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Factors influencing the management of chronic non-communicable diseases in cold regions: a qualitative study from Northeast China

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Abstract

Background and Objectives: Non-Communicable Diseases (NCDs) represent a significant public health burden in China, particularly in cold regions where environmental factors further limit access to healthcare. To address this challenge, China has implemented the National Essential Public Health Service Package (NEPHSP) to improve NCD management through primary healthcare services. However, research on the effectiveness of NEPHSP in cold regions is limited. This study aims to identify the key factors influencing the implementation of NCD management services in cold regions, focusing on both barriers and facilitators. **Methods:** This qualitative study was conducted in three purposively selected cold regions in Northeast China (Harbin, Qiqihar, and Jiamusi). Data were collected through semi-structured interviews and focus group discussions, guided by the RE-AIM framework. Participants included local health administrators, primary healthcare workers, and community-dwelling individuals with NCDs. Thematic analysis was employed to code and extract key themes from the data. **Results:** A total of 72 participants (59.7% female, mean age 49.1 ± 6.24 years) took part in the study. Major barriers to NCD management included low health literacy, limited awareness of NCDs, insufficient medical resources, poor public awareness, inadequate multisectoral collaboration, and the absence of effective audit and feedback systems. Key facilitators included the affordability and accessibility of primary healthcare services, strong patient-physician relationships, and the high priority given to NCD management by local governments. Furthermore, harsh environmental conditions and limited healthcare accessibility in cold regions complicated the management of NCDs, highlighting the need for tailored interventions that address the specific challenges of these regions. **Conclusion:** This study identifies significant facilitators and barriers to the implementation of NCD management services under the NEPHSP in cold regions of China. The unique challenges posed by cold climates necessitate the adaptation of healthcare services to local needs, with a focus on improving health literacy, enhancing healthcare infrastructure, and fostering multisectoral collaboration. These findings provide valuable insights for optimizing NCD prevention and management strategies within China's primary healthcare system.

Keywords

non-communicable diseases; National Essential Public Health Service Package; RE-AIM framework; qualitative study; primary health care

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1 Introduction

Non-Communicable Diseases (NCDs) have become a global health crisis, placing a substantial burden on public health systems worldwide[1]. The World Health Organization (WHO) estimates that by 2030, NCDs will account for 55 million deaths globally[2]. In China, NCDs represent a particularly formidable challenge, contributing to 84.93% of the total disease burden, as reported by the Global Burden of Disease Study 2019[3-4]. This rising prevalence, driven by an aging population and rapid

urbanization, underscores the urgent need for comprehensive health strategies[5].

Since 2009, China has implemented the National Essential Public Health Service Package (NEPHSP), a major policy initiative aimed at improving NCD management through primary healthcare service[6]. Initially proposed by the WHO, the NEPHSP focuses on the prevention and management of diseases such as hypertension and Type-2 Diabetes (T2DM). It mandates that primary healthcare facilities provide standardized public health services, including health education, vaccinations, chronic disease monitoring, and health record maintenance[1,5,7]. This approach shifts the focus from individual treatment to population-level prevention and management, with the goal of reducing the overall burden of NCDs.

In cold regions, managing NCDs is further complicated by extreme climate conditions. Harsh winters and seasonal variations can limit access to healthcare services and exacerbate existing health conditions, particularly for vulnerable populations such as the elderly[8-9]. Cold regions face unique challenges, as low temperatures may increase the risk of cardiovascular events, respiratory diseases, and other chronic conditions[10-11]. These conditions, combined with difficulties in conducting routine health screenings and public health outreach during the winter months, make it more challenging to implement the NEPHSP effectively. Cold weather can also affect residents' ability and willingness to engage with healthcare services. Given these unique obstacles, it is critical to understand how environmental factors in cold regions influence the uptake of NEPHSP services. This will ensure that interventions are tailored to meet local needs. While the NEPHSP has made significant strides in increasing access to primary healthcare and improving NCD management nationwide, there is limited research on its effectiveness in cold regions. This study seeks to address this gap by exploring the perspectives of stakeholders on the factors that facilitate and hinder the uptake of NEPHSP services for NCD management in China's cold regions. Furthermore, the study provides recommendations to enhance the program's implementation in these challenging environments.

2 Methods

2.1 Study Design and Sites

This qualitative study employed face-to-face in-depth interviews and focus group discussions, using a structured interview guide based on the RE-AIM framework. The goal was to comprehensively understand stakeholders' perspectives on the implementation of chronic disease management under the NEPHSP. The study adhered to the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines[12]. It was conducted in three purposively selected cold regions in Northeast China[13]: Harbin, Qiqihar, and Jiamusi, all located in Heilongjiang Province. Ethical approval was obtained from the Medical Ethics Committee of the Second Affiliated Hospital of Harbin Medical University (KY2020-091). All participants provided informed consent prior to inclusion in the study.

2.2 Study Participants and Sampling

Participants were recruited from three key stakeholder groups: policymakers, healthcare providers, and individuals with NCDs. Eligible policymakers were drawn from provincial and municipal health commissions, while healthcare providers included staff from primary health institutions with at least one year of experience in NCD management. Community-dwelling individuals aged 35 or older, diagnosed with NCDs such as hypertension or T2DM, and residing within the jurisdiction of the selected healthcare facilities, were also included. Individuals with severe medical conditions that would prevent them from participating in interviews were excluded[14]. All participants provided written informed consent, including permission for audio recording. Recruitment was carried out using purposive and snowball sampling techniques to ensure diversity among participants[15].

2.3 Data Collection

Semi-structured interview guides were developed to cover the five domains of the RE-AIM framework: reach, effectiveness, adoption, implementation, and maintenance. This framework is widely used for evaluating public health programs[16-17]. Table 1 provides example questions for assessing each dimension. The interview guides (Supplementary File S1) were customized to align with the specific roles of the various stakeholders involved. Interviews were conducted by an experienced qualitative researcher, with assistance from two note-takers. To maintain confidentiality, interviews were held in private locations, and no prior relationships existed between the researchers and participants. Data collection continued until thematic saturation was reached, ensuring that no new themes emerged. All interviews were transcribed anonymously, and both audio recordings and transcripts were securely stored on a password-protected computer.

2.4 Data Analysis

All interviews were audio-recorded and transcribed verbatim in Mandarin Chinese. The quotations used in the study were translated into English using a forward-backward translation process to ensure accuracy and preserve meaning. Thematic analysis was conducted to explore participants' perceptions and experiences, guided by the RE-AIM framework. Initial coding

Table 1 RE-AIM framework dimensions and example interview questions

Dimension	Example interview questions
Reach	In your view, are the current measures for NCD management sufficient to meet the actual demand for healthcare services? How extensive is the coverage of these policies or initiatives?
Effectiveness	What factors do you believe contribute to regional variations in policy development and implementation? How effective have these policies been in practice? What factors influence their effectiveness?
Adoption	How well are the NCD management measures being adopted at the local level? What strategies does your department use to ensure that health service providers and NCD patients, along with their families, accept and adopt these policies?
Implementation	What are the key facilitating and hindering factors in the implementation process? Is your current role involved in the management of NCDs? If so, how?
Maintenance	What steps are being taken to ensure the sustainability of these interventions and their long-term impact? How is the ongoing performance of these policies or interventions evaluated over time?

was deductive, aligned with the five RE-AIM dimensions: reach, effectiveness, adoption, implementation, and maintenance. An inductive approach was also employed to identify emergent themes and codes that were not pre-defined by the framework. Two researchers independently reviewed the transcripts and generated preliminary codes related to the factors influencing the implementation of NCD management under the NEPHSP. These codes were continuously compared, refined, and grouped into broader themes using constant comparative methods. The final coding framework was developed iteratively, ensuring that all relevant themes were captured. No new themes emerged after saturation was reached. The coding process involved multiple rounds of review, with discrepancies resolved through discussions between the researchers. Data analysis was performed using NVivo software version 12 for qualitative data management and coding.

3 Results

A total of 16 in-depth interviews (each lasting between 30 and 60 minutes) and 10 focus group discussions (with approximately 5 participants per session, each lasting 60 minutes) were conducted, involving a total of 72 participants (59.7% female, mean age 49.1 ± 6.24 years). Among the participants, 67.5% of healthcare professionals had more than 10 years of experience, and 77.8% held a college degree or higher. The interviews were conducted between May 2022 and March 2023. Demographic data and categorical results are presented in Table 2, while Table 3 summarizes the identified facilitators and barriers according to the RE-AIM framework.

3.1 Reach

Most participants expressed high satisfaction with the accessibility and coverage of primary healthcare services under the NEPHSP. Key facilitators for extending the reach of primary care to a broader population included the affordability, convenience, and high reimbursement rates for medical expenses through public health insurance. Many participants viewed the program positively, emphasizing that its goal was to serve the entire population, not just individuals with hypertension or T2DM.

"The community health center is only a few minutes' walk from home. Medications and tests are very affordable, and my doctor calls regularly for free health check-ups. It's very convenient, especially for us elderly people!" (Patient 26)

Policymakers and healthcare providers frequently mentioned low health literacy and limited awareness of NCDs as major barriers, particularly among patients aged 35-64. Many in this age group are employed and less likely to engage with services during workdays.

"Patient compliance is poor, and their health awareness is low, particularly among those aged 65 or younger who feel they're still healthy. They often don't see the need for regular management, especially working individuals, who may resent frequent check-in calls." (Staff Member 27)

Healthcare providers acknowledged the benefits of NCD management in improving overall health but pointed out that the limited medical services available at community health centers often fell short of patients' expectations and needs.

"Patients are hesitant to come because they feel they can't get comprehensive check-ups or lab tests at the community health center. They think their issues won't be solved here and prefer going directly to a higher-level hospital." (Health Administrator 6)

Participants also highlighted challenges related to regional economic conditions. In more economically developed areas, high population mobility made it difficult for healthcare providers to maintain regular services. Meanwhile, in economically disadvantaged regions, particularly in Northeastern China, population outflow and aging demographics were growing concerns. Unique cultural practices, such as "mao dong" (staying indoors during winter) and "nan fei" (elderly migrating south for the winter), further complicated regular visits to primary care facilities.

Table 2 Participant Characteristics

Demographic characteristic	In-depth interview		Focus group discussion	
	Policy makers (*N* = 4)	Leaders of primary health institutions (*N* = 12)	Healthcare providers (*N* = 24)	NCDs Patients (*N* = 32)
Gender				
Male (*N* = 29)	3(75.00%)	9(75.00%)	6(25.00%)	11(34.38%)
Female (*N* = 43)	1(25.00%)	3(25.00%)	18(75.00%)	21(65.63%)
Age, mean(SD), y	43.00 ± 2.71	46.33 ± 6.11	40.83 ± 7.83	66.22 ± 8.30
Education				
College and above (*N* = 56)	4(100.00%)	10(83.33%)	20(83.33%)	22(68.75%)
High school and middle school (*N* = 14)	0	2(16.67%)	4(16.67%)	8(25.00%)
Primary school or below (*N* = 2)	0	0	0	2(6.25%)
Years of working				
5 y or below (*N* = 6)	0	1(8.33%)	5(20.83%)	NA
5y to 10y (*N* = 7)	2(50.00%)	1(8.33%)	4(16.67%)	NA
10y and above (*N* = 27)	2(50.00%)	10(83.33%)	15(62.50%)	NA
Years of NCD				
5 y or below (*N* = 11)	NA	NA	NA	11(34.38%)
5y to 10y (*N* = 5)	NA	NA	NA	5(15.63%)
10y and above (*N* = 16)	NA	NA	NA	16(50.00%)

Abbreviation: NA, not applicable

Table 3 Identified themes, barriers, and facilitators under the RE-AIM framework

Domain	Facilitators(8)	Barriers(12)
Reach	Primary healthcare services offer easy access, competitive pricing, and favorable reimbursement rates	The service content and forms of chronic disease management are singular. Severe population loss in cold regions Patients, particularly those aged 35-64, exhibit low awareness of health management, with minimal knowledge and acceptance
Effectiveness	Doctors and patients both acknowledge improvements in health conditions Rigorous quality control and performance appraisal of health records	Inadequate infrastructure and medicines in primary healthcare facilities The characteristics of cold regions limit the forms of health promotion activities to be monotonous
Adoption	Doctors and patients generally agree that accepting chronic disease management services from family doctors is essential Implement regular community health promotion and manage high-risk populations effectively	Inadequate publicity and regulation of policies by the government and media Lack of guidance and incentives (performance appraisal, talent development)
Implementation	Medical personnel establish good doctor-patient relationships Collaborate with community boards and grid workers The health administration agency directs primary medical facilities and arranges training for healthcare personnel	Insufficient medical staff and inadequate capacity in primary healthcare facilities, including general practitioners and public health personnel Lack of attention and cooperation from departments outside of the health administration Health system service information management requires enhancement
Maintenance		Insufficient multi-dimensional assessment and evaluation indicators Inadequate salaries and high turnover rates among medical personnel

3.2 Effectiveness

The effectiveness of the NEPHSP in preventing and managing NCDs was reflected in strong doctor-patient relationships, strict quality control measures, and performance appraisals, all of which were identified as key facilitators. Both healthcare providers and NCD patients reported significant improvements in health outcomes, particularly in the management of blood pressure and blood sugar levels. These improvements contributed to higher patient satisfaction and better compliance with treatment. The regular evaluation of residents' health records further demonstrated the commitment of health authorities to ensuring high-quality care.

"The province conducts a comprehensive assessment of service management every year, and rigorous quality control is regularly carried out within facilities to thoroughly review residents' health records." (Policymaker 1)

However, significant barriers included inadequate infrastructure, limited availability of medicines, and insufficient health education and promotion efforts. Many interviewees emphasized the need for timely updates to the National Reimbursement Drug List (NRDL) to better align with the needs of NCD patients. Current non-pharmacological interventions, such as health promotion activities (*e.g.*, expert lectures, educational materials, and videos), were seen as insufficient to address the needs of NCD patients and high-risk groups.

"Community health centers don't perform enough tests, the

equipment is not as advanced as in higher-level hospitals, and many imported medications are not available here." (Patient 6)

"The variety of medicines is limited. Some medications are only available at secondary and tertiary hospitals and can't be obtained at our primary care facility. Patients won't want to return if they can't get their prescriptions here." (Staff Member 15)

3.3 Adoption

Several factors significantly influenced the adoption of chronic disease management services under the NEPHSP. Key enablers included regular health education activities, financial investment, and increased government attention. Many interviewees emphasized the critical role of community-level public health services in managing NCDs, particularly hypertension and diabetes, in alignment with the Healthy China 2030 initiative. This initiative has strengthened engagement between residents and primary healthcare providers, fostering greater awareness of NCD prevention and management. Policymakers highlighted that Healthy China 2030 provided an opportunity to expand health education, especially targeting high-risk populations. Furthermore, economically prosperous areas were more likely to offer higher-quality services and broader coverage for NCDs due to stronger financial support from local governments.

"The local government invests heavily in public health. Besides good management of hypertension and diabetes, they also offer preventive programs for other conditions like cardiovascular diseases and chronic obstructive pulmonary disease. The quality of the equipment in community health centers has also improved." (Policymaker 4)

"There are a lot of people with hypertension and diabetes, and complications are common. Community health services are currently the most efficient way to prevent and manage chronic diseases. We organize regular health promotion events, check blood pressure and glucose, and provide dietary and exercise guidance. Most residents are receptive to these services." (Staff Member 9)

However, residents' adoption of services was hindered by a lack of understanding of public health policies, such as hierarchical care and the available public health services. This led to a preference for seeking treatment at higher-level hospitals rather than using community health services. Many interviewees suggested that a coordinated effort by the government and media was necessary to improve public awareness of these services, especially the importance of early intervention and prevention through primary care. Mass media campaigns were seen as essential for promoting public health services and correcting misconceptions.

"I am not clear on how hierarchical care works, and my family doctor hasn't referred me to a higher-level hospital. The community mainly offers domestic medicines, and I'm unsure how they compare to imported ones. Many circulation-improving medications aren't covered by insurance. While my family doctor gave useful advice, I'd prefer to hear official information from the government." (Patient 20)

"Health insurance policies for chronic diseases are not yet perfect. In many areas, patients still have to go to higher-level hospitals for chronic disease diagnoses." (Health Administrator 22)

Healthcare providers identified additional challenges, including misinformation from new media sources, residents' inability to discern reliable health information, and a lack of government regulation to counter false claims. Financial incentives were also noted as insufficient to motivate primary healthcare workers. Although local governments have implemented non-financial rewards, such as title promotions, training, and honors, performance-based financial incentives were limited. As a result, many healthcare workers felt their work was underappreciated and favored clinical services over public health management.

"The work we do doesn't always match the compensation. While there are some performance-based incentives, stronger financial support and clear guidelines are needed. Public health services aren't as appealing, and most general practitioners prefer to focus on clinical care." (Health Administrator 10)

3.4 Implementation

Several key strategies were identified for improving the implementation and sustainability of NCD management within the NEPHSP program. Personalized care approaches, strong patient-doctor relationships, collaboration with community groups, enhanced guidance from health authorities, and continuous training for healthcare personnel were all seen as crucial. Patients expressed a strong desire for long-term contact with their primary care doctors, appreciating their dedication, service attitude, and patient-centered care. Similarly, family doctors maintained positive relationships with local community committees and staff. Policymakers emphasized their role in strengthening primary healthcare service capacity through various training initiatives.

"My family doctor is really attentive and always considers my needs. We keep in touch through phone and WeChat, and most of my issues are resolved by them." (Patient 2)

"We have a very close relationship with community councils and grid workers. Thanks to this collaboration, we've been able to successfully carry out regular health education in the community.

During the three-year COVID-19 pandemic, we worked even more closely with grid workers and residents, building trust." (Health Administrator 17)

Challenges affecting the implementation of NCD management under the NEPHSP included staff shortages, insufficient service capacity, high workloads, inadequate health information systems, and limited intersectoral collaboration. Healthcare providers highlighted that the strain from high workloads and lack of staff constrained their ability to deliver services effectively. This shortage extended beyond primary care doctors to public health professionals, making NCD management difficult. While digitalization of health systems is a national priority, the fragmented and siloed nature of these systems presents a challenge, particularly in economically disadvantaged regions. Policymakers underscored the need for quality-focused performance evaluations and stronger multi-sector collaboration to improve the ongoing implementation process.

"The limited capacity of primary healthcare providers, staff shortages, and high workloads have been long-standing issues. We've tried various solutions, like enhancing public health service informatization and creating fast-track channels for transferring patients to higher hospitals, but we're still far from our ideal goal." (Policymaker 3)

"Although we're working on building information technology systems, frequent changes in service providers have caused integration issues, leading to information management challenges, data loss, and time-consuming data entry." (Staff Member 20)

3.5 Maintenance

Key challenges hindering the sustained development of NCD management within the National NEPHSP include the need for multi-dimensional, scientific, and adaptable assessment indicators, as well as issues related to inadequate remuneration and high staff turnover in primary healthcare institutions. There is concern that the current evaluation and feedback system fails to accurately reflect the health status of NCD patients and is overly time-consuming for healthcare staff to implement. Health administrators emphasized that staffing levels remain insufficient, and unattractive salary packages make it difficult to retain skilled personnel, further complicating efforts to attract and keep talented professionals.

"Currently, we lack scientific and adaptable indicators to assess the health records we manage. Nationally issued indicators should take into account local economic development, population disease characteristics, regional climate, and other factors in their formulation. The focus should shift towards quality management." (Health Administrator 10)

"Primary healthcare facilities are often not the first choice for many professionals. Some choose this path because there's no night shift or it's closer to home, making it easier to balance family care. But when the workload becomes overwhelming, and salaries don't improve, with no proper staffing plans in place, many leave. This leads to higher turnover rates in primary care compared to larger hospitals." (Staff Member 3)

4 Discussion

This qualitative study identified several key facilitators and barriers affecting the implementation of NCD management under the NEPHSP, particularly in cold regions of China. The primary facilitators included strong government support, the affordability and accessibility of healthcare services, and positive doctor-patient relationships. Participants emphasized that regular follow-up appointments and strong patient engagement significantly contributed to improved NCD management outcomes. These findings suggest that the structure of the NEPHSP provides a solid foundation for managing chronic diseases.

Globally, primary healthcare services have proven effective in significantly reducing the morbidity and mortality associated with NCDs by ensuring accessibility and continuity of care. Countries such as the UK, the US, Germany, and Canada have successfully adopted models of primary healthcare that prioritize early detection, continuous monitoring, and lifestyle interventions[18-21]. Research has repeatedly shown that early detection, consistent follow-up, health education, and supportive policy frameworks are essential for the effective management of NCDs. These global case studies offer useful insights into improving chronic disease management on a broader scale.

In China, managing NCDs faces significant challenges, especially in economically disadvantaged cold regions. Low health literacy and inadequate public awareness hinder effective management, while wealthier areas benefit from more proactive health promotion. In these cold regions, many patients mistakenly attribute deteriorating health to aging rather than manageable conditions, reducing the perceived need for preventive care and interventions. This misperception further complicates chronic disease management[22-23]. Policymakers and healthcare providers must account for regional variations in education, income, and urban-rural dynamics when developing NCD prevention strategies. To address these challenges, public health promotion should be enhanced through media campaigns, promotional materials, and community-based initiatives, along with stricter regulation of misinformation on social media. Our

research suggests that the government could improve public health promotion through billboards and outreach by family doctors during outpatient visits, focusing on diverse health education in residential areas. While social media platforms like WeChat, TikTok, and Red Booklet offer opportunities for sharing health messages, authorities must closely monitor and regulate misleading medical information.

A critical component of NCD management is the equitable distribution of healthcare professionals, particularly family doctors[24]. Existing efforts, such as recruiting medical students to rural areas and implementing community-based education programs, have aimed to close the workforce gap. However, despite these initiatives, significant workforce imbalances persist. The standardized training launched in 2011 has not fully addressed regional discrepancies in healthcare staffing, which continue to affect healthcare delivery and retention[25-26]. Addressing these challenges requires a normalization of financial and non-financial incentives, such as career development opportunities and adequate salaries, to maintain a strong family doctor system. Additionally, task-shifting initiatives, which involve delegating responsibilities to nurses and rehabilitation specialists, may help alleviate the burden on the existing workforce.

Since 2009, China has focused on enhancing primary care services to promote a hierarchical diagnosis and treatment system, encouraging residents to first seek care at community health centers[27]. In cold regions, the burden of NCDs such as hypertension and cardiovascular diseases is particularly high, exacerbated by environmental factors like extreme temperatures, which contribute to higher incidences of chronic conditions. Cold-induced health problems have increased the need for effective primary healthcare in these areas, further complicating NCD management[28]. Despite efforts to improve infrastructure, expand medication availability, and adjust medical insurance compensation, disparities persist between community health centers and hospitals. Although universal health insurance covers most citizens, it prioritizes inpatient over outpatient care, resulting in higher costs for frequent NCD treatments[29]. Policymakers are pushing for updates to drug catalogs, stronger collaboration between generalists and specialists, and better integration of information systems[30]. In cold regions, the development of cold-weather-specific guidelines for NCD management is being advocated to reduce complications and improve care[31]. These efforts have helped address some unique challenges faced by populations in cold climates.

Periodic feedback assessments and efficient audits are crucial for ongoing quality improvement in managing NCDs[15,32]. However, the current system lacks comprehensive performance indicators, hindering effective evaluation of implementation and health outcomes. Our findings indicate that relying solely on biomedical indicators or strict adherence to government guidelines may compromise care quality and overlook health equity. Normative needs defined by policymakers and healthcare professionals often do not reflect patients' felt needs, which must be considered for equitable healthcare delivery[33]. This study emphasizes the importance of process-oriented indicators, such as the number of follow-ups, health promotion activities, and patient satisfaction levels in NCD management. Given the complexities of managing NCDs in cold regions, where environmental factors exacerbate health risks, it is essential for experienced clinicians and general practitioners to participate actively in the audit and feedback process. This involvement ensures that performance indicators are flexible and scientifically rigorous, allowing interventions to be tailored effectively to local contexts and specific challenges related to cold-induced chronic diseases.

5 Strengths and limitations

This study highlights the various facilitators and barriers encountered in implementing NCD management in cold regions under China's NEPHSP. The strengths of this research include the depth of data collection, the application of an established implementation science framework, and the inclusion of multiple key stakeholders, such as policymakers, leaders of primary health institutions, and patients with NCDs from areas with varying economic development and geographic conditions. Utilizing the RE-AIM framework, the semi-structured interviews provided a comprehensive assessment of the feasibility and facilitators of chronic NCD management across different contexts. However, this study has some limitations. Although we selected representative regions for our research, the data were collected from key informants within a single province, which may limit the broader applicability of the findings. Additionally, because the study relied on qualitative methods, causal relationships between the identified factors could not be established. Future research involving quantitative surveys would be valuable to validate these findings and offer more generalizable insights.

6 Conclusions

This study, based on stakeholder perspectives and experiences, highlights both the progress and challenges encountered in managing chronic NCDs under China's NEPHSP, particularly in cold regions. Participants emphasized the importance of health education and promotion in raising awareness of NCD management and improving health literacy. Moving forward, policies should focus on enhancing public health outreach, ensuring proper oversight, and continuing investment in the implementation of NEPHSP, with a particular focus on strengthening the system for managing chronic conditions. Additionally, multi-sectoral collaboration in policy-making and execution

should be further encouraged and supported to ensure more integrated and effective healthcare delivery. The study identified several systemic barriers affecting NCD prevention and management and offers several recommendations, such as increasing investment in telemedicine infrastructure and ensuring that healthcare providers in cold regions have the necessary tools to offer remote consultations. Furthermore, we propose the development of mobile healthcare units to reach patients in remote areas during severe weather conditions.

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Not applicable.

Research ethics

The Medical Ethics Committee of the Second Affiliated Hospital of Harbin Medical University approved the study (KY2020-091).

Informed consent

All participants provided informed consent prior to inclusion in the study.

Author contributions

Wang Y C and Jiang R were responsible for the conception and design of the work. Jiang R, Zhou Y H, and Yang M were responsible for conducting the interviews. Yang M and Huang L Z were responsible for data analysis and interpretation. Jiang R drafted the manuscript. Wang Y C revised the manuscript. All authors have read and approved the final manuscript.

Use of Large Language Models, AI and Machine Learning Tools

None declared.

Conflict of interest

Wang Y C is an Editorial Board Member of Frigid Zone Medicine. The article was subject to the journal's standard procedures, with peer review handled independently of this Member and his research groups.

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Data availability

The datasets used and/or analyzed in the current study are available from the corresponding author upon reasonable request.

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