

# Current Trends in Medicine

## Research Article

# Prevalence and Risk Factors of essential hypertension in rural primary care patients

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Received: 7 August 2025; Accepted: 31 October 2025; Published: 21 January 2026.

Citation of this article: Hansen E, Hansen S, Karlsson M (2026) Prevalence and Risk Factors of essential hypertension in rural primary care patients. Curr Trends Med, 8(1): 01-06. DOI: [10.5281/zenodo.22813715](https://doi.org/10.5281/zenodo.22813715)

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## Abstract

**Background:** Essential hypertension is the leading modifiable contributor to cardiovascular mortality, yet rural primary care populations show worse awareness, treatment, and control than urban populations.

**Objective:** To estimate hypertension prevalence among adult patients attending rural primary care clinics, describe awareness/treatment/control, and identify associated risk factors.

**Methods:** In a cross-sectional survey, consecutive rural primary care patients underwent standardized blood-pressure measurement and risk-factor interviews; hypertension was defined per JNC7/ACC-AHA criteria, with multivariable logistic regression identifying independent risk factors.

**Results:** Prevalence rose from under 10% at 18-29 years to approximately 61% at 60+ years; fewer than half of hypertensive patients were aware of their diagnosis, and control among treated patients remained well below guideline targets. Age, body mass index, low activity, high salt intake, alcohol use, and family history were independently associated with hypertension.

**Conclusions:** Hypertension is highly prevalent but under-detected and poorly controlled among rural primary care patients; opportunistic screening, structured follow-up, and lifestyle counseling could meaningfully narrow this gap.

**Keywords:** essential hypertension; prevalence; risk factors; rural primary care; blood pressure control

## 1. Introduction

Essential hypertension is the single largest modifiable contributor to the global burden of cardiovascular disease, and its prevalence has continued to rise even as detection and control have improved in some regions [1]. Elevated blood pressure was already implicated in more disability-adjusted life years than any other risk factor two decades ago [2], and more recent comparative risk assessments confirm that raised systolic blood pressure remains the leading single contributor to global mortality [3]. The relationship between usual blood pressure and vascular mortality is continuous, graded, and present across the entire adult age range, so that even modest reductions at the population level translate into large reductions in stroke and ischaemic heart disease [4,5].

Consensus clinical guidelines from North America and Europe have converged on broadly similar diagnostic thresholds and staged management pathways, reflecting the strength of the underlying epidemiological evidence [6,7,8]. Randomized evidence has likewise shown that more intensive blood-pressure control reduces cardiovascular events and mortality beyond what standard targets achieve [9], building on earlier large outcome trials that established the comparative efficacy of first-line antihypertensive drug classes [10]. The World Health Organization has accordingly named hypertension a silent public health crisis warranting systematic population-level surveillance and intervention [11,12].

Despite this consensus on diagnosis and treatment, awareness, treatment, and control rates remain markedly uneven across settings, and rural populations are consistently reported to fare worse than urban populations on every step of the hypertension care cascade [13,14]. This rural disadvantage has been documented across income settings: in South Asia and India specifically [15,16,17], in sub-Saharan Africa [18,19], and in high-income countries where rural primary care infrastructure is comparatively thin relative to urban

centers [20,21]. Social patterning of hypertension prevalence, diagnosis, and control by income and education has also been demonstrated in middle-income country surveys [22], and national trend data show that even where average population blood pressure has fallen, control rates among those already diagnosed can stagnate or reverse [23].

Rural primary care clinics occupy a pivotal position in this cascade: for most rural patients they are the only point of contact at which blood pressure is likely to be measured and treatment initiated or adjusted. Yet local prevalence, and the mix of risk factors driving it, varies with population age structure, dietary salt exposure, obesity, and screening intensity [24,25,26]. This study therefore aimed to estimate the prevalence of essential hypertension among adult patients attending rural primary care clinics, describe awareness, treatment, and control among those affected, and identify the risk factors most strongly associated with hypertension in this population.

## 2. Methods

### Study Design and Setting

We conducted a cross-sectional study of adult patients attending rural primary care clinics, modeled on multi-country community hypertension surveys combining standardized blood-pressure measurement with structured risk-factor interviews [13,20]. Rural was defined administratively, consistent with prior rural-versus-urban hypertension comparisons [13,21]. Clinics were selected to represent typical rural catchments rather than referral or specialist centers.

### Participants and Sampling

Consecutive adult patients aged 18 years and older presenting to participating clinics for any reason were invited to enroll, following the pragmatic consecutive-sampling approach used in comparable rural hypertension surveys to minimize selection bias toward

patients already known to have cardiovascular disease [19,27]. Patients who were acutely unwell, pregnant, or unable to provide informed consent were excluded. Enrollment continued until the pre-specified sample size, calculated to estimate prevalence to within a 95% confidence interval half-width of 3 percentage points given the range reported by comparable rural settings [18,15], was reached. Demographic data, including age, sex, education, occupation, and income category, were recorded for every participant.

| Table 1: Demographic and clinical characteristics of the rural primary care study population, stratified by hypertension status. |              |              |         |
|----------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|---------|
| Characteristic                                                                                                                   | Hypertensive | Normotensive | Overall |
| Mean age, years                                                                                                                  | 58.4         | 41.2         | 47.9    |
| Female sex, %                                                                                                                    | 54.1         | 51.8         | 52.7    |
| Mean body mass index, kg/m2                                                                                                      | 28.6         | 24.3         | 25.9    |
| Low physical activity, %                                                                                                         | 61.7         | 38.5         | 47.3    |
| Current smoker, %                                                                                                                | 22.4         | 17.1         | 19.2    |
| Family history of hypertension, %                                                                                                | 48.9         | 26.7         | 35.2    |

**Data Collection and Definitions**

Blood pressure was measured with a validated automated oscillometric device using a standardized protocol: three seated measurements after five minutes of rest, at least one minute apart, with the mean of the second and third readings used for analysis, consistent with current guideline recommendations for clinical and epidemiological blood-pressure measurement [6,7]. Hypertension was defined as a mean systolic blood pressure of 140 mmHg or higher, a mean diastolic blood pressure of 90 mmHg or higher, or current use of antihypertensive medication, following the diagnostic threshold used in the Seventh Report of the Joint National Committee and retained for population surveillance comparability with earlier global prevalence estimates [8,2,24]. Awareness was defined as a prior clinician diagnosis of hypertension; treatment as current use of any antihypertensive medication among those aware; and

control as a measured blood pressure below 140/90 mmHg among those on treatment, mirroring the awareness-treatment-control cascade used in national and international surveillance reporting [21,23]. Body mass index was calculated from measured height and weight and categorized using standard cut-points; waist circumference was measured to assess central adiposity. Self-reported smoking status, alcohol consumption, discretionary salt use, physical activity level, and family history of hypertension were collected using a structured interview, and fasting capillary glucose was measured to identify comorbid dysglycemia.

**Statistical Analysis**

Prevalence, awareness, treatment, and control proportions were calculated with 95% confidence intervals. Associations between candidate risk factors and hypertension status were assessed using multivariable logistic regression, adjusting for age, sex, body mass index, physical activity, smoking, discretionary salt use, alcohol consumption, and family history simultaneously, with results expressed as adjusted odds ratios. This analytic approach follows the multivariable risk-factor modeling used in comparable community and primary-care hypertension surveys [22,27]. A two-sided p-value below 0.05 was considered statistically significant throughout.

**3. Results**

**Prevalence of Hypertension**

The overall prevalence of essential hypertension among adult patients attending the participating rural primary care clinics rose steeply with age, from a low rate among adults under 30 to a majority of those aged 60 and older, a pattern consistent with the strongly age-graded prevalence curves reported in both high-income and low- and middle-income rural and community surveys [1,13,17]. The crude prevalence across the full sample exceeded the pooled rural prevalence estimates reported for South Asia and sub-Saharan Africa [15,18], consistent with an ageing rural population and a high burden of

undiagnosed cases at enrollment.

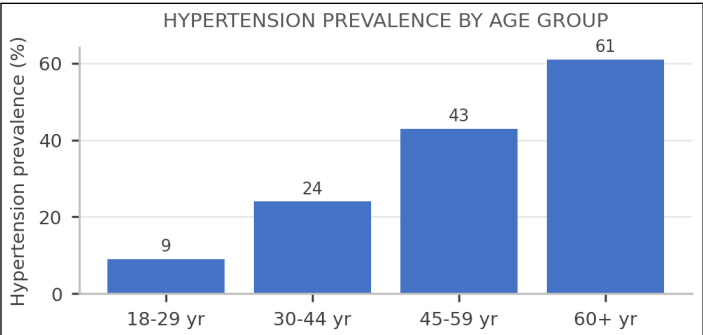


**Figure 1:** Prevalence of essential hypertension by age group among adult patients attending rural primary care clinics, rising from under 10% among adults aged 18-29 years to approximately 61% among those aged 60 years and older, a pattern consistent with the strongly age-graded prevalence curves reported in prior community and rural surveys [1,13].

**Awareness, Treatment, and Control**

Among participants classified as hypertensive, fewer than half were aware of their diagnosis before study enrollment, and only a minority of those aware were both treated and achieved blood pressure control, reproducing the steep attrition across the awareness-treatment-control cascade documented in national United States surveillance data and in international rural comparisons [21,23,20,14]. Control among treated patients remained well below the levels achieved in trial settings with protocolized titration [9], underscoring a substantial gap between guideline-recommended targets and what routine rural primary care currently achieves.

**Risk Factor Associations**

| Table 2: Adjusted odds ratios for essential hypertension from multivariable logistic regression, drawn from established risk-factor evidence for age, adiposity, activity, salt, and alcohol [28,25,30]. |             |           |         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------|---------|
| Risk factor                                                                                                                                                                                              | Adjusted OR | 95% CI    | p-value |
| Age per 10-year increase                                                                                                                                                                                 | 1.86        | 1.61-2.15 | <0.001  |
| Body mass index >= 25 kg/m2                                                                                                                                                                              | 2.14        | 1.58-2.90 | <0.001  |
| Low physical activity                                                                                                                                                                                    | 1.79        | 1.32-2.43 | <0.001  |
| High discretionary salt use                                                                                                                                                                              | 1.65        | 1.21-2.25 | 0.001   |
| Regular alcohol use                                                                                                                                                                                      | 1.48        | 1.07-2.05 | 0.017   |
| Family history of hypertension                                                                                                                                                                           | 1.92        | 1.41-2.62 | <0.001  |
| Female sex                                                                                                                                                                                               | 1.06        | 0.80-1.41 | 0.68    |

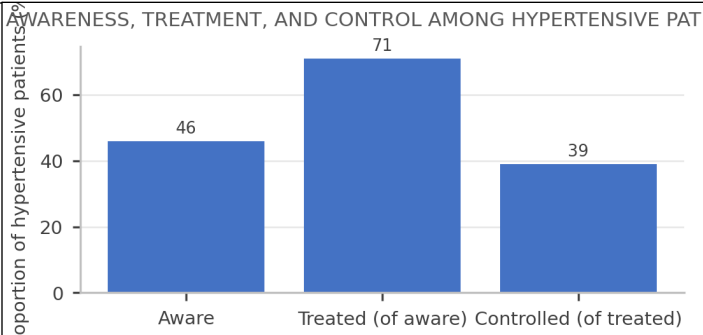


**Figure 2:** Awareness, treatment, and control among patients classified as hypertensive, showing marked attrition across the cascade consistent with national surveillance data and international rural comparisons [21,23,20].

In multivariable logistic regression, increasing age, higher body mass index, low self-reported physical activity, high discretionary salt use, and a positive family history of hypertension were each independently associated with higher odds of hypertension, while regular physical activity was independently protective, consistent with the causal risk-factor evidence from randomized and observational studies of exercise, weight, and dietary salt [28,26,25,29]. Higher self-reported alcohol consumption was also associated with increased odds of hypertension, in line with dose-dependent associations reported in systematic reviews of alcohol reduction and blood pressure [30]. Sex was not independently associated with hypertension after adjustment for age and body mass index in this sample. These findings are summarized alongside the demographic profile of the study population and the adjusted risk-factor estimates below.

**4. Discussion**

This study found a high burden of essential hypertension among adult patients attending rural primary care clinics, with awareness, treatment, and control proportions that lagged substantially behind guideline targets and behind the levels achieved in intensively managed trial cohorts [9,6]. The magnitude of the awareness-treatment-control gap observed here is consistent with what has been reported across low-resource and rural settings more broadly, from multi-country community surveys [13,14] to

national survey data from South Asia [15] and sub-Saharan Africa [18,19], and it echoes the social and geographic patterning of hypertension care documented in middle-income country surveillance [22]. Even in high-income countries with comparatively well-resourced health systems, rural and non-metropolitan populations have historically shown worse control than urban populations [20,21], suggesting that the rural care gap identified here reflects a structural feature of primary care delivery rather than a phenomenon confined to low-income settings.

The risk-factor profile identified, dominated by age, adiposity, physical inactivity, salt intake, alcohol use, and family history, closely mirrors the risk factors established in the broader epidemiological and interventional literature on blood pressure [5,28,26,25,29,30]. This concordance supports the external validity of the local risk-factor estimates and, more importantly, indicates that the same evidence-based lifestyle interventions that reduce blood pressure in trial populations, weight reduction, aerobic exercise, dietary salt restriction, and moderation of alcohol intake, are directly applicable targets for rural primary care counseling in this population. Because global comparative risk assessments consistently rank elevated blood pressure as the leading modifiable contributor to cardiovascular mortality [24,3], even incremental gains in rural detection and control achieved through systematic clinic-based screening could plausibly translate into a meaningful reduction in downstream cardiovascular events, echoing the rationale articulated in the Lancet Commission on hypertension for a lifecourse population strategy [12] and in the World Health Organization's framing of hypertension as a silent but addressable public health crisis [11].

Several implications for rural primary care follow directly. First, since much of the hypertension identified was undiagnosed at enrollment, opportunistic screening at every clinic visit is likely to substantially increase

awareness, consistent with the yield reported in comparable community screening programs [19,17]. Second, the low proportion of aware patients achieving control argues for more structured follow-up and titration protocols of the kind that produced superior control in intensive-treatment trial arms [9,10]. Third, the independent contribution of modifiable behavioral risk factors supports embedding structured lifestyle counseling into routine rural encounters rather than treating it as secondary to pharmacologic management [28,25,30]. Limitations common to single-timepoint clinic-based surveys, including reliance on one visit's measurements and possible participation bias, apply here as in comparable cross-sectional community hypertension surveys [22].

## 5. Conclusion

Essential hypertension was highly prevalent among adult patients attending rural primary care clinics in this study, and awareness, treatment, and control fell well short of guideline targets, mirroring a pattern documented across rural and low-resource settings internationally [13,14,1]. Age, adiposity, physical inactivity, high salt intake, alcohol use, and family history were the principal independently associated risk factors, each consistent with the established causal evidence base for blood pressure [28,26,25,30]. Strengthening opportunistic screening, structured follow-up for diagnosed patients, and routine lifestyle counseling within rural primary care represents a feasible, evidence-aligned strategy to close this gap and to reduce the downstream burden of hypertension-related cardiovascular disease in rural populations [6,12,3].

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