ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7113-7118 (2026)
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BIOINFORMATION
Discovery at the interface of physical and biological sciences
BIOMEDICAL INFORMATICS
www.bioinformation.net
Volume 22(10)
Research Article

Received October 1, 2026; Revised October 31, 2026; Accepted October 31, 2026, Published October 31, 2026
DOI: 10.6026/973206300227113

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

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Edited by Ruby Singh
E-mail: bioinformationruby@gmail.com
Citation: Tiwari & Sharma, Bioinformation 22(10): 7113-7118 (2026)

Socioeconomic factors influencing hypertension care in urban REWA, Madhya Pradesh, India

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ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 7113-7118 (2026)
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Abstract:
Hypertension care remains inadequate among socioeconomically disadvantaged populations, particularly in urban Rewa, Madhya Pradesh. This cross-sectional study assessed 440 hypertensive adults using multistage sampling, a pre-tested questionnaire and a composite Hypertension Care Score. Good, fair and poor care was reported in 35.0%, 45.0% and 20.0% of participants, respectively, while blood pressure was controlled in 54.1%. Education, socioeconomic status, income, health insurance and physical activity were significantly associated with better hypertension care ($p<0.001$). Thus, addressing socioeconomic inequalities through primary care, health literacy and financial protection may improve equitable hypertension management.

Keywords: Hypertension, socioeconomic status (SES), hypertension care, blood pressure control, community-based study, urban health, non-communicable diseases, India

Background:
Hypertension is a major modifiable risk factor for cardiovascular disease (CVD) and a leading cause of premature morbidity and mortality worldwide **[1]**. In 2024, approximately 1.4 billion adults aged 30–79 years had hypertension and only about 23% had controlled blood pressure, highlighting major gaps in detection, treatment and long-term care **[1].** India's epidemiological and lifestyle transitions, including urbanization, population ageing, obesity, unhealthy diets, physical inactivity, tobacco and alcohol use and psychosocial stress, contribute to the growing burden of hypertension and CVD **[2, 3].** National studies report substantial geographic and socioeconomic variations in hypertension prevalence, awareness, treatment and control, particularly among younger adults and underserved populations **[4].** Effective hypertension care requires early detection, accurate diagnosis, timely treatment, uninterrupted medication availability, regular follow-up, blood pressure monitoring, counselling, lifestyle modification and continuity of care **[5].** Socioeconomic status (SES), including education, income, occupation, health literacy, healthcare access and financial security, influences healthcare utilization, treatment adherence, lifestyle practices and hypertension control **[6].** The WHO Commission on Social Determinants of Health emphasizes addressing social, economic and environmental inequalities to reduce health disparities **[7].** The Lancet Commission on Hypertension similarly highlights strengthening primary healthcare and reducing socioeconomic disparities to improve hypertension control **[8].** The India Hypertension Control Initiative (IHCI) promotes standardized treatment protocols, uninterrupted medication supply, team-based care, regular follow-up and monitoring to improve hypertension management **[9]**. Nevertheless, socioeconomic inequalities may continue to influence access to and quality of hypertension care, highlighting the need for context-specific assessments and equitable interventions **[10].** Therefore, it is of interest to assess the socioeconomic factors influencing hypertension care among adults in Urban Rewa, Madhya Pradesh.

Materials and Methods:
Study design and setting:
A community-based analytical cross-sectional study will be conducted in the urban field practice area of the Department of Community Medicine, Shyam Shah Medical College, Rewa, Madhya Pradesh, India, over a period of six months. The study area comprises the urban population served by the Urban Health Training Centre (UHTC), which provides comprehensive primary healthcare services under the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD).

Study population:
The study population will consist of adults aged 18 years and above with a prior diagnosis of hypertension residing in the selected urban wards of Rewa. Individuals who have been diagnosed with hypertension by a registered medical practitioner and have been residing in the study area for at least one year will be eligible for participation. Pregnant women, critically ill patients, individuals with severe cognitive impairment or psychiatric illness that precludes interview and those unwilling to provide written informed consent will be excluded from the study.

Sample size:
The sample size was calculated using the standard formula for estimating a single population proportion: $n=4PQ/L^2$ Where **P** was assumed to be 50%, considering the absence of reliable local estimates regarding optimal hypertension care, **Q** = 100 − P (50%) and the allowable error (L) were taken as 5%. The calculated sample size was 400 participants. After accounting for an anticipated non-response rate of 10%, the final sample size was increased to 440 participants.

Sampling technique:
A multistage random sampling technique was employed. In the first stage, urban wards within the Urban Health Training Centre (UHTC) service area were selected using simple random sampling. In the second stage, households within each selected ward were chosen through systematic random sampling. The selected households were screened to identify eligible individuals with previously diagnosed hypertension. In households with more than one eligible participant, one individual was selected by simple random sampling to ensure equal probability of selection.

Study variables:
The primary independent variables included socioeconomic characteristics such as age, sex, educational status, occupation and monthly family income, socioeconomic status assessed using the Modified B.G. Prasad Scale, marital status, family type, health insurance coverage, household size and perceived social

support. The primary dependent variable was the Hypertension Care Score, a composite index developed to assess multiple dimensions of hypertension care. The score incorporated information on timely diagnosis, treatment continuity, regularity of physician follow-up, frequency of blood pressure monitoring, adherence to recommended lifestyle modifications, affordability of antihypertensive medications, receipt of health education and counselling and blood pressure control. Individual domain scores were summed to generate an overall hypertension care score, which was subsequently categorized as good, fair, or poor hypertension care according to predetermined cut-off values.

Data collection:
Data were collected through face-to-face interviews using a pretested and structured questionnaire administered by trained investigators. The questionnaire comprised five sections. The first section recorded sociodemographic characteristics, including age, sex, educational status, occupation, monthly family income, marital status and family composition. The second section obtained clinical information such as duration of hypertension, coexisting chronic diseases, family history of hypertension and hypertension-related complications. The third section assessed socioeconomic status using the Modified B.G. Prasad socioeconomic classification. The fourth section evaluated various components of hypertension care, including the healthcare provider consulted, frequency of follow-up visits, regularity of blood pressure monitoring, availability of prescribed antihypertensive medications, continuity of treatment, receipt of health education and counselling and adoption of recommended lifestyle practices such as dietary salt restriction, regular physical activity, tobacco cessation, moderation of alcohol consumption and weight management. The final section identified barriers to optimal hypertension care, including financial constraints, transportation difficulties, prolonged waiting time, medicine shortages, inadequate family support, forgetfulness and lack of awareness regarding hypertension management. Blood pressure was measured using a calibrated digital sphygmomanometer following the recommendations of the India Hypertension Control Initiative (IHCI) and standard international guidelines. Two blood pressure readings were obtained at an interval of at least five minutes after the participant had rested in a seated position for five minutes. The average of the two readings was considered for analysis. Blood pressure control was defined as a systolic blood pressure of <140 mmHg and a diastolic blood pressure of <90 mmHg.

Statistical analysis:
Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on the distribution of the data, whereas categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, wherever appropriate. Independent sample *t*-test or one-way analysis of variance (ANOVA) was used to compare continuous variables between groups. Pearson's or Spearman's correlation coefficients were calculated to evaluate relationships between continuous variables according to data distribution. To identify independent socioeconomic predictors of hypertension care, multivariable binary logistic regression analysis was performed after adjusting for potential confounding variables. When the Hypertension Care Score was analyzed as a continuous variable, multiple linear regression analysis was performed. The results were presented as adjusted odds ratios (AORs) or regression coefficients with corresponding 95% confidence intervals. A two-sided *p*-value of <0.05 was considered statistically significant.

Ethical considerations:
The study protocol was reviewed and approved by the Institutional Ethics Committee of Shyam Shah Medical College, Rewa, before the commencement of the study. Written informed consent was obtained from all participants prior to enrolment.

Results:
A total of 440 hypertensive adults participated in the study, with a response rate of 100%. The mean age of the participants was 52.4 ± 11.8 years. Nearly one-third (32.3%) of the participants belonged to the 50–59 years age group, followed by 40–49 years (26.8%), ≥60 years (23.6%) and 18–39 years (17.3%). Males constituted 51.8% (n=228) of the study population, while females accounted for 48.2% (n=212). Most participants were married (80.0%) and 55.5% belonged to nuclear families **(Table 1).**With respect to educational status, 35.5% had completed secondary education and 34.1% were graduates or above, whereas 10.9% were illiterate. Regarding occupation, 26.8% were unemployed or homemakers, followed by semi-skilled workers (24.5%), skilled workers (17.7%), unskilled workers (16.8%) and professionals (14.1%) **(Table 2).** Assessment of socioeconomic status using the Modified B.G. Prasad Scale showed that the largest proportion of participants belonged to Class III (27.7%), followed by Class IV (23.6%), Class II (21.8%), Class I (13.2%) and Class V (13.6%). Only 33.6% of the participants reported having health insurance coverage **(Table 3).** Regarding clinical characteristics, 43.6% of participants had been diagnosed with hypertension for less than five years, whereas 35.0% had hypertension for 5–10 years and 21.4% had the disease for more than ten years. Diabetes mellitus was present in 31.4% of participants, dyslipidaemia in 23.6% and a family history of hypertension was reported by 48.6% **(Table 4).** Evaluation of hypertension care revealed that 72.3% of participants reported continuous use of antihypertensive medication, while 66.8% attended regular physician follow-up visits. Monthly blood pressure monitoring was practiced by 62.7% of participants and 59.5% had received lifestyle counselling from healthcare providers. Salt restriction was followed by 65.0% of participants, whereas only 41.8% engaged in regular physical activity **(Table 5).** Based on blood pressure measurements obtained during the study, 54.1% of participants had controlled blood pressure, whereas 45.9% had uncontrolled hypertension **(Table 6).**

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The overall Hypertension Care Score demonstrated that 35.0% of participants had good hypertension care, 45.0% had fair hypertension care and 20.0% had poor hypertension care **(Table 7).** A statistically significant association was observed between socioeconomic status and hypertension care ($\chi^2 = 34.82$, $p < 0.001$). Participants belonging to higher socioeconomic classes (Classes I and II) had a substantially greater proportion of good hypertension care compared with those in lower socioeconomic classes (Classes IV and V). Conversely, poor hypertension care was more common among participants from lower socioeconomic groups **(Table 8).** Educational attainment also showed a significant association with hypertension care ($p < 0.001$). Participants with graduate-level education or higher demonstrated the highest proportion of good hypertension care, whereas poor hypertension care was most frequently observed among illiterate participants **(Table 9).** Multivariable logistic regression analysis identified higher socioeconomic status (Adjusted OR = 2.74; 95% CI: 1.69–4.45; $p < 0.001$), graduate-level education (Adjusted OR = 2.36; 95% CI: 1.41–3.96; $p = 0.001$), health insurance coverage (Adjusted OR = 1.89; 95% CI: 1.18–3.04; $p = 0.008$), higher monthly family income (Adjusted OR = 1.78; 95% CI: 1.09–2.92; $p = 0.021$) and regular physical activity (Adjusted OR = 1.94; 95% CI: 1.21–3.12; $p = 0.006$) as independent predictors of good hypertension care. Age and sex were not significantly associated with hypertension care after adjustment for other variables **(Table 10).** Among the reported barriers to optimal hypertension care, financial constraints (40.5%) were the most common, followed by medicine cost (36.8%), long waiting time (28.2%) and forgetfulness (26.4%), lack of awareness regarding hypertension (22.3%), transportation difficulties (18.6%) and poor family support (12.3%) **(Table 11).** The annual out-of-pocket expenditure for hypertension management was ₹5,000–10,000 for the largest proportion of participants (41.4%), followed by expenditure of less than ₹5,000 (26.8%), ₹10,001–20,000 (21.8%) and more than ₹20,000 (10.0%) **(Table 12).**

Table 1: Sociodemographic characteristics of the study participants

Variable	Category	n	%
Age (years)	18–39	76	17.3
	40–49	118	26.8
	50–59	142	32.3
	≥60	104	23.6
Mean age (years)		**52.4 ± 11.8**	
Gender	Male	228	51.8
	Female	212	48.2
Marital status	Married	352	80.0
	Single/Widowed/Divorced	88	20.0
Family type	Nuclear	244	55.5
	Joint	196	44.5

Table 2: Educational and occupational profile

Variable	Category	n	%
Education	Illiterate	48	10.9
	Primary	86	19.5
	Secondary	156	35.5
	Graduate & above	150	34.1
Occupation	Unemployed/Homemaker	118	26.8
	Unskilled	74	16.8
	Semi-skilled	108	24.5
	Skilled	78	17.7
	Professional	62	14.1

Table 3: Socioeconomic characteristics

Variable	Category	n	%
Modified BG Prasad Class	I	58	13.2
	II	96	21.8
	III	122	27.7
	IV	104	23.6
	V	60	13.6
Health Insurance	Yes	148	33.6
	No	292	66.4

Table 4: Clinical characteristics of participants

Variable	Category	n	%
Duration of hypertension	<5 years	192	43.6
	5–10 years	154	35.0
	>10 years	94	21.4
Diabetes mellitus	Present	138	31.4
Dyslipidaemia	Present	104	23.6
Family history of hypertension	Present	214	48.6

Table 5: Components of Hypertension Care

Component	Category	n	%
Regular physician follow-up	Yes	294	66.8
BP checked at least monthly	Yes	276	62.7
Continuous medication	Yes	318	72.3
Lifestyle counselling received	Yes	262	59.5
Salt restriction practiced	Yes	286	65.0
Regular physical activity	Yes	184	41.8
Tobacco cessation (among users)	Yes	78	55.7*

**Percentage calculated among tobacco users.*

Table 6: Blood pressure control

Variable	n	%
Controlled (<140/90 mmHg)	238	54.1
Uncontrolled (≥140/90 mmHg)	202	45.9

Table 7: Overall hypertension care score

Category	n	%
Good	154	35.0
Fair	198	45.0
Poor	88	20.0

Table 8: Association between socioeconomic status and hypertension care score

BG Prasad Class	Good n (%)	Fair n (%)	Poor n (%)	χ^2	p-value
I	34 (58.6)	20 (34.5)	4 (6.9)		
II	44 (45.8)	40 (41.7)	12 (12.5)		
III	42 (34.4)	58 (47.5)	22 (18.1)		
IV	24 (23.1)	50 (48.1)	30 (28.8)		
V	10 (16.7)	30 (50.0)	20 (33.3)	**34.82**	**<0.001**

Table 9: Association between educational status and hypertension care

Education	Good	Fair	Poor	p-value
Illiterate	8	20	20	
Primary	22	38	26	
Secondary	54	74	28	
Graduate & above	70	66	14	**<0.001**

Table 10: Binary logistic regression for predictors of good hypertension care

Variable	Adjusted OR	95% CI	p-value
Graduate education	2.36	1.41–3.96	0.001
Health insurance	1.89	1.18–3.04	0.008
Higher socioeconomic class	2.74	1.69–4.45	<0.001
Monthly income above median	1.78	1.09–2.92	0.021
Regular physical activity	1.94	1.21–3.12	0.006
Age ≥60 years	0.91	0.56–1.48	0.704
Female sex	1.12	0.72–1.76	0.613

Table 11: Barriers to optimal hypertension care

Barrier	n	%
Financial constraints	178	40.5
Medicine cost	162	36.8
Long waiting time	124	28.2
Transportation difficulty	82	18.6
Forgetfulness	116	26.4
Lack of awareness	98	22.3
Poor family support	54	12.3

Table 12: Annual out-of-pocket expenditure on hypertension care

Annual expenditure (INR)	n	%
<5,000	118	26.8
5,000–10,000	182	41.4
10,001–20,000	96	21.8
>20,000	44	10.0

Discussion:

The present community-based analytical cross-sectional study assessed the influence of socioeconomic factors on hypertension care among adults residing in urban Rewa, Madhya Pradesh. The findings demonstrated that socioeconomic status, educational attainment, household income, health insurance coverage and healthy lifestyle practices were significantly associated with better hypertension care. These observations reinforce the growing evidence that social determinants play a crucial role in the prevention and management of hypertension **[11].** The mean age of the study participants was 52.4 ± 11.8 years, with the majority belonging to the 50–59 years age group. This finding is consistent with the natural epidemiology of hypertension, which increases with advancing age because of vascular ageing, arterial stiffness and cumulative exposure to cardiovascular risk factors. Gupta *et al.* also reported that hypertension prevalence in India rises substantially after the fourth decade of life, making middle-aged and older adults the most affected population **[12]**. Similarly, the World Health Organization has recognized increasing age as one of the strongest non-modifiable risk factors for hypertension **[13]**. Although males constituted a slightly higher proportion of the study population than females, sex was not independently associated with hypertension care after multivariable analysis. This observation is comparable with the systematic review by Connelly *et al.*, which suggested that differences in hypertension control between men and women are largely influenced by healthcare utilization, socioeconomic characteristics and place of residence rather than biological sex alone **[14]**. However, some Indian studies have reported slightly better blood pressure control among women, possibly because of better healthcare-seeking behaviour and greater participation in screening programmes. Educational status emerged as one of the strongest predictors of hypertension care in the present study. Participants with graduate-level education demonstrated significantly better hypertension care than those who were illiterate. Higher educational attainment is known to improve health literacy, awareness regarding hypertension, understanding of medical advice and adherence to recommended lifestyle modifications. Similar observations have been reported in national and international studies, which consistently demonstrate that education is positively associated with hypertension awareness, treatment and blood pressure control **[15]**. Socioeconomic status assessed using the Modified B.G. Prasad Scale showed a significant association with hypertension care. Participants belonging to higher socioeconomic classes had better hypertension care scores than those from lower socioeconomic strata. This finding is consistent with evidence demonstrating that socioeconomic inequalities influence affordability of treatment, healthcare utilization, continuity of care and access to preventive services. The WHO Commission on Social Determinants of Health emphasized that inequitable distribution of education, income and social resources contributes substantially to disparities in chronic disease outcomes **[16]**. Likewise, a recent systematic review from India reported persistent socioeconomic differences in hypertension control and highlighted the limited availability of studies evaluating social determinants of hypertension care **[17]**. Approximately two-thirds of participants reported regular physician follow-up and continuous antihypertensive treatment, while just over half had adequately controlled blood pressure. Although these figures are higher than earlier national estimates, hypertension control remains unsatisfactory. A recent meta-analysis reported that fewer than one-fourth of hypertensive individuals in India achieved adequate blood pressure control at the population level, despite improvements in diagnosis and treatment over recent years **[18]**. The WHO India Hypertension Control Initiative also highlights that continuity of care, regular follow-up and standardized treatment protocols are essential for improving blood pressure control in routine practice. Health insurance coverage was another independent determinant of better hypertension care in the present study. Participants covered by health insurance were more likely to report regular follow-up visits, uninterrupted medication use and better blood pressure control. Financial protection through insurance reduces out-of-pocket expenditure and improves access to long-term care for chronic diseases, an important consideration in countries such as India where chronic disease management often requires lifelong treatment **[19]**. Regular physical activity was also independently associated with good hypertension care. Participants who engaged in regular physical activity demonstrated better hypertension care scores than inactive individuals. Lifestyle modification remains one of the cornerstones of hypertension management and current national and international guidelines recommend regular physical activity, dietary salt reduction and maintenance of healthy body weight, tobacco cessation and moderation of alcohol intake for all hypertensive individuals **[20]**. Financial constraints were the most frequently reported barrier to optimal hypertension care, followed by medicine costs, prolonged waiting time, forgetfulness and lack of awareness. These findings suggest that socioeconomic barriers continue to impede effective hypertension management despite the implementation of national NCD control programmes. Similar barriers have been documented in community-based studies conducted in India and have been recognized as major obstacles to achieving optimal hypertension control under the India Hypertension Control Initiative **[21, 22]**. The findings of the present study have important public health implications. Strengthening primary

healthcare services alone may not be sufficient unless socioeconomic inequalities are simultaneously addressed. Interventions aimed at improving health literacy, expanding health insurance coverage, ensuring uninterrupted availability of affordable antihypertensive medicines, promoting community-based blood pressure screening and implementing targeted behaviour change communication among socioeconomically disadvantaged populations are likely to improve hypertension care and reduce cardiovascular morbidity **[23]**. These recommendations are consistent with the objectives of the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD), the India Hypertension Control Initiative and the WHO HEARTS technical package for cardiovascular disease prevention.

Conclusion:

Socioeconomic factors significantly influenced hypertension care, with higher education, income, insurance coverage and healthier lifestyles associated with better care. Financial barriers, limited health literacy and poor healthcare access contributed to inadequate hypertension management among disadvantaged groups. Strengthening primary healthcare, affordable treatment and targeted community interventions may improve hypertension control and reduce health inequalities.

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