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ORIGINAL RESEARCH

Utilizing Group Model Building to Identify Barriers and Facilitators of Hypertension Management in Primary Health Care, China

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Purpose: Group Model Building (GMB) is a qualitative method that refers to a participatory process. This project aims to identify barriers and facilitators of hypertension management in primary health care in China, through which, the leverage point for intervention may be found.

Methods: The GMB was used to identify the factors influencing hypertension management. Graphs over time and causal loop diagram (CLD) were main tools of GMB. To propose the influencing factors, key stakeholders were invited to participate in a workshop. During the workshop, stakeholders were encouraged to plot the graphs over time of the variables about research issues and give a descriptive explanation. And based on this, a CLD was initially developed to establish a model of the interaction of factors. After the workshop, the research group further improved the CLD through repeated mutual discussions, and gave feedback to the participants. The Vensim PLE 9.0 software package was used to build CLD.

Results: A total of 14 key stakeholders were invited to participate in the workshop. Finally, 26 influencing factors were identified, which were divided into three dimensions, including the institutional, the community health workers (CHWs), and the patient level. And 5 reinforcing loops and 4 balancing loops were formed in the CLD. Promoting the building of the Medical Community/Regional Medical Association, implementing the family doctor contract service (FDCS), and enhancing the motivation of CHWs may be potential leverage points for hypertension management in China.

Conclusion: By using GMB, we have identified key factors in the management of hypertension in primary health care and provided comprehensive suggestions to overcome the obstacles.

Keywords: group model building, hypertension management, primary health care, causal loop diagram, system dynamics

Introduction

Long-term hypertension is a major risk factor for coronary artery disease, heart failure, chronic kidney disease, and other diseases. According to the Global Burden of Disease Study 2019, elevated systolic blood pressure (SBP) has caused 10.8 million deaths globally, ranking first among all 87 risk factors for early death.[1] The China Hypertension Survey (CHS) 2018 reveals that China's weighted prevalence of hypertension among people aged 18 and above is 23.2% with a total number of hypertension patients reaching as many as 244 million.[2] Hypertension has become a serious health problem of public concern in China, resulting in a heavy burden on society.[3] Therefore, effective management of hypertension serves as the top priority for the prevention and treatment of cardiovascular and cerebrovascular diseases. It refers to the comprehensive approach and strategies employed to address and control high blood pressure levels of population. The Healthy China Action (2019–2030) clearly proposes that by 2030, the standardized management rate of hypertension in China should be more than 70%, the awareness rate no less than 65%, and the treatment and control rates continuously improved as well.[4] The current awareness, treatment, and control rates of hypertension defined as SBP ≥140 mm Hg and/or diastolic BP (DBP) ≥90 mm Hg in China, however, are 46.9%, 40.7% and 15.3%, respectively,[2] which is still far from the expected target in 2030.

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Primary health care institutions (including community health centers and stations in urban areas, and township health centers and village clinics in rural areas) have been proven to play an important role in the management of hypertension.[5–7] Although a series of policies and measures have been taken to improve the effect of hypertension management,[8] it is still challenging since hypertension control is a complex public issue that needs multidisciplinary knowledge and methods. Research shows that the effect of hypertension management is affected by various individual factors including physiological (eg, dyslipidemia, amnesia), psychological (eg, anxiety, depression), and social factors (eg, socioeconomic status, health insurance).[9–13] However, it is still unclear how to design effective hypertension management program from the macro perspective. The previous research mainly focused on quantitative research, which ultimately easily leads to ecological errors for complex and multidisciplinary mechanism analysis. In order to provide valuable strategies for hypertension management, it is essential to explore more appropriate methods to study the interrelationships of different factors from the systems perspective.

Group Model Building (GMB) based on system dynamics could provide strong support for tackling such highly complex issues.[14,15] As a subset of Participatory Model Building (PMB), GMB is a powerful tool for stimulating and extracting stakeholder psychological models and combining them into a system dynamics model.[16] GMB is described as "a process in which team members exchange their views on a problem and explore questions".[17] It is a qualitative method to elicit different viewpoints on research issues from team members through formal workshops. These workshops consist of structured activities or "scripts" which require a collaborative effort from stakeholders potentially including experts, policy-makers, and so on, along with the modelers.[18–20] In the process, stakeholders are engaged in developing, testing, and applying models as a group.[21] In addition, causal loop diagrams (CLDs) are often used in the GMB process. It visually displays the various variables proposed by stakeholders and their relationships with each other, allowing stakeholders to clearly see their own contributions to the model building and think deeply about what actions should be taken to settle corresponding problems.[22,23] Through the whole process of GMB, it is possible to identify leverage points for effective intervention.

Since the appearance of GMB, it has been widely used in various fields. While some studies have applied GMB to public health issues such as health service resilience, acute care delivery, food insecurity, obesity and so on,[24–31] few studies apply this method to hypertension management issues. All these issues have multiple causes and involve multiple institutions to address. And in China, the application of GMB remains relatively new. Compared with traditional qualitative research methods, GMB has been proven to be more effective in stimulating discussion, promoting communication, and consensus building, and could be adapted for community-based projects.[32–34] This method allows diverse stakeholders to share their insights into the discussed problems which are conducive to understanding the underlying factors that might be considered as potential invention pathways for actions. Using GMB in hypertension management could help us discover both tangible and intangible factors which might be ignored and explore how these factors are interconnected through the feedback of CLDs.

Therefore, the research question of this study was how to use the GMB method to explore the factors that affect the effectiveness of hypertension management from a systemic perspective. This study aimed to use GMB to bring key stakeholders together to identify factors affecting the effectiveness of hypertension management in primary health care in China and their relationships from the perspective of system dynamics. Based on this, potentially feasible suggestions are proposed, which are of great significance for improving the status of hypertension management in China.

Materials and Methods

Study Design

This study hypothesized that the effectiveness of hypertension management is influenced by multiple factors, involving different stakeholders. Stakeholders have different powers and interests, complicating the issue of hypertension management. Thus, understanding the perceptions and needs of different stakeholders is critical for developing effective hypertension management strategies. Freeman defines a stakeholder as "any group or individual who can affect or is affected by the achievement of the organization's objective".[35] Based on this, this study defines the stakeholders of hypertension management in primary health care as related institutions, groups, and individuals who could affect the

effectiveness of hypertension management to a certain extent. And according to the analysis of word frequency in literature, expert consultation results, and stakeholder theory, the main stakeholders in this study include those people representing the policy-making department, health commission, Centers for Disease Control and Prevention (CDC), hospital, community management department, primary health care institution, health insurance department, health professional, researcher, and patient.

In December 2021, we conducted a workshop to invite key stakeholders to discuss factors influencing hypertension management in primary health care. During the workshop, stakeholders need to plot the graphs over time of the variables and give a descriptive explanation. After the workshop, the research group discussed the main variables proposed by stakeholders, developed a preliminary CLD, and fed it back to all participants. According to the opinions of stakeholders, the CLD was further modified and finalized.

Participants Recruitment

Before the formal workshop, we held a project kick-off meeting which invited key experts engaged in hypertension management to participate. At the meeting, the study design was discussed and key stakeholders were identified. Key members of the research team are responsible for the recruitment of participants. Various Stakeholders were invited to participate in the workshop. Stakeholders included in this study should have been engaged in hypertension-related work for more than 5 years and have certain insights into hypertension management. The included patients should have been diagnosed with hypertension for at least 1 year, and have received community hypertension management services. Before the formal workshop, brief semi-structured interviews were conducted with various stakeholders to determine their experiences and views on the issues. Please see Table S1 for the outline of semi-structured interview.

GMB Workshop Process

Before the workshop, a member of the project team who were proficient in the GMB method introduced the GMB process to the stakeholders in detail, using specific cases to illustrate how to propose variables, and associated considerations. These included ensuring variables to be nouns and highly related to the discussion topic, distinguishing between causal and correlational relationships, and ensuring clear trends in graphical representations. During the training process, stakeholders were encouraged to ask questions at any time to resolve their confusion and ensure that the proposed variables and graphical representations meet the requirements. The workshop follows a structured process by using scripts. To ensure the achievement of our research goals, we modified several existing scripts[15,19] to better suit this study and develop an appropriate script under the guidance of a method consultant. According to the script, the GMB process requires defining roles for the facilitating team including: (1) the facilitator, who acts as a group guide and knowledge elicitor; (2) the gatekeeper, who carries responsibility for the modeling project and initiates it; (3) the modeler/reflector, who focuses on the model that is being formulated by the group; (4) the observer, who pays attention to the dynamics of individuals within the group; (5) the recorder, whose task is to write down or document the workshop. Therefore, the research team members were assigned different roles with corresponding tasks during the workshop (Table 1). The main contents of the workshop include: (1) the facilitator introduced the goals of the workshop and GMB methods; (2) participants presented and explain the relevant variables of the defined problem; (3) modelers displayed variables in software; (4) participants discussed the relationships of each variable they proposed; (5) modelers drew CLDs based on discussion; (6) participants make possible relevant policy recommendations. As shown in Figure 1, we arranged the room layout in advance with swivel chairs and tables, electronic display screens as well as convenient power sockets.

GMB Tools

Graphs Over Time

Pieces of paper with a blank graph over time were prepared for participants on which the X-axis represents time and the Y-axis represents variables they want to propose. Each participant was asked to come up with at least 3 variables related to hypertension control and plot the changes over time, like Figure 2. In this way, participants might think more deeply about the connection between their proposed variables and hypertension control, which helps elicit as many meaningful variables as possible.

Table 1 Research Team Roles and Tasks During the Workshop

Team Members	Role	Tasks
LX	Facilitator	• Introduce the background and purpose of the project, and explain the GMB[a] method and process. • Guide stakeholders to draw and speak. • After each stakeholder's statement, summarize his/her statement.
WY	Gatekeeper	• Discuss together with the research group to determine the participants. • During the workshop, be responsible for discussion topics and correct the deviation in time.
QK	Modeler 1	• Switch the screen display content (including PPT, online conference, CLDs[b] drawing, etc.) according to the needs of the workshop. • Use Vensim software to draw a CLD.
GM	Modeler 2	• Record the variables described by the participants and their relationships. • Hand-drawn simple cause and effect diagram based on expert opinion.
QT	Observer	• Document the whole process and observe who wants to speak but does not. • Record emergencies that occurred during the recall process, to facilitate feedback on work after the workshop. • Time control, reminding the facilitator to speed up or slow down.
BX	Recorder 1	• Prepare informed consent form and workshop materials, and time each section of the workshop.
WY	Recorder 2	• Responsible for the recording of the workshop.

Notes: [a]Group model building, [b]Causal loop diagram.

Causal Loop Diagrams

The Vensim PLE 9.0 software package was used to build CLD.[36] In the CLD, the direction of the arrow represents the cause-effect relationship, from cause to effect. The "+" and "-" on the arrow represent the changing relationship between the two influencing factors linked. The "+" represents a positive relationship between the two influencing factors, which means an increase in the influencing factor at the beginning of the link will increase the other influencing factor linked. On the contrary, the "-" represents a negative relationship between the two influencing factors.

A loop is formed by a series of causal interactions from one variable, in the direction of the arrow, and then back on itself. There are two types of casual loops: reinforcing loop and balancing loop. A reinforcing loop is a cycle in which the

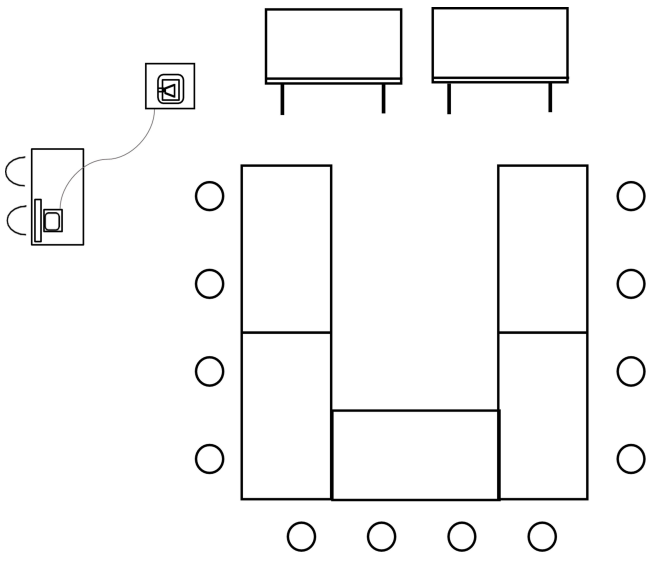

Figure 1 The room layout for the GMB workshop.

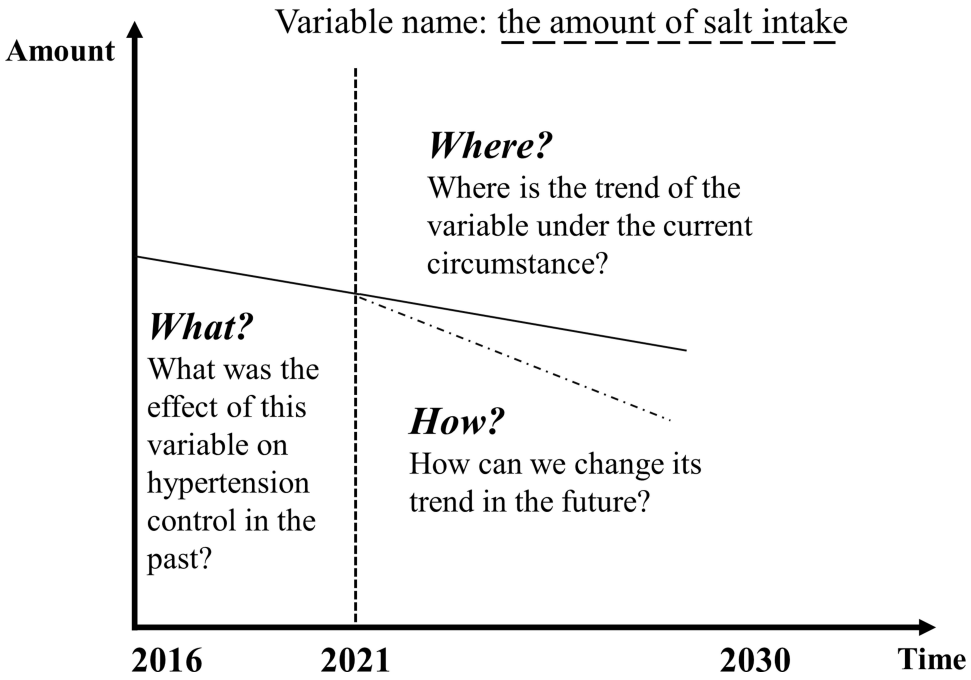

Figure 2 Template of Graphs over time.

effect of a variation in any variable propagates through the loop and returns to reinforce the initial deviation. In contrast, balancing loop counter changes in one direction with a change in the opposite direction.

The variables listed in the CLD are all relevant to the key problem under discussion. In terms of economy and operability, the factors are always selected from the reinforcing loop to intervene, which means all factors in this loop will change, ultimately solving the key problem presented. In this study, after the workshop, two researchers drew CLD diagrams respectively according to the graphs over time collected from stakeholders. And to reduce bias in the causal relationships of different variables, the final CLD diagram was determined through repeated discussions with project team members.

Results

A total of 14 key stakeholders were invited to participate in the workshop, and the details could be found in Table 2. In the workshop, a total of 42 variables related to hypertension management were proposed. After removing duplicate variables and inappropriate variables after discussion and stakeholder consultation, there were 26 variables left in the

Table 2 Stakeholders Including in the Workshop

Stakeholder Number	Institution	Category
01	Primary Health Department of the National Health Commission	Policy-making department
02	Primary Health Research Office, Health Development Research Center, National Health Commission	Health commission
03	Chinese Center for Disease Control and Prevention	Center for Disease Control
04	Department of Cardiology, Peking University People's Hospital	Hospital
05	Cardiopulmonary Vascular Institute, Beijing Anzhen Hospital	Hospital

(*Continued*)

Table 2 (Continued).

Stakeholder Number	Institution	Category
06	Community Health Association	Community management department
07	Community Health Services Institute	Community management department
08	Yubei Road Community Health Service Center, Chongqing	Primary health care institution
09	Medical Insurance Bureau	Health insurance department
10	Institute of Clinical Medicine, Peking University	Health professional
11	People's Hospital of Chengyang District, Qingdao City, Shandong Province	Health professional
12	School of Public Health, Capital Medical University	Researcher
13	School of Public Health, Capital Medical University	Researcher
14	Diagnosed with hypertension about 4 years	Patient

final CLD (Figure 3), which were divided into three dimensions, including the institutional, the community health workers, and the patient level. And the key variable at each level was building of Medical Community/Regional Medical Association, the workload of CHWs and treatment adherence respectively.

As shown in Figure 3, 5 reinforcing loops and 4 balancing loops were marked in the diagram. The relationship between the factors was shown in Figure 3 by the symbols marked by the arrows. And the variables in each loop were shown in Table 3 below. The variables included in 5 reinforcing loops involved in the building of the Medical Community/Regional Medical Association, FDCS, number of long-term prescription and so on. And the variables in 4 balancing loops included number of CHWs, workload of CHWs, motivation of CHWs and so on.

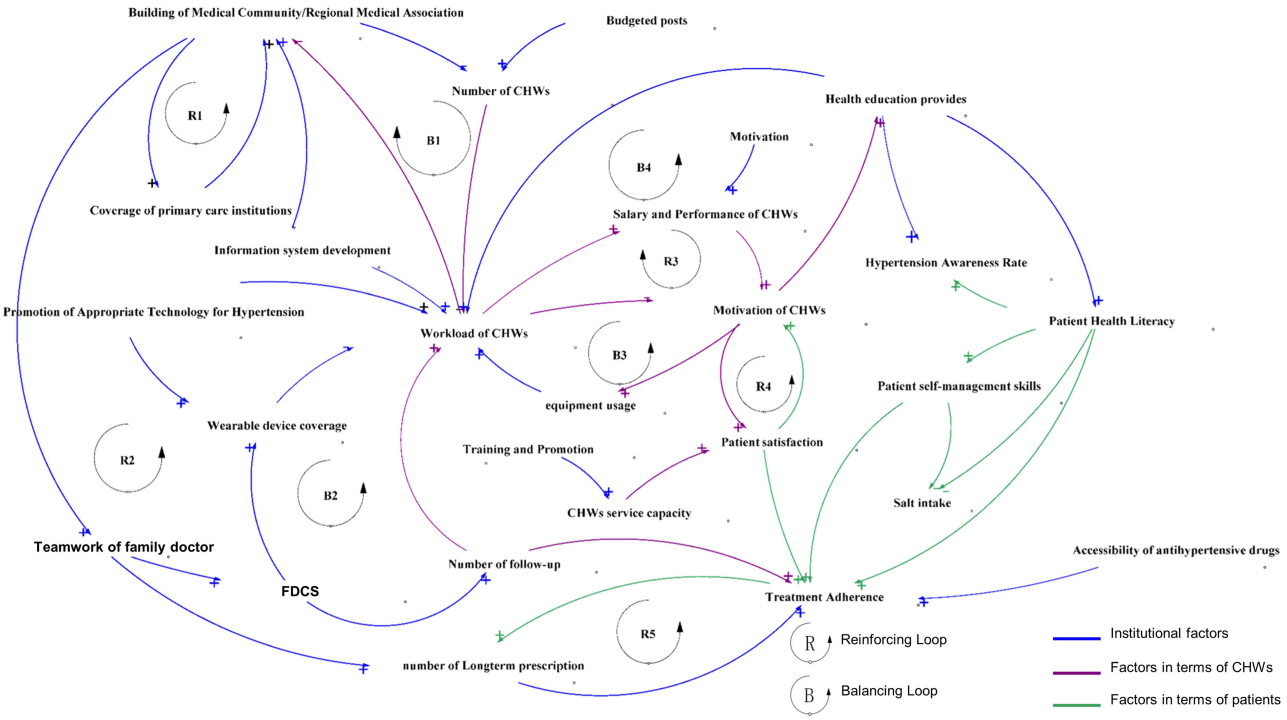

Figure 3 CLD of factors associated with hypertension control rate.
Abbreviations: CHWs, community health workers; FDCS, family doctor contract service.

Table 3 Factors in the Reinforcing and Balancing Loop of the CLD

Loop	Factors in Each Loop
R1	Building of Medical Community/Regional Medical Association→Coverage of primary care institutions
R2	Building of Medical Community/Regional Medical Association→Teamwork of family doctor→FDCS[a]→Wearable device coverage→Workload of CHWs[b]
R3	The workload of CHWs→Salary and Performance of CHWs→Motivation of CHWs→equipment usage
R4	The motivation of CHWs→Patient satisfaction
R5	Number of long-term prescription→Treatment Adherence
B1	Building of Medical Community/Regional Medical Association→Number of CHWs→Workload of CHWs
B2	Building of Medical Community/Regional Medical Association→Teamwork of family doctor→FDCS→Number of follow-up→Workload of CHWs
B3	Workload of CHWs→Motivation of CHWs→equipment usage
B4	The workload of CHWs→Motivation of CHWs→Health education provides

Notes: [a]Family doctor contract service, [b]Community health workers.

Table 4 explained the relationship of key variables in these feedback loops in the CLD. Four feedback loops were related to the building of the Medical Community/Regional Medical Association. And the coverage of primary care institutions as well as the workload of CHWs were two key variables associated with it. The building of the Medical

Table 4 Explanation of the Feedback Loops in CLD

Loop	Description
R1	One of the aims of the Medical Community/Regional Medical Association building is to improve access to health services in primary health care. This work will help improve the quantity and quality of primary medical services, guide people to seek medical treatment reasonably, and thus improve the coverage of primary health services.
R2	The construction of the Medical Community/Regional Medical Association could increase the cooperation between general medical institutions and primary health care institutions, which is conducive to promoting the teamwork of family doctors. This might further promote the implementation of FDCS, which may increase wearable device coverage, along with the development of medical information technology. Thus, the workload of CHWs might be reduced in the short term. And the reduction of its load can also promote the construction of a medical consortium building of the Medical Community/Regional Medical Association.
R3	The increase in the workload of CHWs[a] would make their need to improve remuneration more urgent, thus forcing medical institutions to increase their salary and performance of them, which would improve their work motivation and prompt them to provide more medical services, thereby improving equipment usage in short term. Also, the increased use of medical equipment means an increased workload.
R4	The increase in the motivation of CHWs means an improvement in the quantity and quality of their services, which has a certain effect on improving patient satisfaction. And the improvement in patient satisfaction could increase the value recognition of CHWs, to increase their enthusiasm for work.
R5	The long-term prescription for hypertension can help improve patients' treatment adherence. Also, the improvement of patients' treatment compliance is conducive to the implementation of long-term prescriptions.
B1	The building of a close Medical Community/Regional Medical Association can promote the rational flow of health workers. The personnel from the higher-level medical institutions regularly provided services in the primary medical institutions, so the primary medical institutions do not need to recruit too many CHWs, and the workload of the CHWs would increase.
B2	As mentioned in the description of R2, the building of the Medical Community/Regional Medical Association could promote the implementation of FDCS[b], which means an increase in the number of follow-ups and workloads of CHWs.

(*Continued*)

Table 4 (Continued).

Loop	Description
B3	The increase in workload may reduce the motivation of CHWs to a certain extent, thereby reducing the utilization rate of the equipment.
B4	Increased workload could make medical staff less motivated, thereby reducing the provision of health education services.

Notes: [a]Community health workers, [b]Family doctor contract service.

Community / Regional Medical Association could lead to the increase of coverage of primary care institutions, and the latter would have a counterproductive effect on the former. Also, the construction of the Medical Community/Regional Medical Association could be conducive to reducing the workload of CHWs. In addition, the motivation of CHWs, teamwork of family doctors, and FDCS were also key factors in service supply. The explanation of how these variables interacted was described in detail in Table 4.

Discussion

Hypertension management involves very complex institutional issues, so exploring research methods suitable for this scenario is also one of the focuses of research in this field. Therefore, we conducted a GMB workshop to find underlying variables associated with hypertension management to provide information for improving the management of hypertension in primary health care in China. CLD was used to visualize variables at different levels and their relationships. These variables were found to be potential points for intervention including the building of a Medical Community/Regional Medical Association, the motivation of CHWs, the teamwork of family doctors, FDCS, and the workload of CHWs.

This study found the potential of the GMB approach in designing interventions. Asking participants to put forward potential variables by displaying the graphs over time could improve their participation and the scientificity of variables. Using CLD to allow participants to discuss the relationship between variables together could contribute to stimulating thinking, promote mutual learning, and propose feasible interventions.[22] The GMB method has great advantages in enhancing group learning and fostering consensus.[17] Thus, it could be considered for wider application in the field of public health in the future.

In 2009, the Chinese central government launched a new healthcare reform plan to restore the primary healthcare system.[37] One of the important measures was the program titled "Basic Public Health Services" (BPHS), which supports community health organizations to deliver a clear package of essential health services across the country including providing services for patients with hypertension.[38] Since then, primary health services have become the main provider of hypertension management. In recent years, in order to promote the sinking of medical and health resources and improve the service capabilities of primary medical institutions, the construction of the Medical Community/Regional Medical Association has been gradually developed. This is an important path to achieve hierarchical diagnosis and treatment and is conducive to providing patients with continuous medical service. Therefore, to improve hypertension management in primary health care, it is necessary to further enhance the building of closed Medical Community/Regional Medical Association and achieve the linkage mechanism between general medical institutions and primary health care institutions.

FDCS is the focus of China's current medical and health reform. It is the cornerstone of achieving "Healthy China 2030". The FDCS refers to the establishment of a long-term and stable relationship between general practitioners with family doctors and contracted families. In this way, the corresponding doctors are responsible for the health of the contracted family, and the family members could enjoy safe, convenient, effective, continuous and economical basic medical services and public health services. However, at present, this service has not been effectively implemented due to the complicated signing procedure and the low level of trust among residents. As it is crucial to the management of hypertension, in the future, it is necessary to actively promote the construction of family doctor service stations and use information technology to promote the implementation of this service.

To reduce the workload of CHWs, measures should be taken to further expand the prevention and treatment team and establish a broader alliance of "specialists→community doctors→community health workers→patients" which are

crucial to achieving full coverage of hypertension management and improving the management rate of hypertension. On the one hand, it is necessary to give full play to the professional advantages of nurses and personnel from the department of preventive health care, and clarify the division of responsibilities and work priorities of public health personnel, so that they can undertake their responsibilities in risk assessment and risk factor control of hypertension management according to personal and professional characteristics. On the other hand, publicity measures should be taken to attract more social workers to participate in the management of hypertension. To improve the motivation of CHWs, it is essential to further improve the supporting measures for medical insurance and financial subsidies, establish a contribution division mechanism and corresponding reward mechanism for the control of chronic diseases based on health outcomes and increase the inclination of medical insurance policies to the primary level. In this way, CHWs could be motivated to provide health management services actively, thereby improving their own performance levels.

We realized there were several limitations of this study in using the GMB method. First, due to the impact of the COVID-19 pandemic, we only conducted one session of face-to-face workshop. The discussions on the final CLD were conducted online, which may slightly affect the results. In order to fully understand stakeholders' views, we sent the relevant results to each participant and asked for their comments to achieve consensus. Secondly, the GMB session was an unfamiliar method to most participants, which requires a more detailed introduction and explanation to make them understand. It was difficult to ensure that everyone involved understood the implications of this approach. We clarified the method in detail at the beginning, with examples to ensure that most people could understand this method.

Conclusion

This study described our experience in applying GMB to the problem of hypertension management in primary health care in China. We found that GMB is a useful and feasible qualitative research method that can effectively promote communication and cooperation. Based on the perspective of systematic thinking and adopting visual tools, this method could promote participants to discuss and reach a consensus. In addition, building Medical Community/Regional Medical Association, promoting FDCS, and enhancing the motivation of CHWs may be the potential intervention point for hypertension management in China.

Ethics Approval and Informed Consent

According to the Regulation on Ethical Review Methods Relating to Human Biomedical Research, issued by National Health Commission of the People's Republic of China (Available at: http://www.nhc.gov.cn/wjw/c100022/202201/985ed1b0b9374dbbaf8f324139fe1efd.shtml), this study did not have to obtain the approval of a national ethics committee as it involved only the opinions of experts, rather than patients or their data. These experts were only participants of this study, not part of author list. Written informed consent was obtained from all participants included in the study before the workshop. And all methods were carried out in accordance with the guideline of Group modelling building (https://link.springer.com/referenceworkentry/10.1007/978-0-387-30440-3_264). All protocols were approved by the School of Public Health, Capital Medical University.

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Disclosure

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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