Iran's Hypertension and Diabetes Mellitus Surveillance System and Its Implementation Challenges: A Case Study of Tehran University of Medical Sciences

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ABSTRACT

Introduction: Surveillance systems play a vital role in managing non-communicable diseases (NCDs). This study explores the challenges encountered in the implementation of Iran's hypertension (HTN) and diabetes surveillance system, using Tehran University of Medical Sciences (TUMS) as a case study.

Methods: This study employed a two-part approach, consisting of a literature review and an expert panel discussion. In the first part, a literature review was conducted using PubMed and Google Scholar, encompassing studies published between 2000 and 2023 in both Persian and English. The objectives of this review were to: 1) investigate the history of diabetes and HTN surveillance system and 2) identify implementation challenges of the surveillance system for these conditions. The sources included national guidelines, health surveys, published reports, and academic papers. In the second part, five expert panel discussions (formal focus groups) were conducted semi-structured with seven TUMS specialists. These sessions aimed to pinpoint the challenges in implementing diabetes and HTN surveillance in Iran. Finally, data from both parts were analyzed using conventional content analysis with an inductive approach and were categorized and coded using MAXQDA software to extract the key challenges in implementing the surveillance system.

Results: The National HTN Prevention and Control Program was initiated in 1992 and later expanded its focus to include individuals (both males and females) aged 30 and older in rural areas. In 2004, it merged with the National diabetes Prevention and Control Program, which was established in 1991. This program primarily targeted high-risk individuals aged 15 to 39, as well as those over 40 in selected pilot rural areas. Together, these programs now address both HTN and diabetes prevention through the IraPEN program, launched in 2014. The analysis identified three main categories and eleven subcategories, resulting in a total of 78 codes. The issues have been categorized into three areas: healthcare recipients (lack of public awareness and social issues), healthcare system employees (staffing issues and inadequate training), and upper levels of the healthcare system (ineffective policies, poor evaluation and monitoring, outdated facilities, weak management, insufficient data, and financial constraints).

Conclusion: The study identifies challenges within Iran's healthcare system that impede surveillance programs. To improve outcomes, we should prioritize public education, provide better support for healthcare workers, and implement stronger management practices. By adopting these changes, we can enhance the surveillance systems for HTN and diabetes.

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INTRODUCTION

Among the total deaths worldwide, the mortality rate from non-communicable diseases (NCDs) in 2021 was 73.9%, compared to 65.3% in the periods before and after the emergence of the COVID-19 pandemic.[1] Additionally, premature deaths caused by these diseases often occur in low- and middle-income countries (LMICs).[2] Among NCDs, diabetes, and hypertension (HTN) are frequently referred to as the silent killers of society, as they often coexist due to a shared pathophysiological mechanism that exacerbates the complications associated with these conditions.[3] This is particularly concerning because approximately 75% of cases occur in LMICs.[4] Another significant issue is that nearly 50% of individuals with diabetes[5] and more than half of those with HTN[6] remain undiagnosed. Unfortunately, the prevalence of undiagnosed HTN and diabetes is higher in LMICs compared to high-income countries.[7, 8] HTN has a significant economic and social impact on LMICs.[9] Diabetes, particularly Type 2, significantly raises healthcare costs and diminishes productivity, primarily due to complications such as macrovascular diseases.[10] HTN in LMICs places significant economic burdens on patients and caregivers, leading to increased costs for the healthcare system.[11]

The Centers for Disease Control and Prevention (CDC) defines surveillance as the "ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know".[12] It is important to note that HTN and diabetes are among the diseases that can be managed through lifestyle modifications.[13, 14] The Diabetes Prevention Program (DPP) trial demonstrated that intensive lifestyle interventions can reduce the risk of diabetes by 58% over three years. Additionally, medication can complement lifestyle changes in managing weight and preventing the progression of hyperglycemia to control diabetes.[14] Therefore, an effective healthcare system that incorporates regular monitoring can prevent disease progression and its complications within the community through timely interventions. Despite the active surveillance system for NCDs such as HTN and diabetes in Iran, it is essential to first outline the efforts made by the healthcare system and, in the second part, identify the challenges to implementation. A comprehensive evaluation of these challenges is crucial, as understanding the barriers to effective implementation will aid in refining strategies, improving healthcare delivery, and ultimately enhancing disease control and prevention outcomes. This study aims to assessment of the challenges of Iran's surveillance system and to provide insights into the barriers that impede optimal implementation.

METHODS

This study employed a two-part approach, consisting of a literature review and an expert panel discussion (Figure1).

Part 1: A literature review was conducted using the PubMed database and the Google Scholar search engine, employing keywords such as "Diabetes", "hypertension", "high blood pressure", "surveillance system", "surveillance challenges", "service delivery", and "noncommunicable disease". Eligibility criteria included studies published between 2000 and 2023 in both Persian and
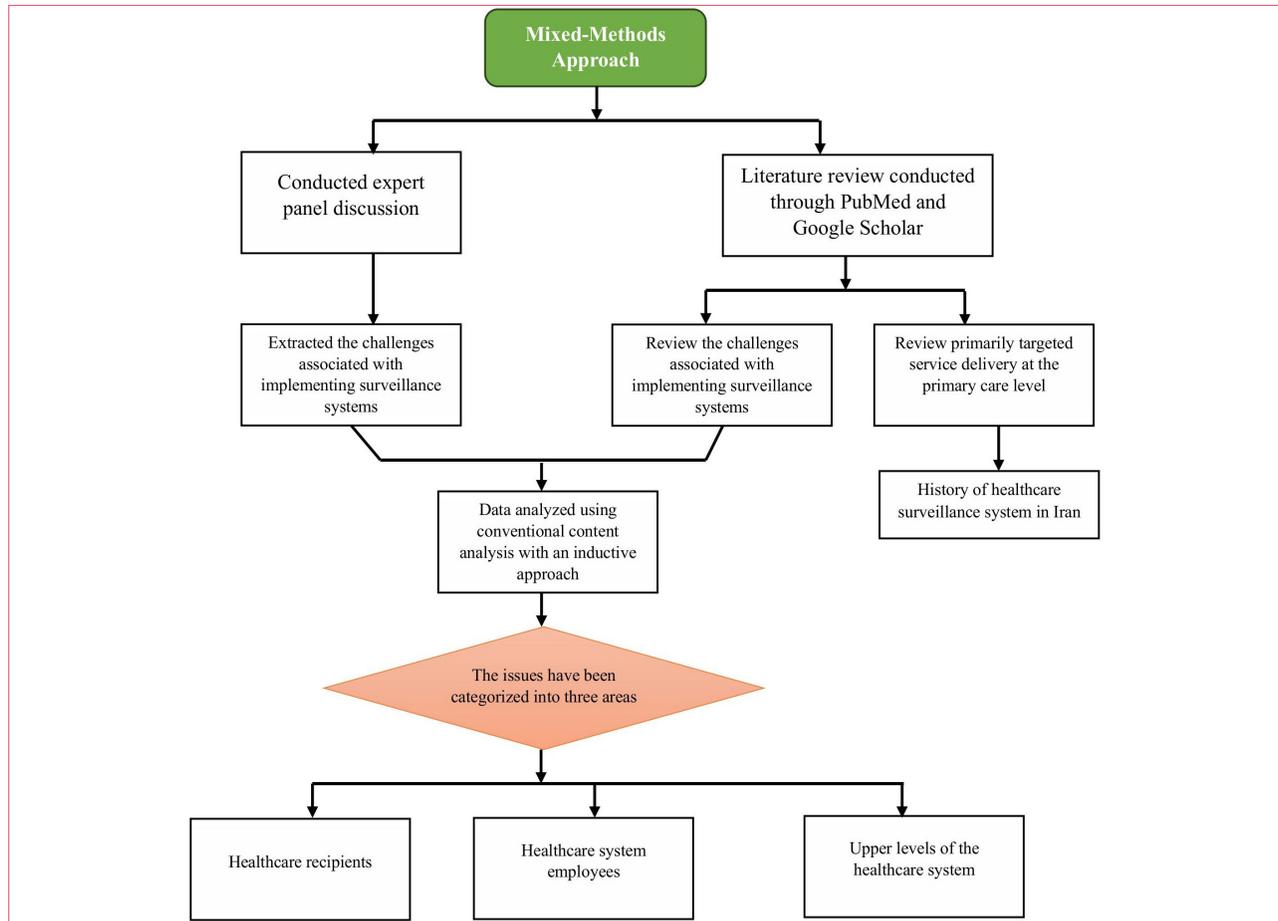
Figure 1. Flowchart of Study

English that were relevant to the research topic. The sources included national guidelines, health surveys, published reports, and academic papers. The review aimed to explore service delivery at the primary care level, which encompasses health houses, health posts, and comprehensive health service centers. Additionally, studies that addressed the challenges of implementing surveillance systems were identified.

Health houses are staffed by male and female health auxiliaries known as "Behvarz," who receive two years of local training after completing their primary or secondary education.[15] These rural primary health care workers play a crucial role in the community.[16]

Health posts: Rural health posts are established when the population exceeds 3,500 individuals, converting existing health houses into rural health posts.[17] Urban health posts serve as the primary point of contact in urban areas, situated in densely populated cities or peri-urban regions.[15] There are two types of posts: attached posts, located next to or within the center, and non-attached posts, situated at a reasonable distance. Urban health posts serve a population of 12,500 individuals.[17]

Comprehensive health service centers: Comprehensive rural health service centers are situated in rural areas and support multiple health houses and rural health posts. Led by a general practitioner

and a dedicated healthcare team, these centers provide essential primary healthcare services to rural and nomadic populations.[17] Comprehensive urban health service centers are situated in urban areas and encompass urban health posts.[17]

Part 2: An expert panel discussion (formal focus group), was conducted using a semi-structured format to gather insights into the key challenges of implementing a surveillance system. The discussions were facilitated by a moderator and included seven specialists from the NCDs unit at the Health Deputy of Tehran University of Medical Sciences. The panel consisted of one manager and six experts, all chosen for their specialized knowledge in HTN and diabetes care. Each participant had a minimum of five years of experience in relevant fields, including public health, healthcare management, and chronic disease prevention. The expert panel discussions, consisting of five sessions, were conducted in person, with each session lasting approximately 90 minutes at the Health Deputy of Tehran University of Medical Sciences. The first question posed to the panel was open-ended and designed to foster rapport between the researcher and the interviewees. It aimed to identify the primary barriers to implementing and operating surveillance systems for HTN and diabetes in Iran (**BOX 1**, **Appendix 1**). The discussions were transcribed on-site to ensure accurate documentation of the insights provided by the participants. The data collected from both the expert panel discussions and the literature review were analyzed using conventional content analysis with an inductive approach and consensus-Building. MAXQDA software was utilized for categorization and coding.

To ensure the trustworthiness of our research, we applied Guba and Lincoln's criteria: - Credibility: Achieved through member checking, where participants reviewed and confirmed key findings. - Transferability: Ensured by maintaining detailed research records and comprehensive participant descriptions. - Dependability: Strengthened by an external audit of the data collection and analysis processes. - Confirmability: Supported through data triangulation, which involved comparing findings from the literature, panel discussions, and field notes.

RESULTS

Part 1: The healthcare surveillance system in Iran

History of the National Hypertension Prevention and Control Program

The national program for HTN prevention and control was initiated in 1992 in response to the high prevalence of the disease. Initially targeting individuals aged 15 and older, the program was piloted in six rural areas. In 1993, the program revised its scope to screen individuals aged 30 and older every three years. By 1994, it had been integrated into the rural healthcare network. In 2004, the HTN program merged with the national diabetes control program due to overlapping target populations.[18] In 2014, the Ministry of Health and Medical Education (MOHEM) launched the Health Transformation Plan to reform healthcare. This plan emphasizes improvements in primary healthcare and includes the IraPEN service package for the prevention and control of NCDs.[19] IraPEN was initially piloted

in Naqadeh (West Azerbaijan), Maragheh (East Azerbaijan), Shahreza (Isfahan), and Baft (Kerman) and is now being expanded nationwide.[20] The National Campaign for HTN Control was conducted from May to July 2019, with support from various organizations, including the MOHME, the Ministry of Education, universities, insurance agencies, volunteers, and others. The primary goals of the campaign were to enhance the identification and management of HTN among individuals aged 30 and older, pregnant females, and those with kidney issues. The campaign focused on two key objectives: identifying individuals with HTN and initiating their treatment, as well as raising awareness about HTN, its risk factors, complications, and the importance of early diagnosis.[21, 22] The second phase of the campaign, which also includes diabetes management, commenced nationwide in 2023.

History of the National Diabetes Prevention and Control Program

The diabetes prevention and control program were initiated in 1991, focusing on high-risk individuals aged 15 to 39, as well as those over 40 in selected pilot regions (rural areas). Initial challenges included high costs and limited access to standard tools. In 1996, a National Committee for diabetes Prevention and Control was established, which led to a pilot program conducted across 17 universities from 1999 to 2002.[23-25] In 2004, the diabetes program was integrated with the HTN control program. In 2009, Iran initiated a diabetes control program in cities with populations exceeding one million, in response to the increasing prevalence of diabetes in metropolitan areas after completing a pilot phase[24] As mentioned in the history of hypertension care, the IraPEN program has been implemented since 2014.[19] Active diabetes screening has been implemented in rural areas, while passive screening has been conducted in urban areas.

Levels of Care for Hypertension and Diabetes

HTN care operates across four levels: Level One involves Behvarz in rural health houses who screen individuals over 30 every three years and refer suspected cases. At Level Two, physicians confirm diagnoses and provide quarterly care, with monthly follow-ups conducted by health workers.[18, 26, 27] Level Three consists of specialized care cardiologists or internists providing for complex cases.[26] Finally, Level Four includes referrals to specialized hospitals in provincial capitals for advanced treatment.

diabetes care follows a similar structure: Level One involves Behvarz at rural health houses and health workers at urban health posts. Their responsibilities include educating the general public, particularly high-risk individuals, under the supervision of a physician. They focus on identifying high-risk individuals among those over 30 years of age, as well as married females of childbearing age who exhibit certain risk factors. At Level Two, physicians conduct screenings and provide monthly care, supported by health workers. Level Three involves endocrinologists and nutritionists in district hospitals who handle advanced care and management. Level Four includes specialized centers in provincial capitals that manage severe cases.[23, 26]

Monitoring and Research

Monitoring HTN and diabetes in Iran has been carried out through national studies and extensive research. Some of the most significant related studies in Iran include.

STEPwise Approach to Non-communicable Disease Risk Factor Surveillance (STEPS)

The STEPS Survey, conducted in Iran over eight rounds, adheres to WHO guidelines for monitoring NCDs, specifically HTN and diabetes. It employs a representative sample and utilizes population-based sampling methods.[28-30] The survey consists of three steps: questionnaires (Step 1), physical examinations (Step 2), and biochemical assessments (Step 3). However, Step 3 was not conducted in the surveys of 2006, 2008, and 2009.[30]

Tehran Lipid and Glucose Study – TLGS

The Tehran Lipid and Glucose Study (TLGS), initiated in 1999, is a significant cohort study in Iran designed to identify risk factors for cardiovascular diseases (CVDs), diabetes, HTN, dyslipoproteinemia, and other NCDs within Tehran's urban population. The first phase consisted of a cross-sectional study conducted in District 13 of Tehran, focusing on the prevalence of CVD and its associated risk factors. The second phase, which began in 2002, is a long-term longitudinal study that collects data every three years. As of 2018, the study is in its seventh cycle.[31]

Prospective Epidemiological Research Studies in Iran (PERSIAN) Cohort Study

The PERSIAN Cohort Study is a large-scale, national cohort study conducted in Iran. Its primary objective is to identify the risk factors for NCDs. This comprehensive study provides critical data on various NCDs, including CVDs, cancers, diabetes, HTN, and respiratory disorders. The PERSIAN Cohort includes over 180,000 participants from 18 provinces across Iran, representing a diverse cross-section of the country's population. Data is collected through detailed questionnaires, clinical examinations, and laboratory tests that focus on demographic, behavioral, and biomedical factors.[32]

Numerous studies have been conducted at local and regional levels in Iran's medical universities and research centers, investigating the prevalence and risk factors associated with diabetes and HTN across various provinces and cities.

Part 2: Challenges in the Surveillance System

From the analysis of interviews with health system experts and articles addressing challenges in the healthcare system (33-40), three main categories, eleven subcategories (Table 1), and 78 codes were identified (Table S1, Appendix 1). The primary categories identified in this study include challenges related to healthcare recipients, challenges concerning healthcare system employees, and challenges associated with the upper levels of the healthcare system.

Challenges Related to Healthcare Recipients

The lack of public awareness regarding health issues and the mistrust in the accuracy of services provided by the healthcare system have been identified as significant challenges facing this sector. Low public attendance at government service centers, particularly in urban areas, is a direct consequence of this lack of awareness and trust. These issues underscore the need for more comprehensive public education initiatives. Furthermore, factors such as societal restrictions on females, rural-to-urban migration, an aging population, and fluctuations in literacy levels have also been identified as social factors contributing to the limited public engagement with healthcare system programs.

Table 1. Challenges Faced by the Healthcare System

Main Categories	Sub-categories
Challenges Related to Healthcare Recipients	Lack of public awareness and information in the health sector.
	Social issues within the healthcare system.
Challenges concerning healthcare system employees	Personnel and manpower issues
	Lack of proper training for healthcare system staff
Challenges associated with the upper levels of the healthcare system	Improper policy is the cause of the deviation of health programs at the macro level.
	Lack of a system of evaluation and monitoring of the implementation process of health programs
	Failure to update facilities and technology in the healthcare system
	Weak and inadequate services of the health care system
	The lack of correct statistics and information hinders the optimal implementation of health programs
	Weakness in the management levels of the healthcare system
	Financial problems hinder the implementation of healthcare system programs

Challenges concerning healthcare system employees

The inadequate living conditions in rural areas, especially in remote and underprivileged regions, represent a significant challenge for healthcare professionals. Consequently, it is essential to provide suitable facilities and favorable conditions to encourage staff retention in these areas. Many employees' express dissatisfaction with their contractual terms. Additionally, the healthcare system is facing a shortage of necessary personnel, leading to increased workloads and additional pressure on the existing staff. Unjust compensation and the lack of a promotion mechanism are also identified as factors contributing to staff demotivation.

One of the prerequisites for delivering quality services to the public is the proper training of healthcare providers and physicians. Many physicians recruited into the family physician system lack a comprehensive understanding of their responsibilities. Staff employed at healthcare centers emphasize the importance of practical, needs-based training that aligns with the requirements of the healthcare system. Historically, due to the population's literacy levels, Behvarz was often selected from individuals with lower educational backgrounds. However, with societal advancements and an increase in overall literacy, the inadequate education of healthcare workers has resulted in public mistrust of the healthcare system.

Challenges associated with the upper levels of the healthcare system

The decisions made by managers at higher levels of policymaking often do not align with the objectives of the healthcare system, resulting in numerous challenges. Furthermore, policymakers face additional issues, including fragmented and parallel structures in the management of non-communicable diseases, inadequate law enforcement, and the healthcare system's inflexibility in adapting to changes. Effective monitoring of healthcare program implementation necessitates specialized tools and human resources, which are currently insufficient. Additionally, there is a significant limitation in the availability of standardized checklists and appropriate criteria for monitoring and evaluating these programs.

To effectively deliver the intended services of the healthcare system, it is essential to have up-to-date facilities and technologies; without them, service delivery remains incomplete. This study highlights the shortage of equipment and technology in healthcare service centers. Additionally, some research indicates that a lack of familiarity among healthcare personnel with modern technologies contributes to weaknesses in this area. Our study also revealed that many individuals are dissatisfied with the services provided at healthcare centers. Key reasons for this dissatisfaction include the absence of evidence-based decision-making, the cumbersome nature of service delivery processes, inappropriate interactions between healthcare personnel and patients, and the lack of integration between primary-level service provision and the secondary and higher levels of care. Furthermore, the services offered by health centers in urban areas are of inferior quality and quantity, and adequate information about these services is not effectively communicated.

While having accurate data and information on current conditions is crucial for planning and executing health programs, there appears to be a lack of an integrated health information system, and researchers remain unaware of findings from studies conducted at other universities. Furthermore, healthcare system managers have contributed to employee demotivation through the unequal distribution of human resources and arbitrary decision-making. Managerial instability, the appointment of leaders unfamiliar with health issues, limited knowledge or weak attitudes among managers, and the lack of expert support in policy decisions underscore the need for trained professionals in health system administration. Financial challenges have significantly hindered the implementation of healthcare programs. The shortage of financial resources and issues with staff compensation have been frequently cited in various sources. Additionally, the ambiguity and instability of funding sources have often

resulted in program failures.

DISCUSSION

The findings of this study underscore a complex array of challenges faced by Iran's HTN and diabetes control and prevention program. These challenges impact healthcare recipients, professionals, and higher levels of the healthcare system, exposing systemic issues that impede the program's effectiveness. We identified these challenges by incorporating expert opinions and reviewing existing studies. However, a comprehensive review, critique, and evaluation of these challenges necessitate further research. We present these challenges to inform policymakers, planners, and researchers, and we propose potential solutions that could be advantageous.

The lack of awareness about HTN and diabetes, particularly in rural areas, poses a significant barrier to effective healthcare. Previous studies have furthermore identified patients' lack of awareness as one of the barriers to obtaining services.[41, 42] Public skepticism regarding the reliability and transparency of healthcare services further exacerbates the issue. Urban populations often exhibit low engagement due to misaligned service delivery, while the migration from rural to urban areas disrupt the continuity of care. Collectively, these factors impede the prevention and management of NCDs. To address these challenges, we should implement culturally sensitive health education initiatives utilizing mass media, social media, and community leaders to raise awareness about the risks associated with hypertension and diabetes. Building public trust is essential and can be achieved through transparent communication, effective feedback mechanisms, and ensuring consistent service reliability. Expanding access to healthcare through decentralized service delivery—such as mobile clinics, community health centers, and telemedicine—will help reach underserved rural populations. Additionally, leveraging technology, including SMS reminders, mobile applications, and wearable devices, can empower individuals to monitor their health and adhere to treatment plans. Engaging local communities in the design and implementation of healthcare programs is essential. Training community health workers can bridge the gap between healthcare providers and the public. Urban healthcare services should be adapted to accommodate the fast-paced lifestyles of city dwellers, ensuring convenience and accessibility. Additionally, developing integrated healthcare systems will facilitate seamless care for individuals migrating from rural to urban areas, preventing them from falling through the cracks of the healthcare system. Our study demonstrated that aging is an additional challenge that hinders the provision of optimal services. A study have also shown that population aging, by increasing the burden of chronic diseases and the myriad challenges associated with an older demographic, complicates the delivery of quality health services.[43]

Healthcare workforce shortages, particularly in rural areas, pose a significant challenge. Poor living conditions and inadequate compensation deter healthcare professionals from working in underserved regions, contributing to burnout and a decline in the quality of care. Additionally, insufficient training for family physicians and Behvarz leads to a lack of public trust and suboptimal service delivery, undermining the effectiveness of NCD prevention and management programs. A study conducted in the United States examined the principal barriers to providing health care services in rural communities.[44] These barriers were identified as follows: Fragmented communication

among health-care providers, Geographic distance between service recipients and available care, Cultural differences and Time and resource constraints. Improving conditions in rural areas by providing better housing, transportation, and amenities will encourage healthcare workers to serve in these regions. Fair compensation, including revised employment contracts with higher salaries, opportunities for career advancement, and hardship allowances for rural positions, will help retain talent. Attracting healthcare workers to underserved areas can be facilitated through scholarships, employment guarantees, and targeted recruitment campaigns. It is essential to redistribute workloads to prevent burnout and enhance job satisfaction among healthcare professionals. Comprehensive training programs should be implemented for family physicians and healthcare workers, focusing on the prevention, diagnosis, and management of NCDs. Enhancing the educational standards of Behvarz workers and recruiting individuals with higher educational qualifications will improve their credibility. Encouraging continuous learning through workshops, certifications, and access to the latest medical research will strengthen professional development. Ultimately, public trust can be reinforced by improving the competencies and professionalism of healthcare workers through transparent communication and visible improvements in service quality.

Additionally, structural, managerial, and resource limitations hinder effective management of NCDs. Fragmented program management results in inefficiencies and duplicated efforts, while outdated medical equipment and technological gaps undermine service delivery. Patient dissatisfaction is prevalent due to poor service quality, and urban-rural divides. Furthermore, the absence of an integrated health information system and stable funding presents significant obstacles to effective NCD prevention and management. To address these challenges, a unified NCD management framework should be established to streamline efforts, reduce duplication, and enhance coordination across healthcare sectors. Training healthcare managers in evidence-based decision-making and prioritizing appointments based on expertise rather than political considerations will improve management efficiency. It is essential to invest in modern medical equipment and upgrade healthcare facilities to meet the increasing demands of NCD care. Additionally, providing hands-on training for healthcare personnel in the use of new technologies and digital tools will further enhance service delivery. Standardizing evidence-based protocols across all regions will ensure consistent, high-quality care. Implementing a centralized health information system will integrate data, improve accessibility, and facilitate data-driven decision-making. Finally, securing stable funding through government budgets, international aid, and public-private partnerships will ensure the long-term sustainability of NCD programs. Partovi et al. [45] in their study examined the challenges confronting non-communicable disease prevention and control programs from the perspective of senior managers in Iran, identified barriers such as insufficient funding; infrastructural deficiencies (including obsolete medical equipment); fragmented program management; and the absence of an integrated health information system. These findings are congruent with our own results.

CONCLUSION

Iran faces significant challenges in its efforts to control and prevent hypertension and diabetes.

These challenges include a lack of public awareness, limited access to healthcare services, shortages of human resources, and systemic inefficiencies. To improve public trust, it is essential to increase transparency and provide culturally relevant education. Expanding services through mobile clinics, telemedicine, and decentralized health centers can enhance access to care. Additionally, creating incentives to attract and retain healthcare workers in underserved areas is crucial. Integrating the management system for NCDs and investing in digital infrastructure will improve overall efficiency. Ultimately, fostering public-private partnerships will be vital for the success of this program.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interest.

Ethical consideration

Ethical approval for the study was obtained from the Research Ethics Committees of School of Public Health & Allied Medical Sciences- Tehran University of Medical Sciences (IR.TUMS.SPH. REC.1402.076).

Abbreviations

HTN, Hypertension;
NCDs, Non-communicable Diseases;
LMICs, Low- and Middle-Income Countries;
CDC, Centers for Disease Control and Prevention;
WHO, World Health Organization;
WHO-PEN, WHO Package of Essential NCDs Interventions;
BP, Blood Pressure;
MOHME, Ministry of Health and Medical Education;
CVDs, Cardiovascular Diseases;
STEPS, STEPwise Approach to Non-communicable Disease Risk Factor Surveillance;
TLGS, Tehran Lipid and Glucose Study;
PERSIAN, Prospective Epidemiological Research Studies in Iran;

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