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PERSPECTIVES

Optimizing the Management of Menopause-Related Chronic Diseases in Rural Settings: A Closed-Loop "Screening-Prevention-Treatment" Model to Promote Healthy Aging – A Descriptive Study

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Background: In rural regions, menopausal symptoms frequently coexist with chronic comorbidities (bone metabolism, cardiovascular, psychological, and urogenital disorders). A structural contradiction of high disease burden, low healthcare utilization, and fragmented management persists due to complex multidimensional barriers.

Objective: This study evaluates a closed-loop "screening-prevention-treatment" pathway shifting the management focus from isolated symptom relief to comprehensive control of menopause-related chronic disease clusters in resource-constrained rural settings.

Methodology: A retrospective descriptive study evaluated a real-world implementation in Changshan County, integrating proactive screening into public health projects via a collaborative network. Data from 10,224 women were extracted from electronic records. The protocol used the modified Kupperman Index and sex hormone profiling for risk stratification to guide targeted interventions—from lifestyle modifications to menopausal hormone therapy (MHT)—with long-term digital follow-up.

Results: Among 10,224 screened women, 2910 (28.46%) exhibited abnormal sex hormones. Of 1995 symptomatic women, 626 initiated interventions (31.37% treatment initiation rate). MHT uptake correlated with symptom severity, reaching 65.50% in the moderate and 100% in the severe group (Kupperman >30). The diagnosis-to-treatment conversion rate reached 72.09% in women aged 40–45 years. The screening yielded pleiotropic benefits, incidentally identifying 11.8 non-target abnormalities (eg, renal/hepatic dysfunction) per 100 screened women.

Conclusion: This closed-loop model effectively addresses fragmented care for rural menopausal women. Utilizing active screening and risk stratification significantly improves diagnostic conversion rates and resource efficiency, providing a replicable framework for managing menopause-related comorbidities and promoting healthy aging in grassroots settings.

Keywords: menopause, healthy aging, rural health, chronic disease management, screening, closed-loop management

Introduction

Globally, the population of postmenopausal women is growing rapidly, with estimates suggesting it will reach 1.2 billion by 2030.[1] In China, where the mean age of natural menopause is approximately 49.5 years,[2] there are currently over 160 million menopausal women, a demographic expected to exceed 280 million by 2030. The perimenopausal to postmenopausal transition represents a critical period during which women experience an accelerated increase in the risk of chronic diseases, with symptoms frequently overlapping with disturbances in bone metabolism, cardiovascular health, and mental well-being. In rural and county-level regions, however, a pronounced gap exists between the

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substantial health burden faced by this population and their utilization of healthcare services—manifested as high prevalence, low consultation rates, and fragmented care delivery. Amid ongoing efforts to strengthen primary healthcare systems and promote healthy aging, there is an urgent need to reconfigure service provision for menopausal women at the county level through a population health management lens. This entails integrating acute symptom management with long-term chronic disease risk mitigation and establishing an actionable, closed-loop pathway to improve access, care engagement, and continuity. Drawing on an analysis of the evidence-to-practice gap in county settings, this paper investigates the underlying causes of low healthcare utilization from three interrelated perspectives: demand-side barriers, supply-side limitations, and systemic challenges. It further proposes a comprehensive closed-loop framework encompassing "screening, prevention, and treatment," and, informed by practical experiences in Changshan County, identifies scalable components and future research priorities.

Menopause-Related Health Burden in County-Level Areas: Coexistence of High Prevalence and Low Healthcare Utilization

The menopausal symptom spectrum among women in county-level regions is complex and frequently overlaps with chronic risks across multiple physiological systems, contributing to a substantial health burden. Vasomotor symptoms—such as hot flashes and night sweats—affect the majority of women, with a subset experiencing severe and prolonged manifestations.[3] Sleep disturbances, mood disorders, and genitourinary syndrome of menopause (GSM) are also highly prevalent.[3–5] Beyond acute discomfort, menopause is fundamentally linked to systemic metabolic shifts. Specifically, the sharp decline in endogenous estrogen levels during the menopausal transition disrupts the balance between osteoclast-mediated bone resorption and osteoblast-mediated bone formation, leading to rapid trabecular bone loss.[6] Consequently, the prevalence of osteoporosis among postmenopausal women in China is alarmingly high, reported to exceed 32%,[7] which significantly increases the risk of fragility fractures.[8] Furthermore, menopause is associated with insulin resistance and elevated cardiovascular and metabolic risks, resulting in a "symptom–chronic disease" synergy that poses a major challenge for women's health management in rural settings.[8–10] Despite this high morbidity, healthcare utilization and rates of standardized treatment remain persistently low,[3] a disparity particularly pronounced in counties with limited medical resources.

The failure to translate disease burden into appropriate healthcare demand stems from the interplay between widespread modifiable risk factors and inadequate primary care capacity. On one hand, conditions such as obesity and insulin resistance are prevalent in these populations and can exacerbate both menopausal symptoms and long-term chronic disease risks, establishing a detrimental feedback loop.[11–13] On the other hand, grassroots healthcare facilities often lack the technical capacity for comprehensive menopause assessment, bone density measurement, and comorbidity management, leading to underdiagnosis and suboptimal care.[14,15] Concurrently, patient-level barriers—including misperceptions of menopause as an inevitable part of aging rather than a manageable health transition, privacy concerns, and limited awareness of available interventions—alongside economic and geographic access constraints, further diminish help-seeking behavior and continuity of care.[14–17] Together, these factors contribute to a systemic challenge characterized by "high prevalence, low service uptake, and high rates of missed diagnosis."

Drivers of Low Healthcare Utilization: A Tripartite Framework of Demand-Side, Supply-Side, and System-Level Barriers

Demand-side barriers primarily include symptom attribution bias and limited health literacy (Figure 1). Many women perceive menopause as a natural and untreatable phase of aging, leading to delayed or foregone medical consultation.[18,19] Misconceptions about the risks of menopausal hormone therapy (MHT), poor understanding of osteoporosis progression and cardiometabolic vulnerability, and stigma surrounding GSM further inhibit proactive engagement with healthcare providers.[10,16,19] These psychosocial and cognitive barriers are compounded by structural challenges, including financial constraints and geographical distance, which become especially burdensome when specialist input or repeated monitoring is required.[11,18]

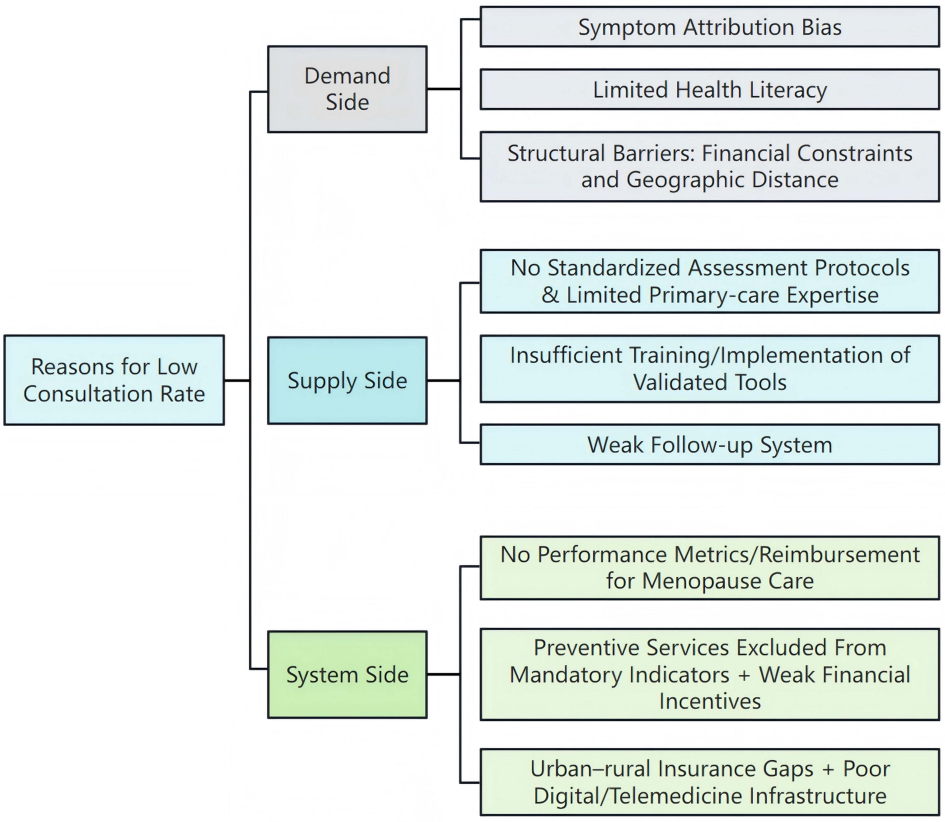

Figure 1 A tripartite framework of demand-side, supply-side, and system-level barriers to menopausal healthcare utilization in county-level regions.

Supply-side limitations are evident in the absence of standardized assessment protocols and insufficient clinical expertise at the primary care level. Inadequate training and implementation of validated tools—such as menopausal symptom scales, risk stratification algorithms, and contraindication checklists—may result in missed diagnoses of high-risk cases or inappropriate treatment decisions.[14,19] Furthermore, weak follow-up systems increase the likelihood of treatment discontinuation and the accumulation of preventable safety risks.[10,16,20]

At the system level, institutional failures manifest in the lack of performance metrics and reimbursement mechanisms that prioritize menopause-related care. Preventive services are often excluded from mandatory public health indicators and lack financial incentives for providers. Disparities in urban–rural insurance coverage, underdeveloped digital health infrastructure, and limited access to telemedicine services further entrench inequities in service delivery.[11,14–17,20] The convergence of these three interrelated barriers creates a structural bottleneck in rural menopause care, typified by "unmet need, fragmented service delivery, and unsustainable care models."

Redefining Management Targets: From Symptom Management to Comprehensive Control of Menopause-Related Chronic Disease Clusters

If menopause health management solely focuses on vasomotor symptoms, it fails to address the true burden of multimorbidity among aging women in rural areas. Evidence suggests that menopausal women frequently present with concurrent osteopenia or osteoporosis, cardiovascular and metabolic abnormalities, depression, anxiety, and GSM. These comorbidities often exacerbate one another, affecting treatment compliance and long-term geriatric outcomes.[4,8,10,16,21] Therefore, county-level management strategies must shift from "single-symptom intervention" to the comprehensive prevention and control of "menopause-related chronic disease clusters," covering key dimensions such as bone metabolism, cardiometabolic health, and urogenital function simultaneously.

County areas possess the practical infrastructure to undertake the management of these chronic disease clusters. Existing chronic disease management platforms, family doctor networks, and public health mobilization systems can serve as integration points. Integrating menopause services with existing public health projects (such as national breast and cervical cancer screening programs, annual physical examinations, or chronic disease follow-ups) can reduce marginal costs and improve outreach efficiency.[14,16,17,20] Under this framework, comprehensive screening yields a "pleiotropic effect," increasing the value density of public health interventions. For example, non-target findings such as abnormal liver and kidney functions emerged during implementation in Changshan County, indicating that integrated screening can efficiently identify multisystem risks, thereby optimizing resource utilization.

Key Levers: Proactive Screening, Risk Stratification, and the Window of Opportunity

In the context of low spontaneous visit rates in rural areas, proactive screening serves as the optimal entry point for health management. Temporally and procedurally bundling menopause screening with mature public health projects, combined with village-level mobilization and community health education, can significantly increase population coverage and service reach.[14–16,20]

Risk stratification is a core tool for optimizing the allocation of limited healthcare resources. Establishing referral thresholds based on standardized scales (such as the modified Kupperman Index) and supplemented by individualized clinical assessments helps reduce unnecessary referrals and overtreatment, while improving the accuracy of identifying severe cases that require specialized intervention.[14–16,20] (While Traditional Chinese Medicine constitution identification can be incorporated for personalized lifestyle counseling, it must function in parallel with, rather than as a substitute for, modern medical risk assessment).

Furthermore, the 40–45 age group serves as a strategic pivot for the "window of opportunity" approach. Identifying high-risk individuals prior to the steep rise in bone and cardiometabolic risks allows for early implementation of lifestyle interventions, risk factor management, and targeted pharmacotherapy (based on strict indication and contraindication assessments), which is expected to yield higher participation and diagnostic conversion rates.[11,16,22]

Methodology

Study Design and Setting

This research utilized a retrospective descriptive study design to evaluate the real-world implementation of a closed-loop "screening-prevention-treatment" model. The program was carried out in Changshan County, leveraging the local maternal and child health alliance (the "U Health" Alliance). This alliance operates through a collaborative three-tiered primary care network, encompassing county hospitals, township health centers, and village clinics. The menopause screening pathway was structurally integrated into the region's existing routine public health examination programs to maximize community reach.

Participant Involvement and Ethical Considerations

The target population comprised midlife women residing in the county who participated in community-based public health screenings. Prior to enrollment, village-level liaison officers and primary care staff conducted community health education sessions to inform potential participants about menopause-related chronic disease risks. All involved subjects provided informed consent for the clinical assessments and the subsequent use of their de-identified medical data for retrospective analysis and health service evaluation.

Data Collection Tools and Procedures

To ensure standardized evaluation and reliable data capture across different primary care facilities, the model employed specific clinical and digital tools:

• Symptom Assessment: The modified Kupperman Index was utilized as the primary quantitative tool for clinical screening. Trained healthcare providers administered the scale to categorize menopausal symptom severity into normal (<6), mild (6–15), moderate (16–30), and severe (>30). This stratification directly informed the threshold-driven referral process.

• Laboratory Profiling: Venous blood samples were collected to assess endocrine status. The hormone panel included follicle-stimulating hormone (FSH), luteinizing hormone (LH), estradiol (E2), progesterone (P), testosterone (T), and prolactin (PRL). Concurrent biochemical tests (such as renal and hepatic function panels) were conducted to identify metabolic comorbidities and assess contraindications for pharmacotherapy.

• Digital Tracking and EHR Integration: Data collection and longitudinal follow-up were managed through a hospital-linked electronic health record (EHR) system and a dedicated chronic disease management platform. This digital infrastructure systematically recorded initial screening scores, diagnostic conversions, intervention types (eg, menopausal hormone therapy [MHT] or lifestyle modifications), and follow-up adherence at predefined intervals (3, 6, and 12 months).

Data Extraction and Analysis

To provide numerical support for the model's operational efficacy, de-identified data were extracted from the EHR system for the screening period. Descriptive statistics were used to analyze the dataset. Categorical variables, including the prevalence of hormone abnormalities, symptom distribution across Kupperman categories, and MHT uptake rates, were expressed as frequencies and percentages. This quantitative approach was specifically designed to measure the diagnosis-to-treatment conversion rate and evaluate the practical feasibility of the closed-loop pathway.

Results: Evidence from County-Level Implementation of a Closed-Loop "Screening–Prevention–Treatment" Model: Replicable Elements of the Changshan Experience

In response to persistently low healthcare utilization, Changshan County developed a closed-loop "screening–prevention–treatment" management pathway by leveraging its three-tiered (county–township–village) primary care network. Embedded within the local maternal and child health alliance—the "U Health" Alliance—this model integrates menopause-related symptom management with chronic disease risk identification through institutionalized mechanisms, including organizational mobilization, digital information platforms, and robust quality control frameworks. Its overarching goal is to address systemic challenges such as fragmented service delivery and care discontinuities characterized by "screening without treatment" or "treatment without follow-up."

At the service delivery level, the Changshan model emphasizes task integration at shared clinical touchpoints. Menopause screening is bundled with established public health initiatives to minimize incremental mobilization costs. Village-level liaison officers play a pivotal role in community engagement, facilitating participation, and supporting longitudinal follow-up. To ensure accountability, the system replaced traditional ad-hoc management with a standardized Quality Control and Performance Metrics framework. Table 1 outlines the village-level operational metrics, focusing on community outreach and follow-up adherence, while Table 2 details the county-level quality assurance indicators, ensuring strict adherence to clinical targets and patient satisfaction.

Technically, the core innovation of the Changshan model lies in the standardization of a workflow that directly mirrors the conceptual framework outlined in Figure 2. The operational pathway follows a precise, step-by-step progression:

First, initial population enrollment is achieved by integrating menopause screening into established, routine public health initiatives (such as cervical and breast cancer screenings), leveraging village-level mobilization to maximize reach among midlife women.

Second, enrolled participants undergo quantitative screening at primary care touchpoints. This step utilizes the modified Kupperman Index to objectively measure symptom severity, combined with laboratory tests for sex hormone profiling and basic metabolic panels.

Third, a threshold-driven triage mechanism is applied. Based on the quantitative assessment, patients are stratified into different risk categories (normal, mild, moderate, or severe) using predefined referral thresholds, which dictates their subsequent clinical pathway and prevents arbitrary referral decisions.

Fourth, patients enter the stratified intervention phase. Women with normal or mild symptoms are managed at the primary care level with targeted health education, nutritional counseling, and lifestyle modification guidance. Conversely, women meeting the threshold for moderate-to-severe symptoms are referred to specialized gynecological clinics via

Table 1 Quality Control and Operational Metrics Framework for Village-Level Primary Care Units

Domain	Key Performance Indicator (KPI)	Target/Standard	Verification Method
Health education	Frequency and reach of community health education	Minimum of one session bi-monthly with ≥50 validated participants	Audit of event documentation, attendance logs, and photographic evidence
Information Dissemination	Timely distribution of health promotion materials	100% compliance in disseminating standardized health content via local digital networks	Digital tracking of communication platforms (eg, WeChat dissemination logs)
Longitudinal Follow-up	Completion rate of assigned high-risk case follow-ups	100% completion of monthly follow-up rosters assigned by the central hospital	Cross-referencing electronic health records (EHR) with follow-up submission logs
Care Coordination	Establishment of expedited referral pathways ("Green Channels")	Seamless, prioritized coordination for symptomatic/surgical patients needing higher-tier care	Review of referral timestamps and patient admission records
Preventive Services	Postpartum and contraceptive health management	Zero unintended pregnancies within 6 months post-cesarean delivery; meeting regional distribution targets	Registry audits and community health surveys

Table 2 Annual Quality Assurance and Clinical Performance Targets for the County-Level Health Alliance

Domain	Key Performance Indicator (KPI)	Target Threshold/Standard	Quality Control Measure
Health Education	Standardized public health seminars	≥6 fully documented sessions annually	Audit of presentation materials, sign-in sheets, and standardized summaries
Digital Engagement & Triage	Responsiveness to patient inquiries and appointment scheduling	<24-hour response time for consultations; zero substantiated patient complaints	Routine audit of digital communication logs and patient feedback portals
High-Risk Follow-up Adherence	Follow-up completion for positive screening results (reproductive health, cancer screening, high-risk maternal alerts)	100% follow-up rate for flagged abnormal results	Monthly EHR reconciliation; corrective action plans triggered for missed cases
Clinical Efficacy Targets	Early pregnancy registration rate	≥95%	Quarterly registry audit
	Cancer screening completion rate	≥80%	Cross-validation with regional public health databases
	Surgical intervention rate for suspected severe cases	≥90%	Audit of diagnostic-to-surgical intervention timelines
	In-district service retention (Delivery rate)	≥80%	Annual health service utilization reports
Patient Satisfaction	Satisfaction scores of community members and liaison officers	≥98% satisfaction rate	Annual health service utilization reports

expedited channels. Following a rigorous evaluation of clinical indications and contraindications, eligible patients are prescribed standardized pharmacological treatments, primarily menopausal hormone therapy (MHT).

Finally, the workflow is completed through long-term digital follow-up. To ensure care continuity and patient safety, all intervention data are integrated into a hospital-linked electronic chronic disease management platform. For patients on

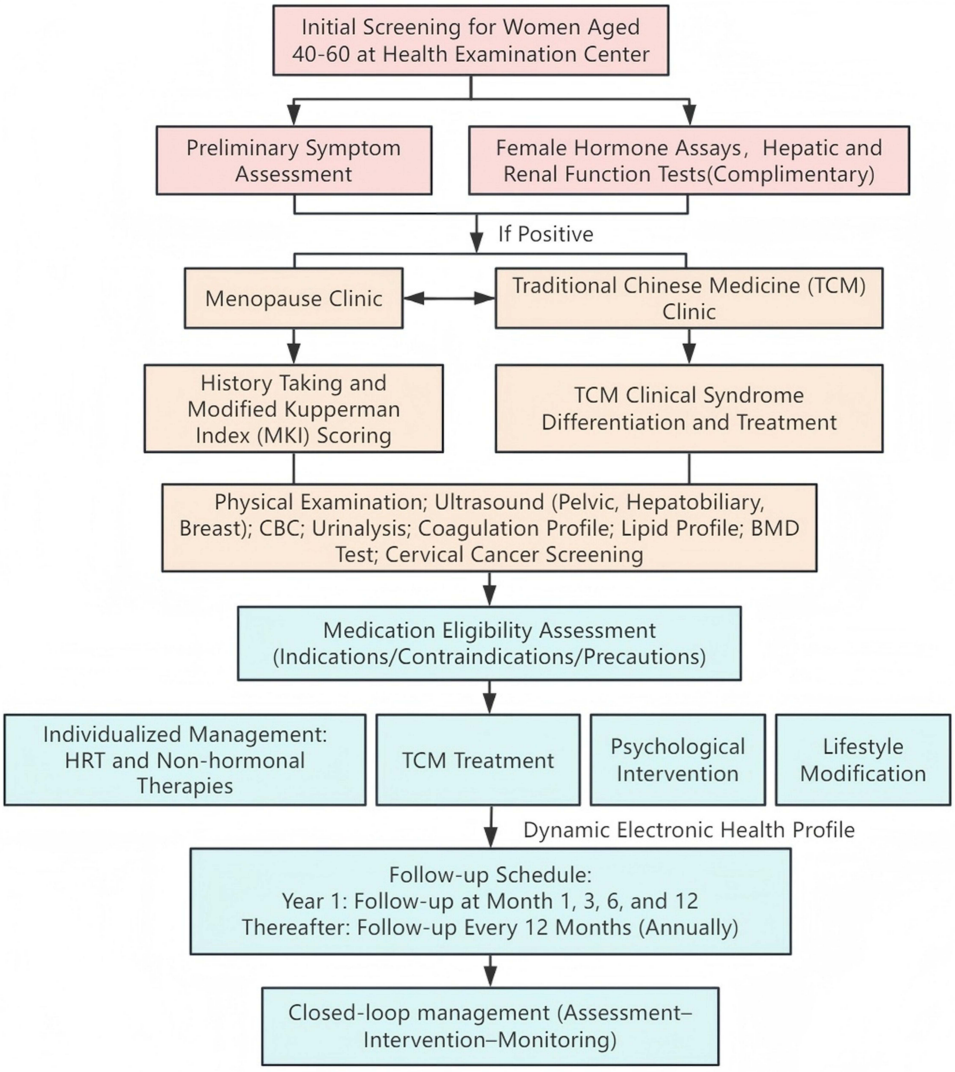

Figure 2 The closed-loop "screening–prevention–treatment" management pathway.

MHT, scheduled monitoring points are strictly enforced at 3, 6, and 12 months to assess liver function, lipid profiles, and gynecological ultrasound findings. Automated alert rules within the digital health records trigger proactive clinical responses for missed appointments or abnormal test results, effectively closing the loop from initial population enrollment to sustained, long-term management (Figure 2).

In real-world implementation, the Changshan program screened 10,224 women in 2025 (Table 3). Analytical evaluation of the screening cohort identified 2910 cases (28.46%) with abnormal sex hormone levels, revealing a substantial "hidden burden" of endocrine dysfunction among midlife women in rural areas. Among these women with objective hormonal abnormalities, 1995 (68.56%) reported experiencing typical menopausal symptoms. However, despite this high prevalence of symptomatic burden, only 626 women entered structured MHT interventions, yielding an overall treatment initiation rate of 31.37% among the symptomatic group. This stark numerical gap—where nearly 70% of symptomatic women with confirmed hormonal shifts initially lacked targeted management—quantitatively illustrates the systemic healthcare deficiencies, low health literacy, and the pervasive "unmet need" discussed earlier in this paper.

To address this gap, the closed-loop model utilized the modified Kupperman Index to drive targeted interventions rather than relying on passive patient visits. A detailed statistical breakdown of the intervention data (Table 4) demonstrates a highly analytical, threshold-driven triage process. MHT uptake was strictly aligned with symptom severity: 0.00% in the normal group, 6.73% (81/1204) in the mild group, surging to 65.50% (467/713) in the moderate

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Table 3 Hormone Abnormalities, Menopausal Symptoms and MHT Uptake

Group	Screened, n	Hormone Abnormalities, n (%)	Symptoms Among Abnormal, n (%)	MHT Among Symptomatic, n (%)
Overall	10,224	2910 (28.46)	1995 (68.56)	626 (31.37)
Age 40–45 y	1794	142 (7.91)	86 (60.56)	62 (72.09)

Note: Hormone abnormalities defined as abnormal FSH/LH/E2/P/T/PRL (lab reference ranges).
Abbreviation: MHT, menopausal hormone therapy.

Table 4 MHT Use by Kupperman Score Category

Kupperman Category	Score Range	Assessed, n	MHT, n	MHT Proportion (%)
Normal	<6	915	0	0.00
Mild	6–15	1204	81	6.73 (81/1204)
Moderate	16–30	713	467	65.50 (467/713)
Severe	>30	78	78	100.00 (78/78)
Total	—	2910	626	21.51 (626/2910)

group, and reaching 100.00% (78/78) in the severe group. This steep gradient confirms that the screening-to-treatment pathway effectively mitigates overtreatment in mild cases while accurately directing specialized pharmacological resources to those with the highest clinical need.

Furthermore, age-stratified analysis highlights the critical value of targeting the 40–45 age group as a "window of opportunity." Among the 1794 women screened in this younger demographic, 142 (7.91%) exhibited hormone abnormalities, and 86 of them (60.56%) were symptomatic. Crucially, the diagnostic-to-treatment conversion rate in this specific cohort reached 72.09% (62/86)—significantly higher than the overall average of 31.37%. This data suggests that early, proactive screening captures a population more amenable to health management, facilitating timely intervention before the onset of severe chronic comorbidities.

Beyond its primary objectives, the program exhibited quantifiable pleiotropic benefits: incidental findings included 897 cases of renal dysfunction and 309 cases of hepatic abnormalities, equating to approximately 11.8 non-target abnormalities detected per 100 women screened. This significantly enhances the value density of each screening encounter, providing actionable, data-driven leads for downstream geriatric management.

From a financing perspective, the screening package is offered at a cost of approximately RMB 220 per person, fully subsidized by local public welfare funding. This financing model lowers financial barriers and supports high participation rates. However, broader scalability will require rigorous cost-effectiveness analysis comparing "proactive screening" with current "passive care" models across key clinical outcomes.

Discussion: Risk Governance and Evidence System Strengthening During Scale-Up

As the closed-loop model is scaled up, it must concurrently address key implementation risks, including over-screening, inefficient resource allocation due to false-positive results, and misdiagnosis resulting from inaccurate risk stratification. A dynamic equilibrium among population coverage, diagnostic accuracy, and system capacity must be maintained through clearly defined screening indications, evidence-informed threshold optimization, standardized provider training, and robust quality control mechanisms.[14–17,20]

Controversies surrounding MHT continue to pose a barrier to adoption. These concerns should be addressed through structured, evidence-based risk communication and shared decision-making strategies. Greater emphasis must be placed

on the therapeutic window, appropriate formulation selection, and systematic monitoring. At the primary care level, drug quality assurance protocols and enhanced contraindication screening capacity must be systematically integrated.[10,15,16,20]

Current research remains predominantly focused on short-term symptom relief, with limited longitudinal data on clinically meaningful geriatric endpoints—such as incident osteoporotic fractures, cardiovascular events, and type 2 diabetes. To strengthen the evidence base, future efforts should prioritize prospective cohort studies and formal cost-effectiveness analyses. Concurrently, sustainable models for digital health technologies in long-term follow-up should be rigorously evaluated to support continuous care beyond initial intervention phases.[14,16,20,22]

Conclusions

Menopause-related health challenges among women in county-level areas are characterized by the dual burden of multisystem comorbidities and low healthcare utilization, rendering reliance on passive outpatient services insufficient to promote healthy aging. Positioning menopause as a strategic entry point for identifying clusters of chronic disease risk —and implementing a closed-loop "screening–prevention–treatment" model—enables proactive outreach, enhances resource efficiency via risk stratification, and ensures care continuity through standardized referral pathways and digital tracking. The Changshan experience demonstrates that coordinated action across the county–township–village continuum, combined with robust quality metrics and government-supported financing, can significantly improve diagnosis-to-treatment conversion rates and realize pleiotropic screening benefits. This approach provides a replicable operational framework for managing menopause-related chronic conditions in resource-constrained settings. Future efforts must prioritize strengthening quality assurance during multi-center scale-up, while generating robust evidence through long-term geriatric clinical outcomes and cost-effectiveness evaluations.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

References

1. Hill K. The demography of menopause. *Maturitas*. 1996;23(2):113–127. doi:10.1016/0378-5122(95)00968-x
2. Menopause Subgroup, Chinese Society of Obstetrics and Gynecology, Chinese Medical Association. [The 2023 Chinese menopause symptom management and menopausal hormone therapy guidelines]. *Zhonghua Fu Chan Ke Za Zhi*. 2023;58(1):4–21. Chinese doi:10.3760/cma.j.cn112141-20221118-00706
3. Duralde ER, Sobel TH, Manson JE. Management of perimenopausal and menopausal symptoms. *BMJ*. 2023;382:e072612. doi:10.1136/bmj-2022-072612
4. Hemachandra C, Taylor S, Islam RM, Fooladi E, Davis SR. A systematic review and critical appraisal of menopause guidelines. *BMJ Sex Reprod Health*. 2024;50(2):122–138. doi:10.1136/bmjsrh-2023-202099
5. Nappi RE, Martini E, Cucinella L, et al. Addressing Vulvovaginal Atrophy (VVA)/Genitourinary Syndrome of Menopause (GSM) for healthy aging in women. *Front Endocrinol*. 2019;10:561. doi:10.3389/fendo.2019.00561
6. Ji MX, Yu Q. Primary osteoporosis in postmenopausal women. *Chronic Dis Transl Med*. 2015;1(1):9–13. doi:10.1016/j.cdtm.2015.02.006
7. Wang L, Yu W, Yin X, et al. Prevalence of osteoporosis and fracture in China. *JAMA Network Open*. 2021;4(8):e2121106. doi:10.1001/jamanetworkopen.2021.21106
8. Palui R, Pramanik S, Mondal S, Ray S. Critical review of bone health, fracture risk and management of bone fragility in diabetes mellitus. *World J Diabetes*. 2021;12(6):706–729. doi:10.4239/wjd.v12.i6.706

9. Martín Timón I, Secades I, Botella Carretero JI. [Smoking, obesity and body fat distribution are independently associated with insulin resistance and other cardiovascular risk factors]. *Rev Clin Esp*. 2007;207(3):107–111. Spanish. doi:10.1157/13100221
10. Arnautu AM, Nimigean VR, Nacea-Radu CA, Tilici DM, Paun DL. Menopausal hormone therapy-risks, benefits and emerging options: a narrative review. *Int J Mol Sci*. 2025;26(22):11098. doi:10.3390/ijms262211098
11. Cohen SA, Cook SK, Kelley L, Foutz JD, Sando TA. A closer look at rural-urban health disparities: associations between obesity and rurality vary by geospatial and sociodemographic factors. *J Rural Health off J Am Rural Health Assoc Natl Rural Health Care Assoc*. 2017;33(2):167–179. doi:10.1111/jrh.12207
12. Pichard C, Plu-Bureau G, Neves-E Castro M, Gompel A. Insulin resistance, obesity and breast cancer risk. *Maturitas*. 2008;60(1):19–30. doi:10.1016/j.maturitas.2008.03.002
13. Sung KC, Jeong WS, Wild SH, Byrne CD. Combined influence of insulin resistance, overweight/obesity, and fatty liver as risk factors for type 2 diabetes. *Diabetes Care*. 2012;35(4):717–722. doi:10.2337/dc11-1853
14. Toh LS, Lai PSM, Wu DBC, et al. A comparison of 6 osteoporosis risk assessment tools among postmenopausal women in Kuala Lumpur, Malaysia. *Osteoporos Sarcopenia*. 2019;5(3):87–93. doi:10.1016/j.afos.2019.09.001
15. Briggs P, Burton R, Mosely C, et al. Methods of assessment of urogenital atrophy and the implication of these in estimated prevalence rates: a review of the literature. *Post Reprod Health*. 2023;29(3):135–142. doi:10.1177/20533691231199803
16. Song BM, Rhee Y, Kim CO, et al. Urban-rural differences explain the association between serum 25-hydroxyvitamin D level and insulin resistance in Korea. *Nutrients*. 2014;6(12):5806–5818. doi:10.3390/nu6125806
17. O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart disease. *Public Health*. 2012;126(10):813–820. doi:10.1016/j.puhe.2012.05.029
18. Wellay T, Gebreslassie M, Mesele M, et al. Demand for health care service and associated factors among patients in the community of Tsegedie District, Northern Ethiopia. *BMC Health Serv Res*. 2018;18(1):697. doi:10.1186/s12913-018-3490-2
19. Begum T, Ellis C, Sarker M, et al. A qualitative study to explore the attitudes of women and obstetricians towards caesarean delivery in rural Bangladesh. *BMC Pregnancy Childbirth*. 2018;18(1):368. doi:10.1186/s12884-018-1993-9
20. Chanda S, Dogra V, Hazarika N, et al. Prevalence and predictors of gestational diabetes mellitus in rural Assam: a cross-sectional study using mobile medical units. *BMJ Open*. 2020;10(11):e037836. doi:10.1136/bmjopen-2020-037836
21. Lin M, Chen X, Wu M, et al. Interactive effects of abdominal obesity and insulin resistance on cardiometabolic risk. *Rev Esp Cardiol*. 2025;78(11):967–976. doi:10.1016/j.rec.2025.03.006
22. Fancher CE, Scott A, Allen A, Dale P. Mammographic screening at age 40 or 45? What difference does it make? The potential impact of American cancer society mammography screening guidelines. *Am Surg*. 2017;83(8):847–849. doi:10.1177/000313481708300834