Prevalence and factors associated with hypertension among adults in rural areas of Patna, India: A cluster cross-sectional study

Alok Ranjan, PhD(Epid.,UCLA),M.Sc.(Stat.),MBA

Department of Community Medicine, All India Institute of Medical Sciences, Patna, India

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Acknowledgements: Sanjay Pandey, CM Singh, SK Nirala

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Introduction

- Hypertension , one of the most significant global public health problems and development challenges of the 21st century
- Rapid cultural and social changes, aging populations, increasing urbanization, dietary changes, reduced physical activity, and other unhealthy behaviours attributed to an increasing trend of hypertension --- causing common cardiovascular health problems in both developed and developing countries
- A disease of the well-off population of urban areas because of their lifestyle and stressful livelihood conditions
- Systematic review and meta-analysis(2014) : Overall prevalence among adults in India 30% - urban prevalence 34% - rural prevalence 28%
- Increasing prevalence of hypertension in rural areas of India observed- causing a serious public health concern

Methodology

- **Study Design & setting: P**opulation-based cluster cross-sectional study conducted in Naubatpur block of Patna District, Bihar, India from July 2022 to June 2023 through Rural Health Training Centre (RHTC) of CFM Department, AIIMS
- **Study population and size:** 840 Adult population aged (≥18 years) and permanent residents of the village (at least for 1 year)
- **Sampling method** :Three-stage cluster sampling – 30 villages randomly using PPS sampling from the sampling frame of 108 villages as the PSU - 28 households selected randomly in each PSU - one adult in the desired age group selected from the household
- **Data collection tools :** A pre-tested standardized structured questionnaire using some of the variables WHO STEPS methodology-socio-demographic, economic, anthropometric, family history and life style behaviours
- **Measurements** : Standard WHO procedures were used to measure blood pressure and anthropometric measurements by resident doctors

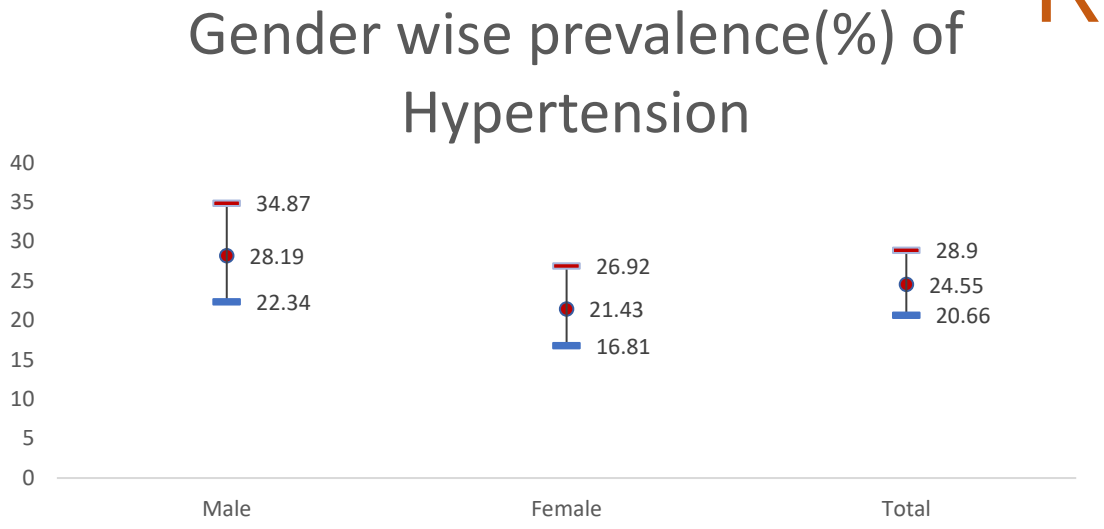
Statistical Analysis

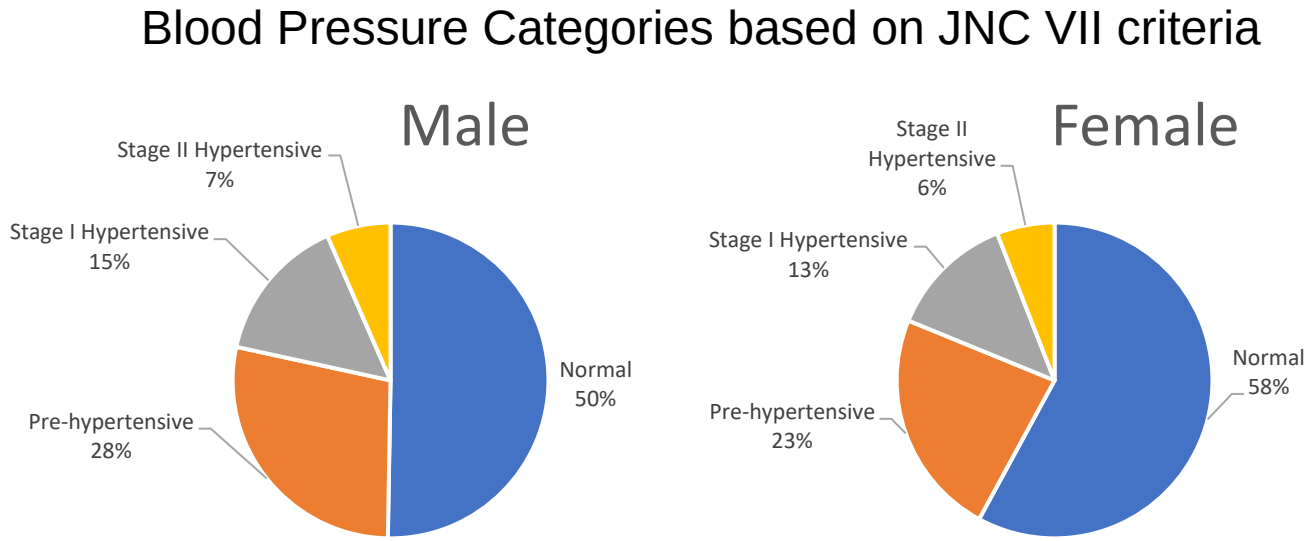
- Stata Version 10 (Stata Corp, Texas, USA) defining the data as cluster data for all analyses.
- Continuous variables such as age, BMI, waist circumference and Waist-hip ratio (WHR) were categorized and presented as proportions with 95% Confidence Intervals.
- Subjects having (SBP ≥ 140 or DBP ≥ 90 mmHg) or with a prior diagnosis by a physician or the use of any antihypertensive medicine as reported by the respondent at the time of survey defined as Hypertensive, otherwise as Non-hypertensives
- Bivariate analyses of each variables with hypertension status to estimate crude odds ratio (95% confidence interval)
- Multivariate logistic regression to estimate adjusted odds ratio(95% CI) after controlling the confounders

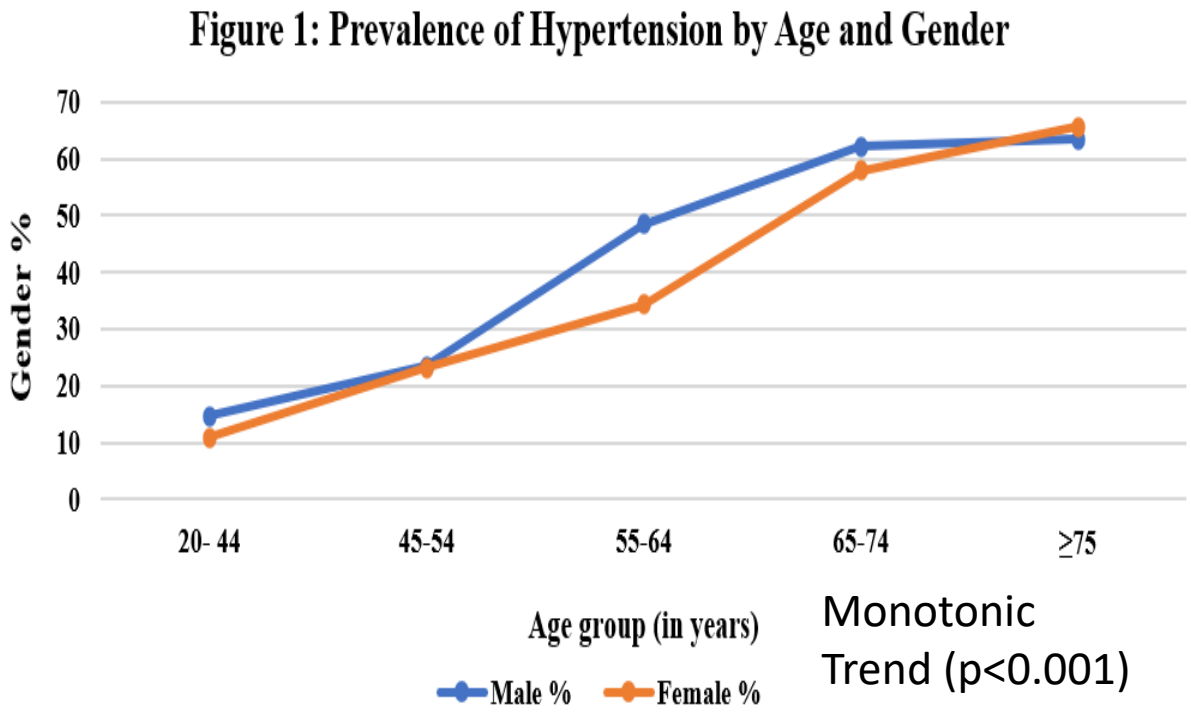
Statistical Analysis

- The likelihood ratio - overall model evaluation, Hosmer-Lemeshaw test of goodness-of-fit test- the fit of logistic models
- Classification tables - estimate the sensitivity (Se), specificity (Sp) and overall correction prediction (cut-off probability of 0.50)
- Area-under-curve (AUC) (95% confidence intervals), similar to c-statistic, for explaining the predictive ability of the models.
- The Gamma statistic, which is based on Kendall's Tau-α, to measure the association between the outcomes and predicted probabilities and tested using z-statistic.
- The Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used for the model selection and comparison.

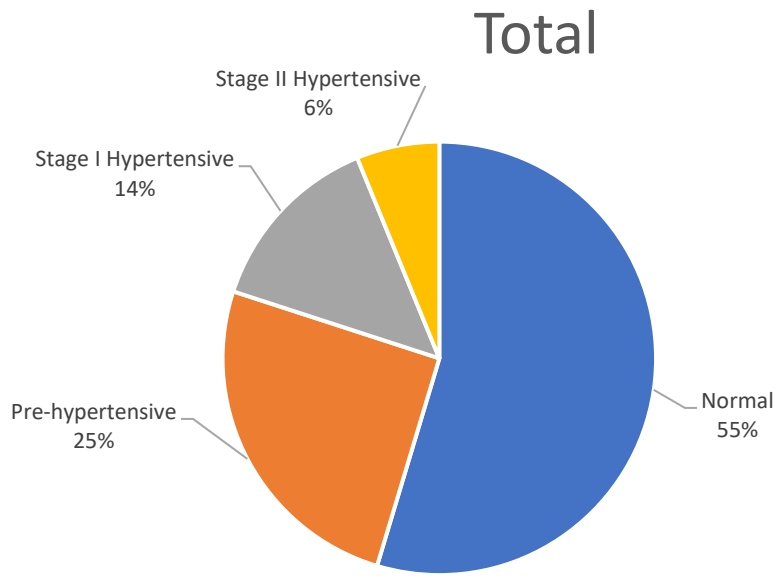
Results







Monotonic Trend ($p<0.001$)



Bivariate Analysis: Association of various factors

Factors	Hypertensive n(%)	Crude OR	95% Confidence Interval	P-value
Gender (Male)	109 (30)	1.65	1.19 – 2.29	0.0019
Age Groups				
45-54	32 (25.6)	2.18	1.31 – 3.58	0.0011
55-64	39 (37.5)	3.79	2.29 – 6.23	0.0001
65-74	45 (58)	8.36	4.84 – 14.45	0.0001
≥ 75	22 (65)	11.59	5.18 – 26.17	0.0001
Marital Status				
Separated/Divorced	9 (41)	2.96	1.07 – 9.26	0.034
Widow/Widower	16 (41)	2.98	1.15 – 7.73	0.0114
Family History (Yes)	73 (45)	3.32	2.27 – 4.84	0.0001
Smoking (Yes)	52 (49)	3.63	2.33 – 5.64	0.0001
Smokeless Tobacco(Yes)	128 (32)	2.16	1.54 – 3.02	0.0001
Salt Consumption (>5gm/day)	117 (57)	2.42	1.16 – 5.62	0.007
BMI (Kg/mt. square)				
25.0 – 29.9	49 (32)	1.52	1.01 – 2.31	0.039
≥30	21 (37.5)	1.95	1.04 – 3.62	0.0217
Waist Circumference(cms) (Male≥90/Female≥80)	114 (34)	2.35	1.68 – 3.28	0.0001
WHR (M≥0.9/F≥0.85)	126 (27)	1.83	1.23 – 2.76	0.019

Multivariate Analysis

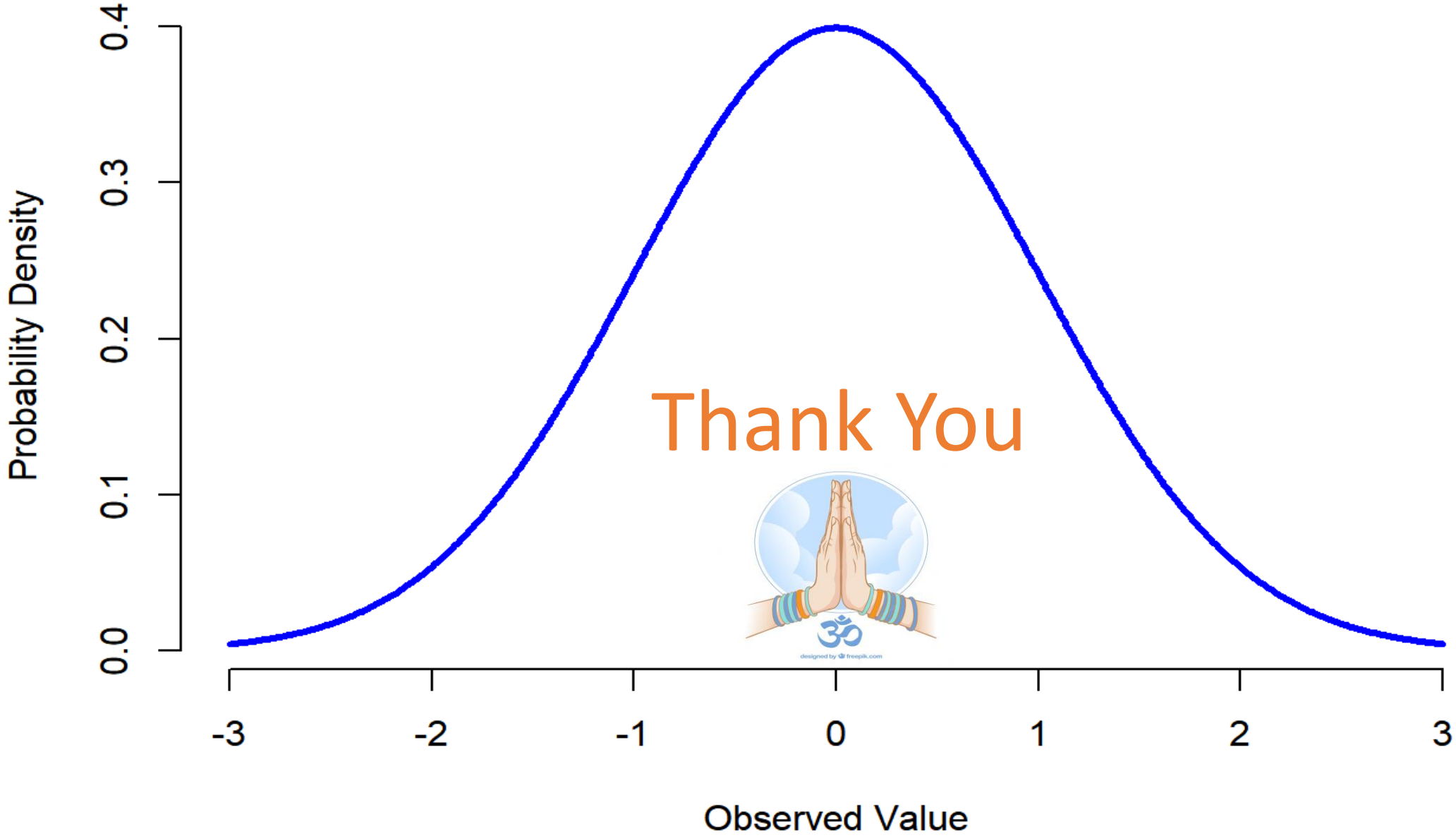
Models	Model I		Model II		Model III	
Factors	Adj. OR (95%CI)	P-value	Adj. OR (95%CI)	P-value	Adj. OR (95%CI)	P-value
Gender (Male)	1.52 (1.07 – 2.16)	0.019				
Age Groups						
45-54	1.94 (1.18 – 3.19)	0.010	1.81 (1.09 – 3.00)	0.022	2.05 (1.21 – 3.48)	0.008
55-64	3.97 (2.43 – 6.48)	0.001	3.63 (2.21 – 5.96)	0.001	4.39 (2.60 – 7.41)	0.001
65-74	9.67 (5.62 – 16.63)	0.001	8.59 (4.96 – 14.85)	0.001	12.18 (6.84 – 21.72)	0.001
≥ 75	15.46 (6.95 – 34.2)	0.001	13.81 (6.15 – 31.03)	0.001	20.59 (9.05 – 46.85)	0.001
BMI (Kg/mt. square)						
25.0 – 29.9	1.76 (1.12 – 2.75)	0.014	1.82 (1.15 – 2.85)	0.036	1.68 (1.06 – 2.68)	0.029
≥30	3.01 (1.57 – 5.73)	0.001	2.77 (1.43 – 5.35)	0.009	2.97 (1.48 – 5.98)	0.002
Salt Consumption (>5gm/day)	4.37 (2.01 – 9.47)	0.001	4.58 (2.08 – 10.08)	0.001	4.79 (2.12 – 10.81)	0.001
Smoking (Yes)	-		1.82 (1.10 – 3.00)	0.020		
Smokeless Tobacco(Yes)	-		1.83 (1.26 – 2.61)	0.001	1.83 (1.26 – 2.61)	0.001
Family History (Yes)	-		-		4.61 (3.01 – 7.09)	0.001
Likelihood Ratio Test	χ^2=149.85 (9d.f.)	0.0001	χ^2=163.82 (10d.f.)	0.0001	χ^2=207.6 (10d.f.)	0.0001
H-L Test Goodness-of-fit	χ^2=4.68 (6d.f.)	0.5861	χ^2=4.82 (8d.f.)	0.7766	χ^2=11.64 (9d.f.)	0.113
Classification (0.50)	72.86% (Se=66.5%, Sp=75%)		72.02% (Se=69%, Sp=73%)		72.5% (Se=69%, Sp=74%)	
AUC (95% CI)	0.766 (0.733 – 0.795)		0.767 (0.738 – 0.795)		0.793 (0.77 – 0.82)	
Information Criteria(AIC,BIC)	AIC = 806.98, BIC = 853.32		AIC = 794.0, BIC = 846.0		AIC = 750.18, BIC = 802.25	
Kendall's coefficient (G-stat)	0.457		0.441		0.459	

Discussion

- Estimated Prevalence of Hypertension was higher compared to NFHS-5 (2019-20) in rural population of state (age 15-49)
- Similar to other studies conducted in the same study area (Singh R et al,2011, Ross et al, 2010)
- Higher prevalence compared to other states like Maharashtra, Tamil Nadu, Haryana, Andhra Pradesh, Punjab – HDI of these states better than Bihar
- Factors advancing age, male, overweight/obesity, salt consumption (>5gm/day), smoking, smokeless tobacco and family history - significant predictors after controlling for the confounders
- Other studies conducted in India in similar populations also reported physical inactivity, central obesity, alcohol consumption as predictors except salt consumption
- 25% of the subjects in pre-hypertensive stage – not aware – lack of awareness
- 61% of the hypertensive not taking antihypertensive medicines regularly – lack of adherence

Limitations and Conclusion

- Limitations: Gender distribution different compared to General Pop, low education level and occupation in non-organised sector causing non-identification of social class, alcohol consumption not possible due to Prohibition and Excise Act, 2016 in state, Missing data on physical activity, income, Lack of temporality - inherent limitation of cross-sectional design
- Conclusion:
- High prevalence of hypertension in the rural adult population is a major public health concern
- Public health policymakers and professionals need to create awareness, early identification, and prevention programs in rural areas to focus on modifiable behaviors in rural areas to combat the menace of diseases associated with hypertension



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