

Recollection

Evaluating Behavioral Risk Factor Interventions for Hypertensive and Diabetic Patient Management in the National Basic Public Health Service Programs from 2009

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BACKGROUND

In recent decades, China has faced a double burden of infectious diseases and noncommunicable diseases (NCDs). The number of deaths due to NCDs accounts for 88.5% of total deaths in China in 2019. To address these public health issues and improve the accessibility and affordability of primary health care, a National Basic Public Health Service Program (NBPHSP) was introduced as part of China's healthcare reform initiated in 2009. Subsidized by national and local government budgets, NBPHSP is mainly implemented by community and township health service centers, as well as health stations in urban areas and village clinics in rural areas (1). Health management of patients with hypertension and diabetes is an integral and pivotal part of the NBPHSP. The National Health Commission successively promulgated the National Standards for Basic Public Health Services (2009, 2011, and 2017 editions) to guide the management of patients with hypertension and diabetes. As required, all primary health care institutions should provide services for detection, comprehensive treatment, and follow-up for the local hypertensive and diabetic residents above 35 years old (2). Lifestyle and behavior risk factor interventions are cost-effective to tackle NCDs and are fundamental components of hypertension and diabetes management in the NBPHSP. Yet, limited literature has evaluated its implementation in China. Therefore, this study used pragmatic approaches to recollect published data and evaluate the implementation of the behavioral risk factor intervention in NCD patients in this nationwide public health action.

METHODS

We integrated the "Reach, Efficacy-Adoption, Implementation, Maintenance (RE-AIM)" framework

to develop the protocol (3). We tailed the maintenance dimension to the policy development process, as NBPHSP is a national-wide policy and funded by the government. We further extended 3 dimensions of cost, successful experiences and challenges, and made the evaluation to 8 final dimensions (Table 1).

Environment scanning was applied to search, identify, extract, and compile implementation data on hypertension and diabetes management in the NBPHSP from January 1, 2009, to November 31, 2021 (4). First, policy notes from the websites of the National Health Commission were reviewed. National medical reform reports, related national health service surveys, statistical bulletins, normative documents, work reports, and data compilation on the NBPHSP hypertension and diabetes management were collected. Subsequently, searches were made in SinoMed, CNKI, WanFang Database, and PubMed with "national basic public health services," "primary care centers," "hypertension management," "diabetes management," "lifestyle intervention," and "behavior risk factor intervention" as keywords. The data collection process was conducted under the study protocol by 2 researchers independently. A total of 128 policy notes, 15 normative documents/guidelines, 17 reports/statistical bulletins and 38 papers/dissertations were reviewed. We classified the above documents into 8 dimensions as predefined in Table 1. When multiple documents were available for a specific indicator, we used data with good representativeness (nationwide), most recently published and officially released by national government institutions. We use data mainly from 3 national reports and 11 papers/dissertations according to representativeness and relevance in this recollection study (Table 2).

MAIN OUTCOMES

Policy Development

The guides for lifestyle interventions for

TABLE 1. Dimensions of RE-AIM framework for implementation of behavioral interventions for hypertension and diabetes management in NBPHSP.

Dimension	Definition	Indicators
Policy	Development of policies for NBPHSP hypertension and diabetes management	Policies, legislative and guideline
Adoption	Institutional and personnel participation	Composition of participating medical staff
Implementation	Content, depth and mode of intervention implementation	Modes of service Application of technical standards Application of information technology Guidance on lifestyle
Cost	Time investment and cost	Service time Cost estimation
Reach	Coverage of target population	Number of people with hypertension managed Number of people with diabetes managed
Efficacy	Intervention effect including work effect and health effect	Awareness rate Satisfaction rate Acceptance Blood pressure control rate Blood sugar control rate
Successful experience	Achievements and benefits	Achievements and benefits
Challenges	Major problem or obstacle	Major problem or obstacle

Abbreviations: RE-AIM=reach, efficacy-adoption, implementation, maintenance; NBPHSP=national basic public health service program.

hypertensive and diabetes patients in the National Standards for Basic Public Health Services were basic between 2009 and 2017 (2). Since 2017, the National Health Commission has recommended contract-based family doctor services and concentration on treatment-and-prevention integration in hypertension and diabetes management (5). National technical guidance on hypertension and diabetes prevention and management at primary medical facilities was developed (2017 and 2020 editions for hypertension, 2018 for diabetes) (5). Primary health workers were trained to strengthen their capacity for patient management. Interventions on risk behavior factors were scaled up, focusing on “salt reduction, weight loss, exercise, quitting smoking and drinking, and keeping a peaceful mind.” Chinese citizens’ privilege of receiving safe and effective services to prevent and control health-related risk factors and diseases is legally guaranteed by the Law of Promotion of Basic Medical and Health Care, promulgated in 2019.

Adoption

Treatment of hypertension and diabetes in NBPHSP has achieved universal coverage in the Chinese primary care system. Village doctors and part of outpatient doctors were providers for hypertension and diabetes in the early stage of NBPHSP. The personnel assigned to the NBPHSP shifted to family doctor teams, mainly composed of general practitioners, specialist physicians, nurses, and public health physicians, with general practitioners taking the

lead role since 2017.

Implementation

SERVICE mode: Outpatient visits were mostly applied for hypertension and diabetes management in the early stage, adopted by 93.8% of primary care centers in a sampled survey in 8 provincial-level administrative divisions (PLADs) in 2015 (6). Multidisciplinary and refined services have been gradually increased since the introduction of contracted family doctor team services in 2017. By the end of 2018, the nationwide coverage of contracted family doctor team services in 10 key groups (including patients with hypertension and diabetes) was 71.3% (7).

FIELD application of technical guidelines: The field application rate of national standards for NBPHSP was 87.5% in hypertension management and 91.7% in diabetes management in 8 selected PLADs in 2015 (6). Although versions of the guidelines for primary care centers were issued in 2017, data to evaluate their application are still pending.

GUIDANCE: Risk behavior factors assessment and guidance to change unhealthy diet, physical inactivity, smoking, and drinking are routine in follow-up visits. Patient self-management is promoted as an appropriate tool for behavior risk factors intervention by National Center for Chronic and Noncommunicable Disease Control and Prevention (NCNCD), China CDC, in 2010. It became one of the tasks for establishing national demonstration areas for comprehensive

TABLE 2. The included national reports and papers/dissertations.

Type/Title	Applied dimension
National reports	
Development Report on Health Reform in China (2020) (7)	Implementation
Statistical Bulletin on Medical and Health Development in China (2020) (11)	Reach
The Sixth National Health Services Survey Special Report Two (2021) (14)	
Papers/ Dissertations	
Progress in basic public health service projects (2017) (1)	Adoption
Assessments of chronic disease management of national basic public health service programs in primary health care institutions (2017) (6)	Implementation
On national demonstration areas: a cluster analysis (2017) (8)	
The role of the basic public health service program in the control of hypertension in China: results from a cross-sectional health service interview survey (2021) (9)	Cost
Research on the current situation of national essential public health services and manpower cost estimation in Jiangsu Province (2017) (10)	
Awareness rate and satisfaction of basic public health services among key population in Henan Province in 2016 (12)	Efficacy
Evaluation on programs regarding the community-based management of hypertension and type 2 diabetes mellitus patients in eight PLADs, China (2014) (13)	
Research on equalization mechanism of essential public health service from the perspective of citizen participation-results from chronic disease management (2020) (15)	
A study of the effect of basic public health services (2018) (16)	
Utilization and Management Effect of National Essential Public Health Services in Chinese Type 2 Diabetic Patients (2021) (17)	
Prevalence and control of hypertension in adults in China, 2018 (18)	

Abbreviation: PLAD=provincial-level administrative division.

prevention and control of NCDs, which covered 17.1% of all counties and districts in China by 2020 (8).

APPLICATION of information technology: Information systems are widely established in primary care centers to promote NBPHSP services. The vast majority have items to support hypertension and diabetes management related to the establishment and exchange of electronic health records, follow up on medication, dietary and physical activity, etc. A cross-sectional health service interview survey in 17 provincial-level administrative divisions (PLADs) in eastern, central, and western parts of China in 2014 showed a 30% higher effect on hypertension management in districts/counties with established information systems (9).

Cost

SERVICE time: A survey in Jiangsu Province in 2017 found that time spent on “hypertension and diabetes management” accounted for over 37% of the total NBPHSP package, making it the most time-consuming item. On average, medical staff in primary health facilities spent 130 minutes treating one case of hypertension or diabetes management per year, in which 22 minutes were spent on risk behavior factors intervention (10).

COST estimate: According to staff expenditures and number of personnel for NBPHSP, the average annual cost of “hypertension and diabetes management” provided by primary medical staff in Jiangsu was 150 CNY/case in 2017 (10).

Reach

The total number of people with hypertension and diabetes under NBPHSP management showed steady increases in China. By the end of 2020, 109.12 million hypertensive patients and 35.73 million patients with type 2 diabetes were covered by standardized management in China (11).

Efficacy

AWARENESS and satisfaction rate: Residents’ awareness and satisfaction rates with the NBPHSP was an important indicator for the NBPHSP performance evaluation. A provincial-wide sample survey in 2016 indicated the awareness rate of lifestyle intervention among urban and rural diabetic patients under NBPHSP management was 86.29% and 85.58%, respectively, which was lower than other services (regular blood sugar measurement and physical examination) (12). Sample surveys conducted in various locations across China showed that

hypertensive and diabetic patients were generally satisfied with NBPHSP services, and the range of satisfaction rates was around 83%–95.87% (12–13).

LIFESTYLE management received and acceptance: The Sixth National Health Service Statistical Survey (2018) indicated 91.5% of self-reported hypertensive patients and 86.2% of self-reported diabetic patients had been followed up by primary healthcare centers or facilities. At their most recent follow-up, 89.9% and 92.9% of self-reported hypertensive and diabetic patients, respectively, had received lifestyle guidance, which was the lowest among all service items (Table 3) (14).

However, the acceptance of the lifestyle intervention was not optimistic. The results of the China Health and Retirement Longitudinal Study (CHARLS) (2011–2015) showed an acceptance rate of 70%–83% for smoking cessation, a rate of 66%–70% for alcohol quitting, and a rate of 28%–39% for body weight control in hypertensive and diabetic patients aged above 45 years old (15).

CONTROL rate: A systematic review found that reported blood pressure control rate was 50%–65% in hypertensive patients and blood glucose control rate was 50%–70% in diabetic patients from studies published between January 1, 2009, and May 3, 2016. Better control of blood pressure and blood glucose was observed after NBPHSP management compared with the baseline at recruitment (16).

CONTRIBUTION of NBPHSP services for hypertension and diabetes control in China: NBPHSP data from pilot areas of primary health care reform in 17 PLADs in China in 2014 indicated a significantly better control rate for hypertension in patients ≥ 35 years under NBPHSP management compared to those not under management (control rate: 76.9% vs. 68.2%) (9). An evaluation study conducted in 5

PLADs showed a positive association between NBPHSP and diabetes control in China during the 10-year implementation (2009–2019) (17). Blood glucose control was improved by utilizing pre-determined diabetes management services, including personal health record review, traditional medication treatment, follow-up, and blood glucose tests, while guidance on lifestyle risk factors was not included.

Data from national behavior risk factor surveillance in 2018 showed that the awareness, treatment, and treatment control rates of hypertensive patients above 18 years old in China were 41.0%, 34.9%, and 31.5%, respectively, lower than those reported from the NBPHSP. However, compared with the National Nutrition Survey in 2002, these rates showed a significant upward trend in 2013 and 2018 in China (Table 4). The monitoring results of these nationally representative large populations may indirectly reflect the effects of the NBPHSP hypertension and diabetes management initiated in 2009 (18).

Successful Experience

According to the NBPHSP, up to over 100 (109.12 million) million hypertensive patients and 30 million (35.73 million) type 2 diabetics were under daily management by primary medical and health care centers in the past 10 years. Based on the estimation of 270 million hypertensive patients and 120 million diabetics in China, the NBPHSP policy has reached around one-third of hypertensive and diabetic patients nationwide. Large numbers of NCDs patients in China were diagnosed early, followed up with, and medicated and treated. Universal health benefits and fairness were demonstrated through the policy guarantee, showing that the Chinese government has taken concrete actions to fulfill its public health responsibilities. The government paid attention to this initiative and

TABLE 3. Lifestyle management during follow-up in self-reported hypertensive and diabetic patients ≥ 15 years.

Indicator (%)	Self-reported hypertensive			Self-reported diabetic		
	Total	Urban	Rural	Total	Urban	Rural
Followed-up ≥ 4 times/year	55.3	45.9	67.0	51.4	44.4	65.0
Followed up with by primary care centers	91.5	88.3	94.7	86.2	84.2	89.4
Guidance received in the follow-up						
Measurement*	97.2	95.3	99.1	93.7	91.2	97.4
Medication	92.8	92.6	93.0	94.2	94.1	94.4
Consult on disease	91.0	90.6	91.3	92.7	92.4	93.3
Lifestyle guide	89.9	88.7	91.0	92.9	91.5	94.9

* refer to blood pressure measurement or fasting glucose measurement.

Data source: the Sixth National Health Service Statistical Survey (2018).

TABLE 4. Awareness rate, treatment rate and control rate of hypertension among people over 18 years old in China from 2002 to 2018.

Indicator (%)	2002	2013	2018
Awareness rate of hypertension	30.2	40.9	41.0
Treatment rate of hypertension	24.7	32.5	34.9
Hypertension treatment control rate	25.0	29.8	31.5

Notes: Awareness rate of hypertension: The proportion of respondents diagnosed with hypertension who has noted being hypertensive before measuring their blood pressure in this survey. Treatment rate of hypertension: The proportion of respondents diagnosed with hypertension who have taken antihypertensive drugs in the last two weeks. Hypertension treatment control rate: The proportion of hypertensive patients with blood pressure below 140/90 mmHg who have taken antihypertensive medication in the last two weeks.

increased investment year by year. The budget subsidy of NBPHSP gradually increased from 15 yuan per capita in 2009 to 79 yuan in 2021.

Challenges

Actions are being taken to promote an integrated strategy for the prevention and treatment of hypertension and diabetes management of NBPHSP. Gaps still exist between guidance on modifiable risk factors and field implementation in the primary health care settings. Due to the lack of targeted, quantifiable, and operational technical specifications and appropriate technical tools, risk behavior factor interventions have not been sufficiently implemented, and their basic therapeutic role in NCDs management has not been fully exerted. Furthermore, patients' acceptance of risk factor interventions remains difficult. Particularly in recent years in China, personalized health demands are rising, and demands for the service capacity of family doctor teams are increasing. Continuous capacity building for the family doctor teams with medical and preventive integration is needed.

Strengths and Limitation

This study evaluates the implementation of the milestone public health action of NBPHSP by robust evaluation framework and has some preliminary findings. However, due to insufficient data on NBPHSP, particularly on the implementation of risk behavior factor intervention in hypertensive and diabetic patients' management, the content of this study was relatively limited. Parts of the evaluation were based on regional and small-scale studies. The findings and suggestions of the study need to be updated and improved by further studies.

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REFERENCES

- Qin JM. Progress in basic public health service projects in China. *Chin J Public Health* 2017;33(9):1289 - 97. (In Chinese).
- National Health and Family Planning Commission. Notice of the national health and Family Planning Commission on printing and distributing the national basic public health service norms (Third Edition). 2017 <http://www.nhc.gov.cn/jws/s3578/201703/d20c37e23e1f4c7db7b8e25f34473e1b.shtml>. (In Chinese). [2022-4-11].
- Glasgow RE, Vogt TM, Boles SM. Evaluating the public health impact of health promotion interventions: the RE-AIM framework. *Am J Public Health* 1999;89(9):1322 - 7. <http://dx.doi.org/10.2105/AJPH.89.9.1322>.
- Charlton P, Doucet S, Azar R, Nagel DA, Boulos L, Luke A, et al. The use of the environmental scan in health services delivery research: a scoping review protocol. *BMJ Open* 2019;9(9):e029805. <http://dx.doi.org/10.1136/bmjopen-2019-029805>.
- National Health Commission, Ministry of Finance, National Administration of Traditional Chinese Medicine. Notes on the implementation of the Basic Public Health Service Programs in 2020. http://www.gov.cn/zhengce/zhengceku/2020-06/16/content_5519776.htm. (In Chinese). [2022-04-11].
- Liu YH. Assessments of chronic disease management of national basic public health service programs in primary health care institutions [dissertation]. Beijing: Chinese Center for Disease Control and Prevention; 2017. <https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CMFD&dbname=CMFD201801&filename=1017219953.nh&uniplatform=NZKPT&v=1gX9eQBlIqIuvbbbc5aNU97QqnsRecE8nDnQAeF2E8yRFL-YKUkgC7pNs4M9RGQ>. (In Chinese). [2022-4-11].
- Liang WN, Wang C, Wu PX. Development report on health reform in China (2020). Beijing: Social Sciences Academic Press. 2020. <http://>

- find.nlc.cn/search/showDocDetails?docId=-5901441058689150929&data Source=ucs01&query=%09%E4%B8%AD%E5%9B%BD%E5%8C%BB%E6%94%B9%E5%8F%91%E5%B1%95%E6%8A%A5%E5%91%8A%EF%BC%882020%EF%BC%89. (In Chinese).
8. Mao F, Jiang YY, Dong WL, Ji N, Dong JQ. On national demonstration areas: a cluster analysis. *Chin J Epidemiol* 2017;38(4):496 – 502. <http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2017.04.017>. (In Chinese).
 9. Qin JM, Zhang YC, Fridman M, Sweeny K, Zhang LF, Lin CM, et al. The role of the Basic Public Health Service program in the control of hypertension in China: results from a cross-sectional health service interview survey. *PLoS One* 2021;16(6):e0217185. <http://dx.doi.org/10.1371/journal.pone.0217185>.
 10. He BY. Research on the current situation of national essential public health services and manpower cost estimation in Jiangsu province [dissertation]. Nanjing: Nanjing Medical University; 2019. https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CMFD&dbname=CMFD201902&filename=1019868564.nh&uniplatform=NZKPT&v=qDNbcukZsrytpaPdfqvhduryf32nyx6la_gkQvRyxfbQkd4EG5OILzxcGS4VOK. (In Chinese)
 11. National Health Commission. Statistical bulletin on medical and health development in China (2020). 2020. http://www.gov.cn/guoqing/2021-07/22/content_5626526.htm. [2022-4-11]. (In Chinese)
 12. Guo WH. Awareness rate and satisfaction of basic public health services among key population in Henan province in 2016 [dissertation]. Zhengzhou: Zhengzhou University; 2018. https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CMFD&dbname=CMFD201901&filename=1018109856.nh&uniplatform=NZKPT&v=zLu3yNWZQUG74vjw3exX_R-z4oIpNYnXPwhr7-6ohk1D8g_c80JYPfTpYqGbNL5f. (In Chinese)
 13. Li Y, Ren DF, Ding PF, Zhang Q, Zhang J, Shi WH, et al. Evaluation on programs regarding the community-based management of hypertension and type 2 diabetes mellitus patients in eight provinces, China. *Chin J Epidemiol* 2014;35(1):35 – 9. <http://dx.doi.org/10.3760/cma.j.issn.0254-6450.2014.01.009>. (In Chinese).
 14. Statistical Information Center of National Health Commission. The sixth national health services survey special report two. Beijing: China Union Medical College Press. 2021. <https://www.dushu.com/book/13879099/>. (In Chinese)
 15. Song HX. Research on equalization mechanism of essential public health service from the perspective of citizen participation-results from chronic disease management. Wuhan: Huazhong University of Science and Technology; 2020. https://kns.cnki.net/kcms/detail/detail.aspx?dbcode=CDFD&dbname=CDFDLAST2022&filename=1021726860.nh&uniplatform=NZKPT&v=oeVXNTQPc_W-ly4Nxvt0T83hEtsuorLGLu3qViBvVh111u0Lqn63BhdQa8FMVuRj. (In Chinese)
 16. Pu X, Gen SP, Cao ZH, Wu S. A study of the effect of basic public health services. *Health Econ Res* 2018(3):17-20. <https://d.wanfangdata.com.cn/periodical/wsjjy201803005>. (In Chinese).
 17. Liu MC, Yang LH, Chen XY, Liu YL, You LL. Utilization of national essential public health services and its relationship with management effect in Chinese type 2 diabetic patients. *Chin Gen Pract* 2022;25(1):43 – 9. <http://dx.doi.org/10.12114/j.issn.1007-9572.2021.00.326>. (In Chinese).
 18. Zhang M, Wu J, Zhang X, Hu CH, Zhao ZP, Li C, et al. Prevalence and control of hypertension in adults in China, 2018. *Chin J Epidemiol* 2021;42(10):1780 – 9. <http://dx.doi.org/10.3760/cma.j.cn112338-20210508-00379>. (In Chinese).