years ( $M = 39.12, SD = 9.79$ ).

We then conducted separate one-way ANOVA's to determine whether there were significant differences in the mean hypertension knowledge scores in the four domains of theoretical, essential, lifestyle and functional knowledge across the four age-groups. The results indicated that there were significant differences in the mean hypertension knowledge scores of participants in the four domains across the four age-groups. Post-hoc comparisons using Tukey's HSD revealed that for the domain of theoretical knowledge, participants in the age-group of 33-43 years ( $M = 5.96, SD = 2.63$ ), 44-54 years ( $M = 5.78, SD = 2.45$ ), and 55-66 years ( $M = 5.62, SD = 2.32$ ) scored significantly higher ( $p < 0.05$ ) mean knowledge scores than those in the age-group of 22-32 years ( $M = 4.40, SD = 3.03$ ). In the domain of essential knowledge, the mean scores of participants in the 33-43 years age-group ( $M = 8.84, SD = 2.64$ ), 44-54 years age-group ( $M = 9.10, SD = 3.14$ ), and 55-66 years age-group ( $M = 9.17, SD = 2.38$ ) were significantly higher ( $p < 0.01$ ) than those in the age-group of 22-32 years ( $M = 7.05, SD = 2.82$ ). For the lifestyle related knowledge domain, participants in the age-group of 33-43 years ( $M = 17.60, SD = 2.56$ ), 44-54 years ( $M = 16.50, SD = 3.16$ ), and 55-66 years ( $M = 15.93, SD = 2.98$ ) had significantly higher ( $p < 0.01$ ) mean knowledge scores as compared to those in the 22-32 years age-group ( $M = 13.47, SD = 4.35$ ). With respect to the domain of functional knowledge, participants in the age group of 55-66 years ( $M = 21.19, SD = 4.62$ ) were found to have significantly higher ( $p < 0.01$ ) mean knowledge scores than those in the age group of 22-32 years ( $M = 16.85, SD = 5.54$ ), 33-43 years ( $M = 18.08, SD = 4.99$ ) and 44-54 years ( $M = 18.63, SD = 6.17$ ), although no significant differences in knowledge were found among the three younger age-groups.

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**Table 2 Mean hypertension knowledge scores of the study sample in the four domains and the overall hypertension knowledge across the four age groups**

Hypertension Knowledge	Age group				<i>F</i> (3, 196)	<i>p</i>
	22-32 ( <i>n</i> = 40)	33-43 ( <i>n</i> = 25)	44-54 ( <i>n</i> = 38)	55-66 ( <i>n</i> = 97)		
Theoretical	4.40 (3.03)	5.96 (2.63)	5.78 (2.45)	5.62 (2.32)	2.98	0.032
Essential	7.05 (2.82)	8.84 (2.64)	9.10 (3.14)	9.17 (2.38)	6.45	0.000
Lifestyle	13.47 (4.35)	17.60 (2.56)	16.50 (3.16)	15.93 (2.98)	9.75	0.000
Functional	16.85 (5.54)	18.08 (4.99)	18.63 (6.17)	21.19 (4.62)	7.93	0.000
Total	39.12 (9.79)	46.60 (8.24)	46.36 (11.16)	48.49 (7.91)	10.25	0.000

*Note:* Figures in parentheses indicate standard deviation scores

### Variations in the Overall and Domain-wise Hypertension Knowledge Scores by Gender in the Total Study Sample, Hypertensive and Normotensive participants:

Gender-wise comparisons of the mean knowledge scores in the four domains as well as the overall hypertension knowledge were computed for the total study sample, hypertensive and normotensive participants as shown in Table 3. The results of the independent samples *t* test showed that the difference in the means of the overall hypertension knowledge scores between men (*n* = 104, *M* = 44.74, *SD* = 10.95) and women (*n* = 96, *M* = 47.32, *SD* = 7.81) was statistically significant,  $t(198) = -1.90$ ,  $p = 0.025$ , 95% CI [-5.25, 0.09], *d* = 0.27. Specifically our results suggest that women in our study had significantly higher knowledge about the condition of hypertension as compared to men. Results of the independent samples *t* test showed a statistically significant mean difference in the lifestyle and functional knowledge scores between men and women in the total study sample. Women were found to have significantly higher mean lifestyle related knowledge scores (*n* = 96, *M* = 16.33, *SD* = 2.91) as compared to men (*n* = 104, *M* = 15.23, *SD* = 3.91),  $t(198) = -2.24$ ,  $p = 0.026$ , 95% CI [-2.07, -0.13], *d* = 0.32. Women in our study sample were also found to have significantly higher mean functional knowledge scores (*n* = 96, *M* = 20.27, *SD* = 4.80) than men (*n* = 104, *M* = 18.69, *SD* = 5.89),  $t(198) = -2.06$ ,  $p = 0.04$ , 95% CI [-3.08, -0.07], *d* = 0.29. However there was no statistically significant difference in the mean hypertension knowledge scores of men and women in the domains of theoretical and essential knowledge.

Among the normotensive participants, there were no significant differences between men and women in the overall hypertension knowledge scores as well as in the domains of theoretical, essential and functional knowledge. However, statistically significant differences in the mean hypertension knowledge scores of men and women were found in the domains of lifestyle-related knowledge among the normotensive participants. Normotensive women in our study sample obtained significantly higher mean lifestyle knowledge scores (*n* = 45, *M* = 16.73, *SD* = 2.97) than normotensive men (*n* = 59, *M* = 14.55, *SD* = 4.26),  $t(102) = -2.92$ ,  $p = 0.004$ , 95% CI [-3.65, -0.69], *d* = 0.60.

Among the hypertensive participants, there were no statistically significant mean differences in the overall hypertension knowledge scores and in the theoretical, essential and lifestyle-related knowledge scores of men and women. However, statistically significant mean differences were found between men and women in the domain of functional knowledge among the hypertensive participants. Hypertensive women were found to have significantly higher mean functional knowledge scores (*n* = 51, *M* = 21.84, *SD* = 4.61) than hypertensive men (*n* = 45, *M* = 19.33, *SD* = 5.62),  $t(94) = -2.39$ ,  $p = 0.018$ , 95% CI [-4.58, -0.43], *d* = 0.49.



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**Table 3 Results of t-test and Descriptive Statistics for Theoretical, Essential, Lifestyle, Functional and Total Hypertension Knowledge of the study sample by gender**

Knowledge Domain	Males		Females		t	P	95% CI	Cohen's d
	M	SD	M	SD				
Theoretical	5.59	2.43	5.30	2.73	0.80	0.423	[-0.42, 1.01]	0.11
Essential	8.46	3.13	8.94	2.31	-1.24	0.211	[-1.25, 0.28]	0.17
Lifestyle	15.23	3.91	16.33	2.91	-2.24	0.026	[-2.07, -0.13]	0.32
Functional	18.69	5.89	20.27	4.80	-2.06	0.040	[-3.08, -0.07]	0.29
Total	44.74	10.95	47.32	7.81	-1.90	0.025	[-5.25, 0.09]	0.30

### Predictors of Hypertension Knowledge

The impact of predictors on the overall hypertension knowledge level in the study sample was examined. Simple regression analysis was done to identify the impact of the following predictors viz. age, hypertensive status and marital status on the overall hypertension knowledge levels. The results are presented in Table 4. The results revealed that age is a significant predictor of hypertension knowledge. It may be observed from the table that age explained statistically significant proportion of variance (11%) in hypertension knowledge,  $R^2 = .11$ , adjusted  $R^2 = .104$ . It can be seen from Table 4 that age was seen to significantly predict knowledge,  $F(199)=24.10$ ,  $p<.01$ . A positive relationship was found between age and hypertension knowledge,  $\beta=.32$ ,  $p<.01$ , indicating that with increasing age, knowledge about hypertension also increased substantially.

The other factor contributing significantly to the overall hypertension knowledge level was found to be the hypertensive status of respondents,  $F(199)=15.11$ ,  $p<.01$ . Hypertensive status of respondents explained a statistically significant proportion of the variance (7%) in hypertension knowledge,  $R^2 = .071$ , adjusted  $R^2 = .066$ . A positive relationship was found between hypertensive status and hypertension related knowledge,  $\beta=.26$ ,  $p<.01$  indicating that hypertensive patients had significantly better knowledge about the condition of hypertension as compared to the normotensive respondents in our sample.

Another significant predictor of hypertension knowledge was found to be marital status,  $F(199)=10.30$ ,  $p<.05$ . Marital status explained a statistically significant proportion of the variance (5%) in hypertension knowledge,  $R^2 = .05$ , adjusted  $R^2 = .045$ . A positive relationship was found between marital status and hypertension knowledge,  $\beta=.22$ ,  $p<.01$ , indicating that married respondents had significantly higher knowledge about the condition of hypertension as compared to the unmarried respondents in our study sample.

**Table 4 Summary of simple regression analyses for variables predicting total hypertension knowledge scores**

Predictors	C	B	SEB	$\beta$	SE	F
Hypertensive status	43.51	5.12	1.31	.266	9.31	15.11**
Marital status	40.32	6.46	2.01	.222	9.42	10.30**
Age	34.74	.228	.04	.329	9.12	24.10**

Criterion: Knowledge, C Constant, B Unstandardized Beta Coefficient

SEB Standardized Error of Beta,  $\beta$  Standardized Beta Coefficient

Since three factors, age, hypertensive status and marital status were found to significantly predict hypertension knowledge, a multiple regression analysis with enter method was done to see the combined effect of age, hypertensive status and marital status. The results are

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presented in Table 5. The results revealed that there was a significant combined effect of age, hypertensive status, and marital status on hypertension knowledge,  $F(199)=9.17, p<.01$  and all the three factors together explained a statistically significant proportion (12%) of the variance in the total hypertension knowledge level of the study sample. It can be seen from Table 5 that there existed a positive relationship between age and knowledge,  $\beta=.22, p<.01$ .

### *Summary of multiple regression analysis for variables- hypertensive status, age and marital status predicting total hypertension knowledge scores*

Predictors	Hypertension Knowledge		
	B	SEB	$\beta$
Hypertensive status	2.14	1.56	.11
Marital status	2.42	2.19	.08
Age	.15	.06	.22
SE		9.09	
R <sup>2</sup>		.12	
C		35.07	
F		9.17**	

Criterion: Knowledge, C Constant, B Unstandardized Beta Coefficient

SEB Standardized Error of Beta,  $\beta$  Standardized Beta Coefficient

SE Standard error of the estimate, \*\* $p<.01$ , \* $p<.05$

## DISCUSSION

It is well-known that improving patient knowledge about hypertension contributes to favorable outcomes in terms of improved adherence to the treatment and lifestyle regimen, enhanced satisfaction, better prognosis, improved quality of life and enhanced well-being in chronic disease management. Our study aimed at understanding the level of knowledge as well as examining the differences between the hypertensive and normotensive participants about the condition of hypertension. The primary finding of this study was that the overall knowledge level about hypertension among both the hypertensive and normotensive participants was found to be inadequate. This rings in alarm bells for the Indian health care system in terms of the health, social and economic costs incurred as a result of the complications of hypertension. Further, hypertension being an asymptomatic condition, often known as the “silent killer”, could result in cardiac, renal and multi-organ damage with life-threatening consequences. According to the World Health Organization (WHO), 25% of Indians are at risk of premature death from non-communicable diseases, accounting for the largest cause of death (Dey, 2016). This spells danger in terms of numbers due to the large population size of India.

The hypertension incidence rates in India have been found to be around 36% among urban adults and 30% among rural adults accounting for 1.1 million deaths annually with an annual expenditure of 20 billion dollars being incurred from the medical care of the untreated complications of raised blood pressure (Ram, 2017). The situation is dismal in light of the fact that only a low proportion of those with hypertension are aware of their hypertensive status leading to severe health complications. Hence these alarming statistics indicate the importance of increasing knowledge and awareness about the risk factors of hypertension as well as the dire need for the early screening of the condition to facilitate the early detection, treatment and effective control of high blood pressure.

The World Hypertension League data states that more than 50% of those with hypertension are unaware of their condition (Witten, Vuuren, & Learmonth 2013; Chockalingam 2008)

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which supports the findings from a study in South India which found that 67% of those with hypertension were ignorant of their hypertensive status (Mohan, Deepa, Farooq, Dutta, & Deepa, 2007).

A meta-analysis of 28 studies from 15 countries has shown that 45% of hypertensive patients and 84% of patients with uncontrolled hypertension were found to be non-adherent to their medication regimen making them susceptible to the adverse health complications of high blood pressure (Abegaz, Shehab, Gebreyohannes, Bhagavathula, & Elnour, 2017). A systematic review of various Indian population based epidemiological studies conducted over the years has found that among the urban populations who were aware of their hypertensive status, the treatment and control rates were found to be 38% and 20% respectively while in rural populations, the treatment and control rates were found to be 25% and 11% respectively (Gupta & Gupta, 2017).

Knowledge about one's disease condition has been shown to influence cognition which in turn generates emotion leading to motivated behavior change. This is resonant with previous findings which have shown that inadequate knowledge about hypertension was found to correlate with decreased treatment regimen compliance leading to increased mortality (Giuse, Koonce, Storrow, Kusnoor, & Ye, 2012; Desmedt & Valcke, 2004). An Indian study by Thankappan, Sivasankaran, Mini, Daivadanam, Sarma, and Khader (2013) showed that counseling, regular monitoring and patient health education by community health workers and volunteers significantly improved awareness, treatment and control of hypertension in a community in Kerala. Previous studies have found that knowledge provision strategies about hypertension and its therapy through presentations, monthly meetings and summary information leaflets, not only resulted in enhancement of knowledge but also had a positive influence on beliefs regarding medicines leading to enhanced adherence (Magadza, Radloff, & Srinivas, 2009).

Kim et al. (2011) have found that although both the literate and illiterate patients had an equal desire to participate in medical decision making, low health literacy was associated with lower BP control and management as low literacy patients were found to ask fewer medical questions and were less able to respond to physician's use of patient centered communication approaches. Thus in order to facilitate health behavior change, knowledge about the condition seems to be the first step to gain positively from physician communication in clinic settings.

Another finding of our study was that the hypertensive participants, had a significantly higher level of knowledge, about hypertension than the normotensive participants. This finding indicates that primary prevention efforts need to be stepped-up as aging patterns, urbanization and globalization of unhealthy lifestyle patterns are rapidly increasing hypertension incidence and prevalence rates afflicting a vast majority of the nation's population. Also our finding presents a dismal picture in terms of hypertension related morbidity and mortality as a majority of those with hypertension are ignorant about the status of their condition. A review by Anchala et al. (2014) found that the overall prevalence of hypertension in India was found to be 29.8% with an estimated 33% of the urban and 25% of the rural Indian population being afflicted with hypertension. However, the alarming finding of the review was that only 25% of the rural and 42% of the urban Indians were found to be aware of their hypertensive status and of those aware only a small proportion of 25% of the rural and 38% of the urban Indians were being treated for the condition. This finding is consistent with the data from a survey conducted by the Cardiological Society of India among 1.8 lakh people across 24 states in the country which found that one-third of Indians were found to be afflicted with hypertension

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and 60% of those with hypertension were unaware of their hypertensive status leading to a steeply rising trend of cardiovascular morbidity and mortality (“Cardiological Society of India”, 2015). The survey also found that nearly 42% of those taking medication for hypertension suffered from uncontrolled hypertension calling for urgent measures to increase knowledge among hypertensives regarding the lifestyle and behavioral modifications to be made for the effective management of the condition.

A major finding of our study was that the hypertensive participants had significantly higher overall knowledge as well as enhanced knowledge in the domains of theoretical, essential and functional knowledge as compared to the normotensive participants. This finding holds particular relevance for the state of Telangana as on the occasion of World Hypertension Day, doctors from the Apollo Institute of Blood Pressure Management warned that although nearly 30-35% of adults in the state of Telangana were hypertensive, less than 10% were aware of the existence of the condition (Ram, 2017). It may be noted that the consequences of being unaware and neglecting a condition like hypertensive can lead to irreparable damage in terms of morbidity and mortality. Dr. Venkata Ram, director of the South Asia regional office of the World Hypertension League (WHL), who also heads the Apollo Institute of Blood Pressure Management in Hyderabad has pointed out that undiagnosed and under-treated hypertension can not only lead to stroke, brain hemorrhage, heart failure, heart attack, kidney failure and “chronic diseases” but can also be a huge social and financial burden for individual families and the health care system. Hence health education efforts must aim at early detection, increasing awareness and effective management of the condition to reverse the health, social and financial costs of treating the adverse health complications of raised blood pressure.

Another dismal finding of the study was that participants in the younger age groups had significantly lower knowledge about hypertension than those in the older age groups. This finding presents a grim picture in light of the younger ages of onset of primary hypertension in India with even children becoming a prey to this condition due to unhealthy dietary habits and sedentary lifestyle patterns. This finding has been supported by a recent cross-sectional population-based study conducted among 1.3 million Indians across 27 states in India between the years 2012 and 2014, which has shown that a significantly higher number of young adults were being afflicted with hypertension, with approximately one in ten persons in the age-group of 18 to 25 years being diagnosed with high blood pressure regardless of their place of residence (rural vs. urban), socio-economic status, or gender (Geldsetzer et al., 2018).

A preventive medical screening survey conducted among 980 school going children in the age group of 5 to 18 years, in the state of Telangana found that an increasing number of children were found to be hypertensive, with the parents of these children being unaware of their child’s hypertensive status (Biswas, 2018). Lack of exercise, excessive use of gadgets, excess intake of junk food and aerated drinks, long hours of study and academic stress were identified as the main risk factors for the development of hypertension in children. Nearly 50% of the children surveyed in the study were found to be either overweight or obese (31% were found to be overweight and 18.6% were found to be obese), thus increasing the likelihood of the future development of hypertension (Biswas, 2018).

A study conducted among 1611 students aged between 17 and 25 years randomly selected from two colleges in the Moinabad area in the outskirts of the city of Hyderabad, showed that the prevalence of pre-hypertension and hypertension in the study sample were found to be

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26.95% and 4.86% respectively (Srinivas, Pallerla, Madoori, Ramdas, Kotla, & Jalagam, 2015). Further the study also found that being over-weight, obesity and having a family history of hypertension were associated with an increased likelihood of hypertension.

The statistics in India related to hypertension incidence and prevalence rates have been found to be increasing astronomically with a growing number of children and adolescents being afflicted with the disease (Ram, 2017). Hence preventive measures need to be taken and effective management of the condition through appropriate lifestyle modifications is the key to reversing the course of this dangerous non-communicable epidemic. In light of the increasing prevalence of hypertension among young adults in the state of Telangana, increasing awareness about hypertension in schools, colleges, workplaces and the IT industry was suggested as part of the primary prevention efforts on the occasion of World Hypertension Day (Ram, 2017).

According to a study by Manorenj,Inturi, and Jyotsna (2016), a majority of the victims of small vessel occlusion type stroke in which there is a blockage of small vessels deep in the brain belong to the younger age groups with nearly 68% of the cases being attributed to uncontrolled hypertension, 79% being attributed to higher than normal LDL and low HDL cholesterol, smoking being a risk factor in 58% of the cases, excessive alcohol use contributing to 55% of the cases, diabetes contributing to 40.4% and physical inactivity being a risk factor for 27.3% of the overall stroke cases.

In light of these findings, it is alarming to envisage that a nation's most productive age-group is susceptible to life-threatening consequences as a result of being unaware of the risk factors of hypertension. With younger age-groups being increasingly afflicted with hypertension, loss of productivity can hinder the health, economic and social advancement of a developing nation like India. Hence enhancing the knowledge of younger age-groups by incorporating hypertension related health education in the curriculums of schools, colleges, universities and workplaces will reverse the adverse consequences of undetected and uncontrolled hypertension for the most productive age-group of the nation.

Another finding of our study was that women were found to have significantly higher levels of knowledge about hypertension than men. This finding is consistent with previous reports which have shown that a significantly higher proportion of men have been diagnosed with "Very high hypertension", "Slightly above normal" and "Moderately high hypertension" with Mumbai occupying the top slot (35.2%), followed by Hyderabad (24.1%), Kolkata (23.3%), Chennai (8%) and Bengaluru (11.5%) in all the three categories of hypertension (Sikdar, 2016). Women of Hyderabad were found to figure third in all the three categories of hypertension with 12.3% of women categorized as hypertensive, next to Kolkata's 12.5% and Mumbai's 12.5% (Sikdar, 2016). Hence women were found to have better knowledge than men about the modifiable risk factors of hypertension leading to lower hypertension prevalence rates among this sub-group. The National Family Health Survey 4 (2015-16) conducted in 17 states covering 20,000 individuals by the Union health ministry shows that Hyderabad men are afflicted with "very high" level of hypertension as compared to men in other cities such as Chennai, Mumbai, Bengaluru, Kolkata, Dehradun, Bhopal and Patna (Sikdar, 2016). The findings of our study are consistent with a study conducted by Srinivas et al. (2015) among college students in Hyderabad which showed that the prevalence of pre-hypertension and hypertension was found to be 35.29% and 6.64% respectively in males as compared to 9.64% and 1.18% respectively in females. Hence hypertension related health

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education efforts must be directed at enhancing knowledge and mitigating the risk factors of hypertension in this vulnerable group.

### *Implications of the study*

Hypertension is an epidemic reaching gargantuan proportions in terms of rapidly increasing incidence and prevalence rates and early ages of onset in India. Undetected, undiagnosed and untreated hypertension will have serious consequences for a nation in terms of health, social and economic costs. In a bid to reverse the course of the non-communicable disease burden in India, the government has launched the “Prevention, Screening and Control of Common Non-Communicable Diseases” programme as part of the National Health Mission which will roll out door to door screening in 100 districts (Dey, 2016). The WHO’s latest assessment that 25% of the Indian population are at risk of premature death from non-communicable diseases primarily cardiovascular diseases, respiratory diseases, cancer and diabetes calls for immediate prevention and control measures (Dey, 2016). Door to door screening initiatives, public health education in schools, colleges and offices will pave the way for the effective mitigation and reversal of this non-communicable epidemic. A concerted multi-disciplinary effort by government officials, policy makers, public health specialists, doctors, and academicians in disseminating knowledge about this condition will serve to facilitate primary prevention, screening, detection, diagnosis and treatment of this largely preventable condition. The initiation of preventive care clinics in primary care facilities will greatly serve to provide the much needed screening for hypertension, health education and counseling on the risk factors, management, control and treatment of chronic non-communicable diseases like hypertension, thus optimizing health outcomes among the general community. Also, the government needs to step in and provide affordable and accessible anti-hypertensive medication as well as basic primary health care to all sections of society especially the socio-economically disadvantaged groups and those living in rural areas to reduce the burden of hypertension in a developing country like India.

### *Limitations of the study*

Purposive sampling was used to recruit the sample from two geographical locations which may have led to a certain amount of bias. Hence, there is a need to establish the validity of the study by using a more representative sample to improve generalizability of results.

## CONCLUSION

Enhancing knowledge about the condition of hypertension among hypertensive and normotensive participants alike has been found to be the forerunner of improved medication and lifestyle recommendations adherence facilitating prevention and effective disease management of the condition. Ours is one of the few studies to assess the knowledge about the condition of hypertension among hypertensive and normotensive participants. The findings of our study point to the importance of designing health education modules and health promotion interventions, to improve knowledge about the condition of hypertension, thereby facilitating the primary prevention and improved control of this chronic lifestyle-related condition.

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### **Acknowledgments**

We would like to thank all the patients who participated in this study. We would also like to express our sincere thanks to all the doctors and subject matter experts for their valuable inputs and guidance during the study.

### **Conflict of Interest**

There is no conflict of interest.

### **Funding**

The study is part of the PhD work which is funded by UGC NET with the JRF award number of 487/(NET – DEC. 2015)

**How to cite this article:** Oruganti, R., Paidipati, S., & Dinaker, M.(2018). Knowledge about Hypertension among the Hypertensive and Normotensive Population. *International Journal of Indian Psychology*, 6(4), 27-43. DIP:18.01.064/20180604, DOI:10.25215/0604.064