# Postprint: Blood Pressure Control and Influencing Factors in Standardized Management of Hypertensive Patients in China: Current Status, Challenges, and Future Prospects

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## Abstract

Hypertension is a common chronic disease characterized by a large patient population and low blood pressure control rates, imposing a substantial economic burden on individuals and society; strengthening health management for hypertensive patients represents a critical intervention for improving blood pressure control. Although standardized hypertension management has been extensively implemented at the primary care level, existing studies demonstrate that blood pressure control rates in China remain suboptimal. This article systematically reviews domestic studies published in China concerning the effectiveness of blood pressure control and its influencing factors among hypertensive patients receiving standardized management, and analyzes limitations in current research. We identify a paucity of studies on blood pressure control effectiveness and influencing factors among hypertensive patients receiving standardized management in China, with additional limitations including a scarcity of high-quality research, constrained dimensional scope in studies of influencing factors, inconsistent selection of blood pressure values and methodologies for evaluating long-term blood pressure control, and blood pressure target achievement criteria that are not aligned with international guidelines. This article proposes recommendations for future research, including standardizing evaluation criteria for blood pressure control and increasing research on patients receiving standardized management; broadening research perspectives to thoroughly investigate multi-level factors affecting blood pressure control; and harnessing big data and artificial intelligence technologies to advance research on precision management of hypertensive patients.

## Full Text

# Research on Blood Pressure Control and Its Determinants Among Hypertensive Patients Under Standardized Management in China: Status, Challenges, and Future Directions

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### Abstract

Hypertension is a prevalent chronic condition with a sizable patient population and suboptimal blood pressure control rates, resulting in a substantial economic burden on individuals and society. Strengthening health management strategies for hypertensive patients is a crucial intervention to improve blood pressure control. Although standardized hypertension management has been widely implemented in primary care settings, existing studies indicate that blood pressure control rates in China remain unsatisfactory. This paper examines research conducted in China on the effectiveness of blood pressure control and the factors influencing it among hypertensive patients receiving standardized management. Several limitations in the current body of research are identified, including a paucity of high-quality studies, narrow research scope in terms of influencing factors, inconsistent selection of blood pressure metrics, varied approaches to evaluating long-term blood pressure management, and non-alignment of target blood pressure definitions with international guidelines. The paper proposes future research recommendations, such as standardizing blood pressure control criteria, expanding the study of patients under standardized management, broadening research perspectives to explore the impact of multilevel determinants on blood pressure control, and leveraging big data and artificial intelligence technologies to advance precision management for hypertensive patients.

**Keywords:** Hypertension; Standardized management; Influencing factors; Blood pressure control rate; Editorial

# 1 Current Status of Research on Blood Pressure Control and Its Determinants Among Patients Under Standardized Management in China

## 1.1 Limited Relevant Research

This study systematically searched Chinese databases (CNKI and Wanfang) and English databases (PubMed, Embase, and Cochrane Library) for articles on factors influencing blood pressure control among Chinese hypertensive patients from January 2018 (following the release of the primary care guideline) to July 2024. The search yielded surprisingly few studies examining blood pressure control and its determinants among patients receiving community-based management. Fewer than 40 high-quality studies with controlled bias were identified, and most were descriptive rather than cohort studies. Among the literature mentioning hypertension patient management, only five papers explicitly emphasized the concept of community standardized management, and merely two used receipt of standardized management (defined as at least one follow-up every three months plus an annual physical examination) as inclusion criteria. One of these required standardized management to last five years, while the other required only 30 days, and both lacked detailed descriptions of evaluation standards.

## 1.2 Influencing Factors Span Patient, Provider, and Social Environmental Domains

Studies investigating determinants of blood pressure control among community-managed hypertensive patients have primarily focused on three categories: patient-related factors, provider-related factors, and social environmental factors. First, patient-related factors: Most studies consistently identified certain protective factors including higher education level, higher income, retirement status, regular exercise, high disease literacy, and habitual blood pressure monitoring. Conversely, smoking, alcohol consumption, high-salt diet, BMI outside normal range, high baseline blood pressure, and poor adherence were identified as risk factors. However, some factors showed contradictory effects across studies, such as age, gender, and comorbidities. Notably, advanced age and presence of other chronic conditions were associated with better blood pressure control in some studies. Additional risk factors identified included ethnic minority status, specific dietary patterns, and elevated physiological markers such as total cholesterol, glycated hemoglobin, and uric acid.

Second, provider-related factors: These primarily encompassed family doctor contract status, number of outpatient follow-ups, medication information, patient health management, and payment methods. However, studies varied considerably in their specific foci, and overall, few examined characteristics of healthcare providers. Third, social environmental factors: Aspects such as favorable exercise environments and family/social support demonstrated positive impacts on blood pressure control.

## 2 Challenges Facing Research on Blood Pressure Control and Its Determinants Among Community-Managed Hypertensive Patients

### 2.1 Lack of High-Quality Research and Limited Scope of Influencing Factor Studies

Overall, these studies suffer from limitations including small sample sizes and lack of representativeness due to localized data. Determining whether patients receive standardized management requires assessment of healthcare utilization over time. The national evaluation system assesses this annually based on whether patients receive at least four face-to-face follow-ups and one physical examination per year. However, research lacks consensus on standardized definitions, particularly for evaluating standardized management in long-term longitudinal studies. Regarding the scope of influencing factor research, current studies predominantly focus on individual-level factors while paying relatively less attention to healthcare provider and environmental factors.

### 2.2 Inconsistent Selection of Blood Pressure Values and Evaluation Methods for Long-Term Control

The measurement and selection of blood pressure values, criteria for target achievement, and methods for evaluating long-term management all significantly affect research outcomes. Although national policy documents such as the *National Essential Public Health Service Specifications (Third Edition)* and the *National Primary Care Hypertension Management Guidelines (2020 Edition)* propose using the most recent follow-up blood pressure record before the annual assessment to calculate control rates, with measurement frequency and value selection determined by initial follow-up blood pressure achievement and subsequent measurements, substantial inconsistencies remain across studies. Some researchers require three uniform measurements averaged for analysis; others utilize multiple blood pressure values over extended periods, such as three consecutive days of readings, annual average values from medical records, or one week of home blood pressure monitoring data. Some studies also mandate uniform measurement timing (e.g., morning vs. afternoon) and measurement sites. A 2024 study by Professor Wang Jiguang's team demonstrated that hypertension control rates vary significantly across different months and hours, recommending that evaluation protocols should account for measurement timing at both monthly and hourly levels.

### 2.3 Blood Pressure Target Criteria Not Aligned with Guidelines

The vast majority of studies uniformly apply the 140/90 mmHg threshold for evaluating blood pressure target achievement, with only 极少数的研究 considering age and comorbidities. In recent years, domestic and international research and expert recommendations have introduced Time in Target Range (TTR) to evaluate long-term blood pressure management effectiveness. Although no definitive

TTR standard currently exists, the latest Chinese expert recommendation suggests a TTR of $ $75% during follow-up as a qualified standard, yet this metric remains underutilized in domestic research.

## 3 Future Research Recommendations

### 3.1 Standardize Evaluation Criteria and Increase Focus on Standardized Management Patients

Future research should establish unified evaluation criteria and expand studies specifically targeting patients receiving standardized management. Although standardized hypertension management represents a distinctive concept in China's healthcare system with clear administrative evaluation standards, academic consensus is needed on how to assess and evaluate patient receipt of standardized management, particularly in longitudinal studies. Blood pressure evaluation should incorporate out-of-office measurements, including 24-hour ambulatory blood pressure monitoring and home blood pressure data when feasible. Dynamic indicators such as TTR and blood pressure variability should be introduced. Furthermore, since chronic disease management aims to reduce or delay complications, evaluation of standardized management should incorporate hypertension-related complication incidence and progression as health outcome indicators alongside process measures.

### 3.2 Expand Research Perspectives to Multi-Level Influencing Factors

Future research should adopt multi-dimensional perspectives, examining how primary care accessibility, service quality, staffing, medication availability, community health support systems, green space availability, and air pollution influence blood pressure control. Such comprehensive investigations would provide robust evidence for developing more targeted and effective interventions.

### 3.3 Leverage Big Data and Artificial Intelligence for Precision Hypertension Management

Although common health determinants show consistent effects across multiple studies, some variables demonstrate contradictory effects across different study populations, possibly due to population heterogeneity, sample size variations, measurement tools, timing, and blood pressure value determination methods. Future research should fully utilize mobile internet and wearable devices for continuous health monitoring, collect detailed individual characteristics, and employ machine learning and large language models to build virtual simulation prediction models. These models could prospectively identify the most significant influencing factors for intervention effectiveness in individuals and provide personalized recommendations. Dynamic adjustment of intervention priorities based on changing individual characteristic data would ensure timely responses to health changes, enhancing the precision and effectiveness of hypertension

management. Such research would not only provide patients with the most appropriate personalized interventions but also offer novel approaches for public health management.

## Conclusion

While the standardized management rate of hypertensive patients in China has improved annually, actual blood pressure control rates remain suboptimal. This study calls for future research to establish standardized evaluation criteria for standardized management, conduct in-depth analyses of patients already receiving such management, incorporate dynamic blood pressure indicators and health outcome assessments, and enhance the scientific rigor and consistency of management evaluation. Regarding influencing factor research, perspectives should be expanded to systematically examine the combined effects of healthcare accessibility, community support, and environmental factors on blood pressure control. With the rapid development of big data and artificial intelligence technologies, precision and personalized hypertension management models will become increasingly important. Dynamic prediction and intervention systems based on continuous health data hold promise for significantly optimizing patient management outcomes and providing new theoretical support and practical pathways for chronic disease prevention and control system innovation.

## Author Contributions

HE Jinyu was responsible for literature review and manuscript writing. ZHULIDUZI Jiesisibieke and ZHANG Ning were responsible for quality control and manuscript revision. LIU Min and LIANG Wannian provided guidance and final approval and take overall responsibility for the article.

## Conflict of Interest

The authors declare no conflicts of interest.

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## References

[1] ZHOU B, PEREL P, MENSAH G A, et al. Global epidemiology, health burden and effective interventions for elevated blood pressure and hypertension[J]. Nat Rev Cardiol, 2021, 18(11): 785-802. DOI:10.1038/s41569-021-00559-8.

[2] NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104

million participants[J]. Lancet, 2021, 398(10304): 957-980. DOI:10.1016/S0140-6736(21)01330-1.

[3] YIN R Y, YIN L S, LI L, et al. Hypertension in China: burdens, guidelines and policy responses: a state-of-the-art review[J]. J Hum Hypertens, 2022, 36(2): 126-134. DOI:10.1038/s41371-021-00570-z.

[4] Chinese Hypertension Prevention and Treatment Guidelines Revision Committee, Hypertension League (China), International Exchange and Healthcare Promotion Association of China Hypertension Branch, et al. Chinese hypertension prevention and treatment guidelines (2024 revised edition)[J]. Chinese Journal of Hypertension: Chinese and English, 2024, 32(7): 603-700. DOI:10.16439/j.issn.1673-7245.2024.07.002.

[5] World Health Organization. Global report on hypertension: the race against a silent killer[R]. Switzerland: Geneva, 2023.

[6] Ministry of Health. Notice on issuing the "National Essential Public Health Service Specifications (2011 Edition)"[EB/OL]. [2024-10-15]. https://www.gov.cn/zwgk/2011-05/24/content_{1870181}.htm.

[7] National Essential Public Health Services Program Primary Hypertension Management Office, Primary Hypertension Management Expert Committee. National primary care hypertension prevention and management guidelines[J]. Chinese Circulation Journal, 2017, 32(11): 1041-1048. DOI:10.3969/j.issn.1000-3614.2017.11.001.

[8] General Office of the State Council. Medium- and long-term plan for chronic disease prevention and treatment in China (2017-2025)[EB/OL]. (2017-02-14)[2024-10-15]. https://www.gov.cn/zhengce/content/2017-02/14/content_{5167886}.htm.

[9] YOU L L, ZHAO J H, CHEN X Y, et al. Ten-year evaluation of the national essential public health service program (2009-2019) series report (2)—progress and effectiveness of the national essential public health service program over ten years[J]. Chinese General Practice, 2022, 25(26): 3209-3220.

[10] PICKERSGILL S J, MSEMBURI W T, COBB L, et al. Modeling global 80-80-80 blood pressure targets and cardiovascular outcomes[J]. Nat Med, 2022, 28(8): 1693-1699. DOI:10.1038/s41591-022-01890-4.

[11] National Health and Family Planning Commission. National essential public health service specifications (third edition)[Z/OL]. (2017-02)[2024-10-15]. http://www.nhc.gov.cn/ewebeditor/uploadfile/2017/04/20170417104506514.pdf.

[12] ZHU W Q, LIAN J F, SHEN P, et al. Analysis of standardized management effectiveness and influencing factors for hypertension in Yingzhou District, Ningbo City[J]. China Health Standard Management, 2020, 11(6): 1-3. DOI:10.3969/j.issn.1674-9316.2020.06.001.

[13] LIU R H, LI A C. Study on the impact of kidney stones on blood pressure target achievement in community hypertension health management[J]. Chinese Community Physicians, 2022, 38(28): 130-132.

[14] GAO Y. Analysis of blood pressure control status and influencing factors among hypertensive patients in Dougezhuang Community, Chaoyang District, Beijing[J]. Smart Health, 2019, 5(14): 108-110. DOI:10.19335/j.cnki.2096-1219.2019.14.046.

[15] LI G J, SHI H Y, ZHOU P, et al. Analysis of blood pressure control effectiveness and influencing factors among community hypertensive patients in Haikou, Hainan Province[J]. Journal of Clinical Internal Medicine, 2022, 39(3): 180-182. DOI:10.3969/j.issn.1001-9057.2022.03.011.

[16] LU J P, LI C Y, LV J, et al. Current status of behavioral factors and their relationship with blood pressure control among community hypertensive patients[J]. Chinese Journal of Social Medicine, 2019, 36(6): 622-625. DOI:10.3969/j.issn.1673-5625.2019.06.018.

[17] ZHAO R R, ZHOU G Q, LI W L, et al. Blood pressure control status and influencing factors among hypertensive patients over 50 years old in Tianhe Community, Guangzhou[J]. Guangdong Medical Journal, 2020, 41(15): 1606-1610. DOI:10.13820/j.cnki.gdyx.20194272.

[18] SONG Z W, ZHANG M, ZHANG X, et al. Analysis of community health management and hypertension treatment control among hypertensive patients aged 35 and above in China in 2015[J]. Chinese Journal of Epidemiology, 2021, 42(11): 2001-2009.

[19] XIE C C, TANG W Q, LV J, et al. Differential analysis of behavioral factors for blood pressure control among hypertensive patients in three Shanghai communities[J]. Medicine and Society, 2019, 32(4): 1-5. DOI:10.13723/j.yxysh.2019.04.001.

[20] YE Y Q, HUANG J N, LIANG Z J. Analysis of influencing factors related to hypertension control effectiveness in a Shenzhen community[J]. Chinese Journal of the Frontiers of Medical Science: Electronic Edition, 2018, 10(3): 76-79. DOI:10.12037/YXQY.2018.03-14.

[21] LI F L, LIU J M. Analysis of influencing factors for blood pressure control among hypertensive patients in a Ningxia community[J]. Electronic Journal of Clinical Medical Literature, 2020, 7(28): 183-184. DOI:10.16281/j.cnki.jocml.2020.28.118.

[22] LI H, WANG Z Y, QIAO L. Analysis of blood pressure control effectiveness and influencing factors among elderly hypertensive patients in communities[J]. Chinese Community Physicians, 2024, 40(11): 129-131.

[23] LIANG X H, ZHONG H Y, XIAO L. The effect of community hypertension management on blood pressure control and its determinants in southwest China[J]. Int Health, 2020, 12(3): 203-212. DOI:10.1093/inthealth/ihaa002.

[24] LIANG C B, ZHENG J R, HUANG F M. Analysis of blood pressure control status and influencing factors among hypertensive patients in Chang'an Town, Dongguan City in 2019[J]. Chinese Primary Health Care, 2021, 35(2): 36-40.

[25] SHUAI Z Y, ZHANG D H, HUANG Y S, et al. Analysis of blood pressure control status and influencing factors among community hypertensive patients[J]. Chinese Primary Health Care, 2021, 35(11): 49-50, 55.

[26] TIAN H Y, GANG H Y, ZHANG R, et al. Analysis of blood pressure control and influencing factors among hypertensive patients under health management[J]. Modern Preventive Medicine, 2021, 48(5): 893-896. DOI:10.20043/j.cnki.mpm.2021.05.030.

[27] CHU J J, ZHANG W, FANG R, et al. Study on hypertension control status and influencing factors in Bengbu communities[J]. Journal of Bengbu Medical College, 2020, 45(2): 263-266. DOI:10.13898/j.cnki.issn.1000-2200.2020.02.035.

[28] ZHENG T R, HU Y T, YANG S Q, et al. Investigation and analysis of influencing factors for blood pressure target achievement among community hypertensive patients in Chengdu[J]. Guide of China Medicine, 2023, 21(34): 112-115. DOI:10.15912/j.cnki.gocm.2023.34.028.

[29] HONG Y, LI H, KUANG N Y. Influencing factors and medication status of blood pressure control among hypertensive patients over 45 years old in Xinjiang Production and Construction Corps[J]. China Modern Medicine, 2022, 29(34): 179-182, 186, 197.

[30] JIANG Y Q, SHEN Q, TANG H Y, et al. Association between dietary carbohydrate intake and control of blood pressure in patients with essential hypertension[J]. Healthcare (Basel), 2022, 10(11): 2245. DOI:10.3390/healthcare10112245.

[31] JIANG P, LI J H, TANG H Q, et al. Evaluation of standardized management effectiveness for occupational population with hypertension in a functional community[J]. Chinese Journal of Clinicians, 2019, 47(12): 1419-1422. DOI:10.3969/j.issn.2095-8552.2019.12.012.

[32] YE J L. Analysis of blood pressure control status and related influencing factors among hypertensive patients in Tiecun New Community, Xinzhou District[J]. Primary Medical Forum, 2018, 22(11): 1555-1556. DOI:10.19435/j.1672-1721.2018.11.077.

[33] XU J J, CHEN X Y, JIANG X J, et al. Analysis of antihypertensive drug use status and blood pressure control rate in Chengdu communities[J]. Sichuan Medicine, 2020, 41(3): 239-244. DOI:10.16252/j.cnki.issn1004-0501-2020.03.004.

[34] XUE P, HUANG W H, MAO G F, et al. Analysis of reasons for uncontrolled blood pressure among patients with type 2 diabetes and hypertension in Suzhou Tong'an Community[J]. China Modern Doctor, 2022, 60(16): 36-39.

[35] SUN Y, WANG Y Y. Study on the impact of routine follow-up on blood pressure control among community hypertensive patients[J]. Chinese Primary Health Care, 2020, 34(1): 79-81. DOI:10.3969/j.issn.1001-568X.2020.01.0023.

[36] ZHANG R Z. Analysis of community hypertension control effectiveness and influencing factors[J]. Smart Health, 2021, 7(8): 116-118. DOI:10.19335/j.cnki.2096-1219.2021.08.037.

[37] National Cardiovascular Disease Center, National Essential Public Health Services Program Primary Hypertension Management Office. National primary care hypertension prevention and management guidelines 2020 edition[Z/OL]. (2020-12)[2024-10-15]. https://www.nccd.org.cn/News/Information/Index/1090.

[38] ZHANG S S, WANG G Z. Analysis of related factors affecting blood pressure control effectiveness among elderly hypertensive patients in communities[J]. Tibet Medicine, 2023, 44(3): 21-23.

[39] HUANG J, ZHOU H X, REN L J. Analysis of influencing factors for blood pressure control rate among 208 community hypertensive patients during the COVID-19 pandemic[J]. Modern Medicine and Health, 2022, 38(11): 1834-1837, 1842.

[40] QIN N, YAO Z Q, SHI S J, et al. Association between medication literacy and blood pressure control among hypertensive patients[J]. Int J Nurs Pract, 2024, 30(2): e13153. DOI:10.1111/ijn.13153.

[41] YAN Q H, CHENG M N, XU W L, et al. The control rate of hypertension across months of year and hours of day in a large real-world database[J]. Hypertens Res, 2024, 47(11): 2981-2988. DOI:10.1038/s41440-024-01817-1.

[42] Chinese Hypertension League "Chinese Expert Recommendations for High-Quality Blood Pressure Management in Hypertensive Patients" Committee. Chinese expert recommendations for high-quality blood pressure management in hypertensive patients[J]. Chinese Journal of Hypertension: Chinese and English, 2024, 32(2): 104-111. DOI:10.16439/j.issn.1673-7245.2024.02.002.

[43] CHEN K Y, LI C, CORNELIUS V, et al. Prognostic value of time in blood pressure target range among patients with heart failure[J]. JACC Heart Fail, 2022, 10(6): 369-379. DOI:10.1016/j.jchf.2022.01.010.

[44] LIN Z Q, XIAO Z W, CHEN W, et al. Association of long-term time in target range for systolic blood pressure with cardiovascular risk in the elderly: a Chinese veteran cohort study[J]. Eur J Prev Cardiol, 2023, 30(10): 969-977. DOI:10.1093/eurjpc/zwad083.

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*Note: Figure translations are in progress. See original paper for figures.*