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A qualitative exploration of disseminating research findings among public health researchers in China

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Abstract

Background Research dissemination is essential to accelerate the translating of evidence into practice. Little is known about dissemination among Chinese public health researchers. This study aimed to explore the understanding and practices of disseminating research findings and to identify barriers and facilitators that influence dissemination activities to non-research audiences.

Methods This study deployed an exploratory qualitative design with purposive and snowball sampling. One focus group with 5 participants and 12 in-depth interviews were conducted with participants working in diverse fields from universities ($n=10$), the National Chinese Center for Disease Control and Prevention ($n=4$), the Chinese National Cancer Center ($n=1$), the Chinese National Center for Cardiovascular Disease ($n=1$), and China office of a global research institute ($n=1$) from May to December 2021 to reach saturation. Data were initially analyzed using inductive thematic analysis. The designing for dissemination (D4D) logic model was then used to organize themes and subthemes. Two coders independently coded all transcripts and discussed disparities to reach a consensus.

Results Out of 17 participants, 12 misunderstood the concept of dissemination; 14 had disseminated to non-research audiences: 10 to the public, 10 to practitioners, and 9 to policymakers. We identified multiple barriers to dissemination to non-research audiences across four phases of the D4D logic model, including low priority of dissemination, limited application of D4D strategies, insufficient support from the research organizations, practice settings, and health systems, and overemphasis on academic publications.

Conclusions There was a lack of understanding and experience of dissemination, indicating a lack of emphasis on active dissemination in China. We provide implications for raising awareness, building capacity, facilitating multidisciplinary collaboration, providing incentives and infrastructure, changing climate and culture, establishing communication and executive networks, and accelerating systematic shifts in impact focus.

Keywords Dissemination, Barriers, Public health, China, Evidence-based

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Introduction

The gap between research and practice is well documented [1–4]. Dissemination refers to the active approach of spreading evidence-based interventions to the target audience via predetermined channels using planned strategies [3, 5] and is a prerequisite for bridging the gap between research and practice. The concept of dissemination has some overlap with other related concepts including science popularization and knowledge translation. Although both use communication techniques as useful strategies, science popularization is mainly about propagating general knowledge to the public with the aim of improving citizens' science literacy [6], whereas dissemination involves wider audiences and aims to maximize the impact of research and promote the uptake of evidence. On the other hand, although sharing a similar goal with dissemination of bridging the research-practice gap, knowledge translation refers to the dynamic and iterative process involving synthesis, dissemination, exchange, and ethically-sound application of knowledge, which considers dissemination a component of translation [7, 8].

Despite the importance of dissemination, dissemination is often not a priority for researchers and their organization [9] and is largely missed. For example, in a study of US public health researchers, 78% reported dissemination as important to their research, while only 27% spent over 10% of their time on dissemination [3] and 28% rated their dissemination efforts as excellent or good [10]. In addition, there are inconsistencies in preferred sources of information between researchers and non-researchers. Almost all researchers disseminated their research through academic publications [11–14], yet practitioners and policymakers may find them inaccessible, difficult to understand, or time-consuming [11, 15–17].

To effectively disseminate the evidence, dissemination and implementation (D&I) science has thrived and designing for dissemination (D4D) has emerged as a promising direction within D&I science. The D4D perspective highlights the responsibility of researchers to actively disseminate and the need to plan from the outset to fit the adopters' needs, assets, and time frames [3]. Useful D4D strategies include stakeholder involvement, application of D&I science theories and frameworks, incorporation of marketing, business, communication, systems approaches and professionals, and related disciplines [3, 18, 19]. Despite the availability of D4D, the application remains insufficient. For example, only 17% of US public health researchers used a framework or theory to plan their dissemination activities and only 34% typically involved stakeholders in the research process in 2012; 55% of US and Canadian D&I scientists typically involved stakeholders in the research process in 2018. While there is a growing body of evidence on D4D in some regions of the world, there are limited data on D4D from China.

Evidence from high-income countries has revealed individual-level barriers such as lack of capacity and reluctance to disseminate findings of a single study, and organizational-level barriers such as lack of financial resources, staff time, and academic incentives [14, 20]. Yet, little is known about dissemination in China, where the D&I science is still in its infancy. With progresses in China's health reform, science popularization and knowledge translation has received increasing attention, but dissemination received little attention in the field of public health. In addition, the large population, high disease burden, shortage of healthcare providers, and relatively centralized health system further exacerbate the complexity of dissemination in China [16, 21]. A quantitative study conducted by the current team among Chinese public health researchers suggested that only 58.1% had disseminated their research findings, and that main barriers included a lack of financial resources, platforms, and collaboration mechanisms at the organizational level, as well as a lack of time, knowledge, and skills at the individual level [22].

Hence, there is urgency to explore factors underlying the dissemination in China from the perspective of researchers. We aimed to explore researchers' understanding of the concept of dissemination and current dissemination activities, further to identify barriers and facilitators that influence dissemination to non-research audiences guided by the D4D logic model.

Methods

Design

A qualitative study design was deployed to explore public health researchers' perspectives on contextual factors affecting the dissemination of research findings in China. The study was reported according to the Consolidated criteria for reporting qualitative research (COREQ) guidelines (see Additional file 1) [23].

Theoretical framework

With the aim to gain insight into the barriers and facilitators for researchers to design for dissemination, this study adopted the D4D logic model as an analytical framework. The D4D logic model was published by Kwan and colleagues [19] in 2022 and included four phases: (1) the initial conceptualization phase identifying need and demand, and establishing evidence base of health issues; (2) the design phase using multiple strategies to determine the design of dissemination product as well as the packaging, messaging, and distribution plan; (3) the subsequent dissemination phase based on the push-pull-capacity model and situating the push of research, pull of practice, and capacity of health systems to support

dissemination; and (4) the impact phase ensuring adoption, sustainment, and equity benefits [19].

Participants and sampling

Study participants were public health researchers working in universities, the National Chinese Center for Disease Control and Prevention (briefly as China CDC), the Chinese National Cancer Center, the Chinese National Center for Cardiovascular Disease, or China Offices of global research institutes. Universities are the most important producers of evidence in China, followed by healthcare institutions, research institutions, and companies [24].Teaching and researching are core activities for university researchers, and academic publication is one of the key tenure and promotion criteria. The China CDC is a governmental and national-level technical institution affiliated with the National Health Commission of China, and shoulders the responsibilities of focusing on the key tasks of national disease prevention and control and of instructing the provincial-, prefecture-, city-, and county-level CDC. Also under the leadership of the National Health Commission of China and shoulder responsibilities of evidence generation and implementation, the Chinese National Cancer Center and the Chinese National Center for Cardiovascular Disease are based in two big specialized hospitals in China. Given that university researchers are the biggest community for evidence generation in China, most of the participants were university researchers.

Purposive and snowball sampling methods were applied to reach less accessible target participants. First, participants were purposively selected on the basis that they had rich experience in public health research and took an active part in academia. Second, interviewees were asked to nominate other researchers who might be willing to provide information for in-depth interviews, particularly those with expertise in dissemination and implementation science. All potential participants were contacted directly by telephone by a senior member (JZ) of the research team to seek their participation. Participants were informed of the study's purpose, process, confidentiality, and right to withdraw at any time. They were then asked to give informed oral consent to participate in the study and to be audio-recorded prior to the formal interview. In total, 18 researchers received the invitation; one declined due to unavailability during the time of this study.

Data collection

Data were collected from May 2021 to December 2021 through a focus group and in-depth interviews. Given that participants may be unfamiliar with the concept of dissemination and the experience of dissemination may be limited, we initially conducted a focus group of five participants to stimulate discussion. During the discussion, participants were actively involved and contributed a lot to the topic, so we later conducted individual interviews to gather a rich and detailed understanding of the participants' perspectives. The focus group of five participants and the first two individual in-depth interviews were conducted face-to-face, while later ten individual in-depth interviews were conducted via Tencent Meeting (Chinese online meeting software, similar to Zoom) because of the COVID-19-related physical distancing restrictions. During the interviews, participants were alone in their office or a private space to ensure confidentiality so that they could share freely.

A multidisciplinary team of researchers and students in dissemination and implementation science, behavior science, psychology, and qualitative methods contributed to developing the interview guide. The interview guide was pilot tested and refined prior to the formal interview. As dissemination is a relatively new concept in China, participants entered interviews with a discussion about their understanding of this concept. To ensure participants have consistent understanding of dissemination, the interviewer then clarified the concept as the active approach of spreading evidence-based interventions to the target audience via predetermined channels using planned strategies [3, 5]. Then, participants were encouraged to have a deep, detailed discussion on their dissemination experience and barriers and facilitators of dissemination to non-research audiences. Participants' demographic information, which was pre-collected, was confirmed with participants at the end of the interview. The interview guide can be found in supplementary file 2.

All interviews were conducted in Mandarin Chinese by an interviewer experienced in qualitative research (JZ, professor, Ph.D., female) with a note-taker (YH, master's student, female). No repeat interviews were conducted. The researchers collected participants' demographic information, research interests, and research projects online before the formal interview to have a deep understanding of their perspectives. All interviews were audio-recorded and transcribed after obtaining oral consent from the interviewees. Transcripts were not returned to participants for comment or correction. Following qualitative research best practices [25–27], data collection ended when information saturation occurred and no new information was observed.

Data analysis

Data analysis occurred concurrently with data collection. Verbatim transcripts were coded using the inductive thematic analysis approach in NVivo 11 software. First, a coder (YH) reviewed transcripts to generate initial codes and aggregated them into categories to form early themes and subthemes. The D4D logic model [19] was then used

to organize and map the relationships between themes and subthemes. Then, another coder (YW) independently applied codes to transcripts using the same coding framework. The codebook was constantly checked against the transcripts and was finally determined by comparison until no new information was identified. All coding results were compared and discussed between the two coders to reach a consensus. Unsolved discrepancies were resolved through discussion with a senior researcher (JZ) and at research team meetings. Data analysis was conducted in Chinese. All themes, subthemes, and typical verbatim quotes used to illustrate the main themes, were translated into English. Quotes are identified by participants' ID to guarantee anonymity. Participants did not provide feedback on the findings.

Results

Information saturation was reached after completing a focus group of 5 participants and 12 in-depth individual interviews with public health researchers in China. The interviews took 41.9±10.9 min on average. Participants aged between 32 and 65 years, with an average of 46.5±8.3 years, were primarily female (70.6%), and had a Ph.D. degree (88.2%). They worked in the universities in the field of health policy, behavioral science, global health, and implementation science ($n=10$), the China CDC in the field of tobacco control, AIDS/STD control, tuberculosis control, and environmental health ($n=4$), the Chinese National Cancer Center ($n=1$), the Chinese National Center for Cardiovascular Disease ($n=1$), and the China office of a global research institute ($n=1$).

Theme 1: understanding of the concept of dissemination

Five out of 17 participants had no difficulty understanding the concept of dissemination as the active approach of spreading evidence-based interventions to the target audience via predetermined channels using planned strategies, while 12 participants misunderstood dissemination to some extent. Eight participants did not differentiate dissemination of research findings from science popularization of general knowledge when discussing their dissemination activities.

Dissemination means that I share some knowledge with others… I have always paid close attention to new media, and I have written and post some health science articles in Zhihu (Chinese online question-and-answer social media, similar to Quora) … Some online magazines often invite me and my colleagues to write some science articles, for example, I recently wrote an article to share some psychological and behavioral techniques for smoking cessation (Participant 01).

One participant viewed dissemination as knowledge translation, saying that dissemination referred to the process of translating and applying research, especially interventional research, into practice and policy.

I feel that dissemination in Chinese would be easily understood as science popularization, but it actually highlights the translation to the practice and policy, so translating it as 'knowledge translation' in Chinese may be more appropriate (participant 16).

Three participants argued that dissemination was similar to health communication, which refers to the communication and sharing of information.

The government is now promoting the awareness of knowledge translation, but I feel that knowledge translation in Chinese emphasizes the process of translating and applying our research, which is more about health technology, and sometimes there may be some commercial elements in knowledge translation. Dissemination is more similar to health communication (participant 14).

Theme 2: experience of dissemination
Subtheme 2.1: dissemination within academia
Three participants working in the universities mainly published their research findings in peer-reviewed journals or through academic conferences for different reasons: one expressed a lack of resources in reaching non-research audiences, while two showed a lack of motivation, saying that dissemination to non-research audiences was not their priority.

I mainly published my research on peer-reviewed journals… for ordinary researchers like me, access and resources were limited (participant 07).
As a researcher, I am very competent when disseminating within academia. Even if I encounter difficulties, I will face them. But for dissemination to practitioners or policymakers, the main disseminator is not me and should not be me… I am a teacher, and my priorities for the next five to ten years include publishing textbooks, participating in academic activities, working with young students, and conducting research (participant 17).

Subtheme 2.2: dissemination beyond academia
Fourteen participants described their experiences disseminating research findings to non-research audiences: 10 had disseminated to the public, 10 to practitioners, and 9 to policymakers. Participants disseminated to the

public through social media and mass media. They cited social media as an accessible channel for every individual researcher. However, they felt their personal influence was limited in reaching a wide population, and they needed more resources to use mass media for dissemination. In addition, researchers were worried about possible misinformation and disinformation when disseminating on social media and mass media.

> *Our impact as a researcher to disseminate is so weak that our research findings posted on WeChat (Chinese social media, similar to WhatsApp and Snapchat) Moments can only be noticed by a few hundred people at most (participant 02).*
> *We are not required to add references, and sometimes the already added ones may even be deleted… and because our target audience is the public, we need to translate academic language into plain language… sometimes I am afraid of making scientific mistakes or causing misinformation (participant 01).*

Dissemination to policymakers was considered impactful but with a high threshold. A participant indicated that in such cases, dissemination to practitioners was an alternative strategy to influence practice since it was more accessible. Of nine participants who have ever disseminated to policymakers, three worked in China CDC, and five engaged in health policy research.

> *My organization (China CDC) is a technical support organization for administrative decisions and policy-making, so a lot of our work is done for dissemination (participant 15).*
> *For researchers conducting health policy research like me, it is a must to disseminate to our government (participant 08).*

Some participants felt the issuance of standards and guidelines (*n*=4) and publication of patents (*n*=5) as their dissemination routes. In contrast, some participants thought standards, guidelines, and patents were dissemination products that needed further disseminated, and the issuance of these products did not mean successful dissemination.

> *The implementation of patents is limited… now patents are mainly used by my peer researchers. Publishing patents does not mean dissemination, and patents themselves actually need to be further disseminated and implemented (participant 15).*

Theme 3: facilitators and barriers of dissemination based on the D4D logic model

Factors influencing dissemination to non-research audiences emerged across four phases of the D4D logic model [19], and seven subthemes were identified: (1) motivation; (2) design processes; (3) packaging and distribution design; (4) push of research; (5) pull of practice; (6) capacity of health systems; and (7) impact of research. The subthemes are discussed in detail below and in Table 1.

Subtheme 3.1: motivation

Most participants expressed their willingness to disseminate to non-research audiences out of a sense of social responsibility and social recognition, with the exception of two participants who did not consider dissemination to be their priority. Social climate was mentioned as another facilitator of dissemination.

> *The ultimate goal of scientific research is to change the public's cognition and behavior, and the government's decision-making process. If you do not consider dissemination, your research has no value, and it is hard to get recognition from our peers and the public (participant 12).*

Subtheme 3.2: design processes
Subtheme 3.2.1: stakeholder involvement and context analysis

Some participants indicated difficulties building relationships and reaching consensus with stakeholders (e.g., the public, media, practitioners, and policymakers) because of potential conflicts of interest between stakeholders and researchers. Involving stakeholders from the outset, building contacts based on previous relationships, and matching stakeholders' needs were recommended by participants as helpful for stakeholder involvement. In addition, involving stakeholders from all sectors of society, not only within the health system but also outside of it (e.g., education system, non-governmental organizations, non-profit organizations, and commercial organizations), was thought to have the potential to make a greater influence.

> *This was based on previous collaboration between their organization and ours, and we have a long-term collaboration with them, so it was quite natural and easy to involve them… We got in touch with them when the research is being formulated. The sooner you can get in touch with stakeholders and get their support, the better… and if we can connect with people and organizations outside the health system, our dissemination efforts may have a greater impact and be more sustainable (participant 13).*

Table 1 Barriers and facilitators of dissemination based on the D4D logic model

Phase	Theme	Subtheme	Barriers	Facilitators
Conceptualization phase	Motivation	-	• Low priority of dissemination to non-research audiences	• Social responsibility and recognition • Social climate

Design phase	Design processes	Stakeholder involvement	• Lack of relationships to stakeholders	• Involving multi-stakeholders at multiple stages
				  • Involving stakeholders from the outset
				  • Building contacts based on previous relationship
				  • Matching stakeholders' needs
				  • Involving multi-stakeholders from all sectors of society

		Application of D&I methodologies	• Lack of understanding of D&I methodologies	• Using D&I methodologies
		Marketing and communication approaches	-	• Using marketing strategies and communication methods
		Context and situation analysis	-	• Conducting context and situation analysis

		Systems and complexity science	• Complexity of social, health, organizational, and political systems
			  • Policy and economic resistance
			  • COVID-19 pandemic increased uncertainty in research and dissemination
				-

	Packaging and distribution design	Capability of packaging	• Difficulties in integrating and packaging for non-research audiences	• Building capacity in D&I science and marketing and communication methods
		Availability of distribution channels and platforms	• Lack of access to channels to interact with policymakers	• Leveraging existing channels, platforms, and programs
Dissemination phase	Push of research	Incentives	• Academic publications were the chief yardstick of performance evaluation, promotion requirements, and grant obligations	• Dissemination to policymakers affected performance evaluation and were encouraged by employers and funding agencies

		Infrastructure	-	• Support of the organization
				  • Having a dedicated person or team for dissemination-related activities
				  • Providing intangible support

	Pull of practice		• Lack of climate or culture supporting dissemination	-
	Capacity of health systems	Communication networks	• Lack of partnerships between researchers and non-research audiences	• Building communication networks
		Executive networks	• Lack of executive network or human resources	• Executive network support
Impact phase	Impact of research	-	• Overemphasis on academic publications	• Policies and supporting measures to drive structural change in academic systems

Abbreviation: D4D, designing for dissemination; D&I, dissemination and implementation

Subtheme 3.2.2: application of D&I methodologies

The application of D&I methodologies was stressed as a facilitator of dissemination. However, some participants indicated that D&I science was still an emerging field in China, the limited understanding of D&I methodologies impeded the dissemination and implementation of research.

Currently, there is limited knowledge of methodologies including research design, theoretical frameworks, and qualitative methods for D&I science in China, which hinders the dissemination and implementation of research (participant 16).

Subtheme 3.2.3: marketing and business approaches

Some participants mentioned that the field of marketing was quite relevant to dissemination design and that marketing and communication approaches were promising for dissemination to non-research audiences, especially to the general public.

Take food marketing in food policy as an example, I feel that Coke's advertising is so good that I also want to drink it; on the contrary, if you simply tell me not to eat food high in sugar and salt, then I will just not listen, let alone the ordinary consumers (participant 06).

Subtheme 3.2.4: context and situation analysis

Conducting context and situation analysis was cited as the foundation for understanding context and tailoring dissemination efforts.

> *Health communication always emphasizes needs assessment and audience segmentation, and it is important to understand the audiences' needs. In many cases, what we were doing did not meet the needs of our audiences, and they did not accept (participant 04).*

Subtheme 3.2.5: complexity of social, health, organizational, and political systems

Participants perceived policy resistance and low confidence in disseminating research with negative, politically or economically sensitive findings in complex social, health, organizational, and political systems. In addition, some participants noted that the COVID-19 pandemic increased the uncertainty of research findings and the vulnerability of collaboration networks.

> *For example, research involving the control of the tobacco industry, which is related to the economy, is very sensitive (participant 06).*
> *At first, everything went well, and they were very supportive. But because of the COVID-19 pandemic, the organization changed leadership, so we had to communicate with them again (participant 13).*

Subtheme 3.3: packaging and distribution design
Subtheme 3.3.1: capability of packaging

Participants indicated that integrating and packaging for non-research audiences was difficult and time-consuming and could be irregular and misleading, which calls for special competencies that differ from usual academic training.

> *It is demanding, requiring a high level of processing, summarizing, writing, and packaging skills. These are huge challenges that our daily training does not teach us (participant 12).*

Subtheme 3.3.2: availability of distribution channels and platforms

The availability of channels and platforms was highlighted as an important contextual factor affecting dissemination. Those in the early stages of their careers, who had not yet established academic influence, expressed a lack of access to channels to interact with policymakers who were beyond the reach of individual researchers.

Leveraging existing channels, platforms, and programs was recommended to facilitate dissemination to intended audiences.

> *Especially, we young researchers actually have many ideas and know a lot, but we do not have channels to share (participant 01).*
> *It is important to consider taking advantage of existing platforms or programs and hitching a ride whenever possible. Otherwise, dissemination involves a lot of financial and personnel input (participant 13).*

Subtheme 3.4: push of research
Subtheme 3.4.1: incentives

Academic publications were cited as the chief yardstick of performance evaluation, promotion requirements, and grant obligations. Some participants stated that the extent of dissemination to policymakers would also influence performance evaluation but were not given the same importance as academic publications. This was attributed by some participants to the difficulty in quantifiably evaluating dissemination activities. Although the China CDC participants expressed less pressure for academic publication than their university counterparts, they also complained about the academic incentive systems.

> *Dissemination to policymakers is now considered in performance evaluation, but still not as much as publishing papers on peer-reviewed journals... they may never regard dissemination as the most important criterion (participant 06).*
> *Currently, the value of science is still limited to publication and 'Impact Factor'... Another problem is that it is difficult to define our dissemination efforts. For example, I cannot say how many people are using my APP and how much impact it burst, but I can say how many papers I have published in top journals (participant 11).*

Subtheme 3.4.2: infrastructure

Seven participants reported having a dedicated person or team responsible for dissemination-related activities in their organization. These persons or teams served mainly for patent applications, communication, and publicity.

> *We have a Development Office dedicated for knowledge translation. They would organize seminars on dissemination like how to apply for patents (participant 14).*
> *The attitude of the communication platform in our school is very clear, and its purpose is to build prestige for our school. If we have proper research to dis-*

seminate, they will help with propaganda (participant 17).

Some participants mentioned that their organization would provide additional support, such as administrative facilitation, to help them disseminate more smoothly.

In addition to providing administrative costs, our university also provides intangible support for the development of D&I science and for the coordination of different departments (participant 16).

Subtheme 3.5: pull of practice

Participants noted a lack of climate or culture to support dissemination mainly because of the lack of priority given to some health issues themselves and the dissemination activities among leaders and practitioners.

The national government is advocating the dissemination and implementation of many innovations, but the local government may find it difficult to understand the value of (disseminating) these innovations and may not be unwilling to provide financial or personnel support (participant 10).

We introduced our research and why we wanted to work with them to disseminate it, but they said that was not their focus. Then what was their focus at that time? All they wanted to do was help village doctors to pass a qualification exam and select the 'most beautiful village doctor'. They were not interested in our dissemination of chronic diseases (participant 17).

Subtheme 3.6: capacity of health systems
Subtheme 3.6.1: communication networks

The lack of networks between researchers and non-research audiences was cited as a barrier. Some researchers expected the health systems to build mechanisms for bidirectional communication networks between researchers and non-research audiences.

There is no mechanism to collaborate us with non-research audience... some researchers may have such relationships with non-research audiences, but that is out of their personal impact and efforts rather than the mechanisms in the health system (participant 02).

There is a gap between researchers and policymakers in the academic system... maybe our organization could help bridge the gap. For example, the organization could build a system to collect our research findings regularly and disseminate to policymakers

because universities have this kind of relationship with the government (participant 07).

Subtheme 3.6.2: executive networks

Executive network in the health system was considered necessary for dissemination on a large scale but difficult for ordinary university researchers to have. A participant in the China CDC pointed out that although the top-down CDC system in China, including CDCs at national, provincial, city, and county levels, could facilitate wide dissemination, their dissemination impact was still limited by the lack of human resources for public health.

Our dissemination success has benefited greatly from the solid executive network built before. For example, under the Chinese National Cancer Center, we have Cancer Prevention Offices at the provincial level. They could help us disseminate our research findings, like our evidence and apps. However, most researchers, especially university researchers, do not have such an objective support network (participant 11).

The lack of human resources in public health is one of the most common problems in our country. For example, we have 40 staff working on tuberculosis at the China CDC, but only 10 at each provincial CDC, and 2 at each county CDC. In many cases, there are even half a person in counties working on tuberculosis (participant 10).

Subtheme 3.7: impact of research

Participants noted a chasm between overemphasis on academic publications and ignorance of long-term impact in the current academic system. Despite a series of national policies designed to break the undesirable orientation of "academic publications only" issued by the Chinese government, participants were pessimistic about them. They stated that the interpretation and implementation of these policies need to be further reviewed and improved.

Dissemination to non-research audiences is not expected by my organization, which does not care about these activities. However, it is the government that holds the baron, and there is nothing my organization can do about it. (participant 09).

At present, national policies are developing and changing fast, but how to interpret and implement these policies needs to be gradually improved... our government is paying more and more attention to dissemination, but when it comes to the implemen-

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tation level, there are still many shortcomings (participant 14).

Discussion

This qualitative study explored the understanding and practices of dissemination, and further identified the barriers and facilitators of dissemination, which may be the first of this type in China. We found a lack of understanding of the concept and inadequate practices of dissemination to non-research audiences among Chinese public health researchers. We also identified barriers and facilitators in the conceptualization, design, dissemination, and impact phases of the D4D logic model [19], suggesting considerable room for improvement in the application of D4D strategies and the development of systematic resources. Our findings begin to provide a roadmap of ideas and actions to improve the active dissemination of research in China.

Dissemination was poorly understood by Chinese public health researchers, who confused it with some related concepts such as communication, science popularization, and knowledge translation, indicating a lag in the development and advocacy of dissemination in China. The lag in development and the lack of understanding of dissemination may hinder the dissemination practice and the uptake of evidence. Hence, dissemination, which highlights taking an active approach, identifying target audience, selecting predetermined channels, and using planned strategies to disseminate, should be deeply rooted in researchers' mind to facilitate research uptake and understanding.

The public, practitioners, and policymakers were identified as three key non-research audiences for dissemination, yet most only gave a brief description when asked about their dissemination practices. While the internet and media are promising for large-scale dissemination, there is a need to strengthen the capacity of researchers to address misinformation and disinformation [28, 29] and to facilitate collaboration between researchers and the media to achieve wide dissemination in China. Dissemination to the public and practitioners is considered as feasible and direct, while dissemination to policymakers as crucial for long-term impact. Indeed, the Chinese government holds accountability for the health of people, and proactively disseminating research findings to policymakers and government officials helps make a a greater public health impact. Nevertheless, the participants faced the dilemma of lacking personal relationships and access to channel to interact with policymakers. Although some academic associations (e.g., the Chinese Preventive Medicine Association) bring together researchers and practitioners in China, their potential to connect researchers and policymakers needs to be further strengthened to

lead to dissemination success. Most of the participants with experience of dissemination in policy dissemination were those working in the China CDC or engaged in health policy research: the former stressed the mission of the China CDC to provide technical support for policymaking, and the latter stated that influencing policy was the fundamental goal of health policy research. This also suggests that organizations and researchers with stronger missions and resources to influence policy may have greater opportunities to disseminate to policymakers.

Although few in this study explicitly stated that dissemination to non-research audiences was not their priority, a lack of design capacity and distribution channels among researchers, insufficient support in organizations and the health systems, and an overemphasis on academic publications hindered dissemination to non-research audiences. First, there was a limited application of D4D strategies in the design of dissemination products, packaging and distribution plans. This is consistent with other studies suggesting that the lack of capacity was a common barrier to dissemination practice in low- and middle-income countries [30]. A good news was that Chinese researchers were actively involved diverse stakeholders at multiple stages of their research, which is consistent with the international trend of increasing emphasis on stakeholder engagement [31, 32]. A survey of US and Canadian researchers in 2018 also revealed increases in stakeholder involvement compared to a survey of US researchers in 2012 [3, 33]. However, there was a need to build multisectoral partnerships and improve stakeholder involvement's depth and quality [32]. In addition, some researchers were aware of the potential for leveraging methods and frameworks from D&I science, marketing and business, communications and visual arts, and systems science to achieve dissemination success, yet the practical application needed to be improved. These disciplines (e.g., D&I science, marketing, systems science, and complexity science) originated from abroad and may not seem familiar to the Chinese public health researchers, it may require a lengthy learning and adaptation process. There are some simple tools and principles for guidance [34]. Notably, not all research finding should be disseminated to all audiences, the ability of deciding what to disseminate and to whom to disseminate should be strengthened in initial stage. Therefore, it is necessary to build capacity in the D4D principles and skills and to promote teaming across disciplines, as it may be unrealistic for public health researchers to develop all the D4D skills [13].

In addition to the need to improve researchers' capacity and partnership across disciplines, there remained substantial room for improvement in the resources and structures that support dissemination. Specifically, there was a lack of incentives and infrastructure in research

organizations (the push), a lack of climate and culture in practice or policy settings (the pull), and a lack of dissemination networks in the health system (the capacity). The persistent push–pull disconnect between researchers and practitioners was reported in other study [35, 36]. As might have been expected, academic publications were the main criteria for performance evaluation, which may also be true in many other countries [10, 14, 33, 37–39]. Furthermore, although some participants reported having a dedicated person or team for dissemination-related activities, the responsibilities of these dedicated persons or teams need to be further clarified and their capacity needs to be further enhanced. On the other hand, previous research points out that attention to dissemination tends to focus more on the push side than the pull and capacity sides [11, 19]. For example, studies in the US suggested that 53% of researchers reported having a designated individual or team for dissemination [3] while only 20% of practitioners reported so [40]. Thus, changing the climate and culture in practice or policy settings to be receptive and prepared for dissemination, providing infrastructure to enhance communication between researchers and non-research audiences, and building executive networks to support wide dissemination are needed as a lack of platforms and collaboration mechanisms is also a common barrier to dissemination [30].

Problems with the lack of push, pull, and capacity for dissemination may be partly attributed to overemphasizing academic metrics rather than the long-term health and equity impacts. Several government funding agencies in developed countries have adopted policies to support or even require dissemination efforts [12, 19, 41–43]. Yet most funding agencies in China still focus on academic impact, existing fundings for dissemination in China are small in terms of its scale and are competitive to apply for. To address this issue, the Chinese government has adopted a series of national policies to reduce the overemphasis on academic publications and improve the evaluation system [44–47]. However, policy interpretation and grassroots implementation need to be further improved to accelerate the system shift to focus on the long-term impact of research. Frameworks such as the Research Excellence Framework (REF) [48] and the Translational Science Benefits Model (TSBM) [49] provide an outline and benchmarks by which researchers can measure the impact of scientific discoveries beyond traditional academic metrics.

This study revealed important aspects regarding research dissemination in China from the perspective of researchers with some limitations. First, 17 interview participants may not fully reflect the full spectrum in China although data saturation was reached. Given that dissemination is in its infancy in China, this study plays an initial study and future studies may need to involve more and more diversified participants to reveal dissemination of the whole research system in China. Second, some interviews were conducted online due to the COVID-19 pandemic, which limited the ability to gain information from contextual details and nonverbal expressions during the interviews. Third, the study is a qualitative exploratory study, additional large-scale quantitative studies are needed to triangulate the findings across the broader population. Indeed, the research team has run a large-scale survey to examine the attitudes and practices of Chinese public health researchers towards dissemination.

Conclusion

This study highlights a lack of emphasis on active dissemination in China and identifies multiple barriers to dissemination. There is a need to advance the field to promote understanding and raise awareness of dissemination—with the goal of ultimately more rapidly and equitably moving evidence to practice and policy. There is also a need to build capacity in D4D and to collaborate with experts from multiple disciplines (e.g., marketing, systems science, complexity science) to break down disciplinary silos. The findings also provide implications for promoting training programs, providing incentives and infrastructure for diverse dissemination activities, creating a climate and culture of readiness for dissemination, establishing bidirectional communication networks and efficient executive networks, and accelerating systematic shifts in policy orientation. Otherwise, dissemination is likely to sink to low priority in the already over-stretched system.

Abbreviations

D4D	designing for dissemination
D&I	dissemination and implementation
China CDC	National Chinese Center for Disease Control and Prevention

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Data availability

All the data and materials of this qualitative study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Ethics Committee for Biomedical Research Projects involving Humans of the Chinese Academy of Medical Sciences and Peking Union Medical College (CAMS&PUMC-IEC-2021-12) on March 15, 2021. Informed consent was obtained from all participants involved in the study. Consent included permission to be audio-recorded.

Disclaimer

The findings and conclusions in this paper are those of the authors and do not necessarily represent the official positions of the National Institutes of Health or the Centers for Disease Control and Prevention.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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