The Development of Humanities and Social Sciences, 2025, 1(2), 105-114
https://doi.org/10.71204/20yjdm28

Analysis of the Construction and Application of the Care-4D Model of Medical Communication Oriented to Public Reception Needs

Yueyang Jiang [1], Tong Wu [2], Jianing Liang [3], Wenjie Cai [4], Yangyang Zhang[4,*]

[1] School of medical humanities and hospital management ,Wenzhou Medical University, WenZhou 325000, China

[2] School of clinical medicine, Wenzhou Medical University,WenZhou 325000, China

[3] School of Traditional Chinese Medicine, Wenzhou Medical University,WenZhou 325000, China

[4] Hospital of Wenzhou People's Hospital, Wen Zhou 325000, China

*** Correspondence**:

Yangyang Zhang

51345608@qq.com

Received: 7 June 2025/ Accepted: 27 June 2025/ Published online: 28 June 2025

Abstract

Based on the classic 5W theoretical framework of communication studies, this study systematically analyzes the multidimensional challenges faced in medical science popularization communication and thereby constructs the CARE-4D dynamic closed-loop medical communication model. This model aims to address the gaps in traditional science popularization models, which are characterized by one-way communication, simplified effectiveness, and the absence of cultural dimensions, and thus struggle to meet the public health needs of the precision medicine era. The model innovatively proposes four core mechanisms: scenario-driven, four-tier audience segmentation, dynamic response, and four-dimensional effect evaluation. It deeply integrates time, space, cognition, and emotion-enhanced strategies to form a multi-stakeholder collaborative, all-scenario-covered science popularization closed-loop system. The model breaks through the traditional linear communication paradigm, providing a theoretical tool that combines scientific authority and cultural adaptability for biomedical knowledge popularization. It holds significant methodological value for advancing precision science popularization practices under the Healthy China Initiative.

Keywords: Popularization of Science Communication; 5W Theory; Healthy China Initiative; Medical Communications

1. Introduction

The *Healthy China Initiative (2030)* lists "health knowledge dissemination" as a major special action, clearly stating that the core task is to "strengthen supply-side structural reform in health science popularization"(Central Committee of the Communist Party of China,2017). Currently, traditional science popularization models in China's medical science popularization practices struggle to address complex decision-making scenarios such as intergenerational negotiations within Chinese families and regional cultural differences. These challenges highlight the profound contradiction between the one-way, top-down science popularization paradigm and the precise, context-specific health needs of the public. Therefore, it is urgent to introduce new communication models to overcome the efficiency dilemma, break the deadlock of the supply-demand contradiction in traditional medical science popularization, and enhance the quality and effectiveness of medical communication.

While the classic 5W theory in communication studies provides a foundational analytical framework for medical communication, it has limitations in terms of contemporary health communication subjects, processes, and effect evaluation dimensions, leading to the current medical science popularization practices being trapped in an "high communication volume, low conversion rate" efficiency dilemma. Therefore, this paper innovatively proposes the construction of the CARE-4D dynamic closed-loop science popularization model. This model addresses the limitations of the 5W theory by deconstructing the dynamic mechanisms of "subject-content-channel-audience-effect" and implementing four-dimensional enhancement strategies (4D). It provides a theoretical framework that combines scientific rigor with cultural adaptability to address the "knowledge-belief-action conversion gap" under the Healthy China strategy, driving the strategic transformation of medical knowledge dissemination from "broad coverage" to "precise conversion."

2. Overview and Limitations Analysis of the 5W Communication Model

2.1. The Theoretical Basis of the 5W Model

In 1948, political scientist Harold D. Lasswell proposed the classic proposition in his work The Social Functions and Structure of Communication: "A convenient way to describe communication behavior is to answer the following questions: Who communicates what through which channels to whom, and with what effect?"(Mills B and Barlow D M ,2014). This model deconstructs the five core elements of the communication process, constructing a unidirectional linear analytical framework from the source to the audience. Its value lies in systematically defining the core categories of communication research for the first time, providing a foundational paradigm for subsequent communication studies(Zalpour A et al.,2024).

2.2. Adaptability and Limitations of the Model in Medical Popularization

Harold Lasswell's "5W" communication model deconstructs the communication process into five key elements from a cybernetic perspective: the communicator, the message, the channel, the

audience, and the response. This linear model provides a foundational analytical framework for medical and health communication, with its comprehensive elements systematically covering the entire process of science popularization communication. It particularly demonstrates its adaptability in the structured transmission of medical information.

In medical health communication, the advantages of the 5W theory are manifested in three aspects: first, the professionalization of the communicator. Medical communication requires content to be scientific and authoritative, and the 5W model clearly defines the communicator as medical professionals, aligning with the "gold standard theory" of medical communication that emphasizes the professionalism of the information source; second, the standardization of content. The model standardizes the boundaries of communication content to a certain extent, thereby also imposing certain restrictions on communication formats. It emphasizes the use of established knowledge sources such as textbooks and guidelines, avoiding unverified academic controversies; third, quantifiable effectiveness. Through communication effectiveness evaluation dimensions, the reach rate and audience coverage of information can be preliminarily assessed, such as by counting the distribution volume and reading rate of umbilical cord blood science popularization manuals in prenatal care clinics.

However, the cybernetic paradigm of the 5W theory has significant limitations. First, it lacks consideration of factors related to the diversity and complexity of scenarios in which audiences encounter medical-related information(Sapienza Z S et al.,2015). Second, the 5W model does not sufficiently address the differences in audience roles and information needs in medical science popularization communication. In medical science popularization communication, information recipients often engage in multi-agent negotiation during the process of understanding and decision-making, but traditional models do not incorporate such complex social relationship networks, leading to limitations in theoretical explanatory power(Lin Zhidai,1996). Third, its one-way communication chain (Sender→Message→Receiver) ignores the dynamic interactivity inherent in the real-world context of medical science popularization. Research indicates that the essence of doctor-patient communication is "meaning co-construction" rather than one-way information transmission(Yilidana Yilihamu.2021). Factors such as audience feedback and cultural cognitive differences can diminish the potential for interactivity, thereby directly impacting communication effectiveness. Fourth, the 5W model prioritizes enhancing overall outreach and establishing a standardized framework, thereby neglecting cultural contextuality. It applies the same communication model to regions and areas with different cultural backgrounds, ignoring the role of cultural context in the communication process, which reduces communication effectiveness(Yu Guoming.2011).

3. Medical Communication CARE - Construction of a 4D Model

3.1. Constructing the CARE - 4D Model of Medical Communication

This study builds upon the 5W theory, integrating the current state of medical science

communication, to develop the CARE-4D (Context-Audience-Response-Effect-4D) model, which is tailored to the characteristics of the discipline. The CARE-4D model addresses the four limitations of the 5W theory, combines the shortcomings of current medical science communication, and constructs a multi-dimensional, dynamic, and interpretable CARE theoretical model. It also takes into account the current state and specific issues within the field of medical communication studies. The team focused on four dimensions—time, space, cognition, and emotion—and enhanced the 4D model through targeted adjustments. Ultimately, this resulted in a conceptual model that addresses the challenges of traditional communication models while enhancing overall communication effectiveness in response to current conditions: the CARE-4D model.

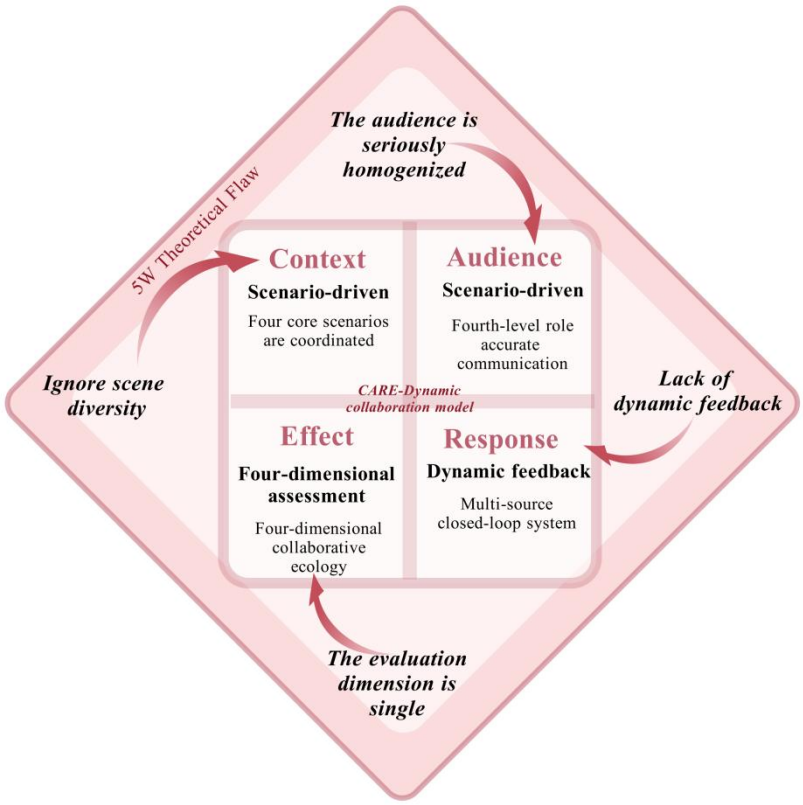

Figure 1. Schematic diagram of CARE-4D cord blood popularization model

3.2. Analysis of Key Elements of the CARE Model

3.2.1. Context-Driven (Context)

The CARE-4D model addresses the issue of the diversity and complexity of contexts in which audiences encounter medical-related information, which was overlooked in the 5W model. It innovatively divides application contexts into four core categories: medical, family, community, and digital, forming a multi-dimensional, collaborative communication system.The medical professional scenario leverages the specialized nature of hospital physical spaces to integrate clinical data into an evidence-based knowledge system, analyzing stored value and risks to

enhance information transmission efficiency under doctor-patient trust, thereby achieving precise dissemination of scientific information within an authoritative context. The family decision-making scenario addresses cognitive differences among members by developing tools such as qualification assessment matrices and cost-benefit models, combined with expert dialogue mechanisms to resolve decision-making conflicts. The community scenario employs communication strategies such as patient family narratives and treatment imagery. In public spaces, the digital scenario designs layered communication pathways: short video platforms present scientific principles through dynamic visualization, social media creates communication virality through topic interaction, and professional platforms build literature databases to deepen understanding, ultimately forming a multi-dimensional, collaborative communication ecosystem. The four communication scenarios form synergistic effects through information complementarity mechanisms and audience migration pathways. The professional authority of the medical scenario provides credibility for other scenarios, the emotional mobilization of the community scenario enhances family decision-making motivation, and the fragmented communication of the digital scenario guides audiences toward deeper cognitive scenarios through the “anchoring effect,” ultimately constructing a communication ecosystem covering multiple layers of cognition, emotion, and behavior.

3.2.2. Four-tier Audience Segmentation (Audience)

Addressing the issue of insufficient attention to the differing roles and information needs of audiences in medical science communication within the 5W model, the model deconstructs the target audience into four tiers: direct decision-makers, influencers, potential demanders, and public supervisors, providing tiered, differentiated content. This forms a complete communication chain from individual decision-making to social supervision.Direct decision-makers serve as the core action agents, whose information processing combines rational cognition with emotional drive. The study constructs a medical knowledge graph and a technical safety assessment system, combining medical-patient dialogue records and treatment documentaries with narrative medical content to achieve dual reinforcement of decision support and value recognition. Additionally, it is essential to cultivate preventive health concepts among influencers to effectively enhance their information dissemination efficiency. Potential demanders exhibit forward-looking cognitive characteristics in their information exposure. Effective measures can be employed to help them perceive the potential value of relevant medical knowledge. Public supervisors' information needs focus on industry governance and social benefit dimensions. By integrating regulatory databases, social benefit assessment models, and public opinion monitoring platforms, structured policy reports can be generated to support scientific decision-making. The four-tier communication system achieves coordinated operation through an information flow nesting mechanism. The knowledge internalization of direct decision-makers forms the communication base, the social networks of influencers constitute the communication relay, the cognitive reserves of potential demanders expand the communication depth, and the institutional feedback of public supervisors improves the communication ecosystem, ultimately forming a spiral-ascending communication enhancement loop.

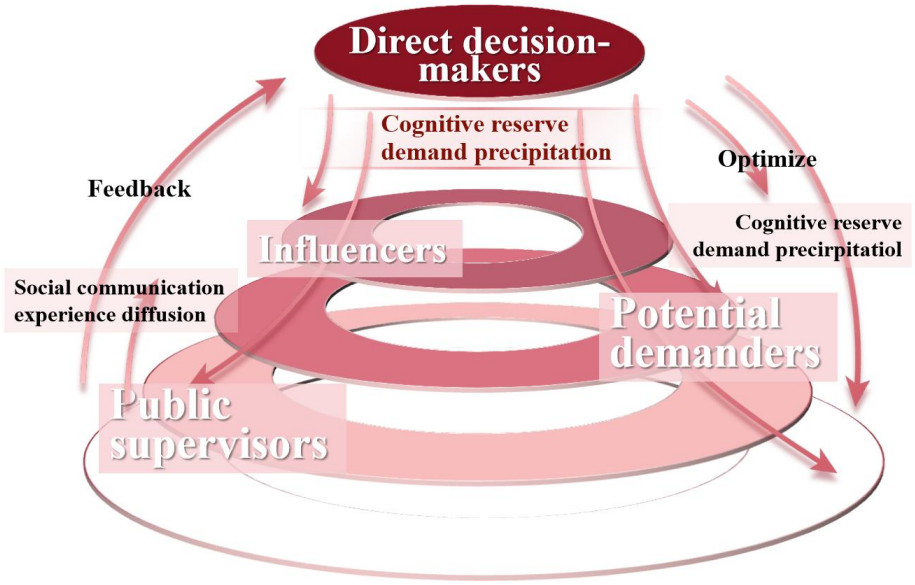

Figure 2. 4-level audience stratification diagram

3.2.3. Dynamic Feedback Strategy (Response)

Compared to the 5W model, which focuses solely on unidirectional communication channels and ignores real-time feedback and changes in communication status, significantly impacting communication effectiveness, establishing a real-time dynamic feedback mechanism is crucial for improving the effectiveness of medical science communication. A closed-loop feedback model that integrates information from multiple sources should include the following four dimensions: First, establish diversified information collection channels such as online surveys and social media comments to achieve real-time acquisition and structured integration of audience feedback data; Second, use a three-tier response system to classify and process collected information. Routine inquiries are handled by an artificial intelligence system for immediate response, professional medical questions are transferred to an expert response channel within 24 hours, and sudden public opinion incidents trigger an emergency response plan; Third, for special dissemination events such as health rumors, a four-step emergency mechanism of "monitoring-identification-response-tracking" is established to ensure scientific intervention within the golden response period (within 4 hours). Finally, based on the results of multi-dimensional data analysis, the presentation form and knowledge structure of dissemination content are continuously optimized to form an iterative upgrade closed-loop of "data collection-analysis and processing-strategy optimization." This mechanism combines dynamic monitoring with rapid response to effectively enhance the accuracy and timeliness of medical knowledge dissemination.

3.2.4. Four-Dimensional Effect Evaluation (Effect)

Aiming at the problem that the 5W model ignores the cultural context in order to enhance the overall popularity and form a paradigmatic model, the team constructed a four-dimensional assessment system of knowledge-behavior-emotion-society to form a complete closed loop of

popularization of science communication. At the knowledge level, the team relies on questionnaires and online testing tools to monitor the accuracy of the audience's awareness of the core knowledge of the tested medical categories, and through dynamic data analysis, the team realizes the targeted optimization of popular science content to ensure the effective transformation of scientific information. The behavioral level establishes a two-way feedback mechanism, through donations, storage of quantitative statistical analysis, and attribution analysis in combination with the communication cycle, so as to refine the key elements that drive behavioral transformation and realize the precise iteration of communication strategies. The emotional assessment system builds emotional coordinates through the monitoring of content credibility and institutional credibility, accordingly adjusting the narrative strategy and emotional touchpoints of communication, and injecting emotional resonance in rational communication. The social influence dimension establishes a multi-source data collection network, draws a social influence model from three dimensions: participation in policy formulation, media agenda-setting ability, and public issue activity, and integrates professional science popularization into the public health discourse system by building a collaborative platform for industry, academia, research, and media, and ultimately forms a benign ecological cycle of knowledge dissemination-behavioral change-emotional recognition-social resonance.

3.3. Overview of 4D Enhancement Dimensions

3.3.1. Time Dimension

In terms of communication cycle planning, it is recommended to establish a tiered and progressive scientific communication system(Chou et al., 2009). For key nodes, precise communication reinforcement plans should be implemented, such as conducting perinatal education courses in collaboration with medical institutions and systematically distributing multimedia educational materials to enhance the target population's understanding and decision conversion rate. For the child growth cycle, a continuous information push mechanism can be established to regularly push cutting-edge achievements in the field of regenerative medicine and typical clinical conversion cases to storage families through a database, thereby strengthening the long-term positive perception of storage decisions through value continuity advocacy.

3.3.2. Spatial dimension

Construct a hierarchical dissemination matrix based on regional characteristics. In grassroots counties, use grassroots science popularization carriers such as visual science popularization display boards and interactive health lectures to systematically disseminate the biological characteristics and basic medical value of relevant medical resources. Central cities should focus on technical analysis and quality presentation of storage services, hold cell therapy theme summits in collaboration with authoritative academic institutions, and set up consultation service stations in tertiary hospitals to comprehensively demonstrate the technical support system for cell preparation and cryopreservation.

3.3.3. Cognitive Dimension

Tailor communication strategies based on the educational level of the audience. For highly educated groups with strong learning and information analysis capabilities, provide authoritative content such as research paper abstracts and academic conference reports to meet their demand for in-depth information. At the same time, encourage them to participate in science popularization discussions and academic exchanges to promote the dissemination and innovation of knowledge. For low-educated groups with relatively weaker comprehension abilities, provide easy-to-understand content such as animated diagrams and comic stories to transform complex medical knowledge into vivid images and stories, thereby lowering the barrier to understanding.

3.3.4. Emotional Dimension

Utilizing emotional drivers such as “loss aversion,” we enhance the public's perception of the value of relevant medical knowledge. The model begins by conducting public surveys on specific types of medical knowledge to understand the level of public awareness and the difficulties in disseminating such knowledge. At the same time, we introduce emotional content through warm and friendly language and images to enhance public recognition and participation, thereby improving the effectiveness of communication from an emotional perspective.

4. Conclusion and Prospect

This study is based on the 5W theoretical framework of Lasswell's communication theory, combined with the current practical challenges in medical science popularization communication, such as fragmented scenarios, homogeneous audiences, and vague communication effects (Lv, 2013), and proposes the original “CARE-4D” dynamic closed-loop science popularization communication model. This model operates through four core mechanisms: scenario-driven communication, four-tier audience segmentation, dynamic response, and four-dimensional effect evaluation. It also integrates four expanded dimensions: cultural embedding, emotional connection, technological enhancement, and ethical constraints, thereby establishing a biomedical knowledge dissemination system that balances scientific rigor with adaptability. The CARE-4D model addresses the limitations of traditional linear communication paradigms(Wang and Shi, 2018) by dividing audiences into four progressive tracking tiers: decision-makers (C1), executors (C2), influencers (C3), and potential recipients (C4). Through dynamic response mechanisms, it achieves precise alignment between science communication content and scenario needs, providing a theoretical tool to address the “knowledge-belief-action” conversion dilemma. By integrating the collectivist characteristics of Chinese family decision-making culture, regional health cognition differences, and emotion-driven mechanisms, it significantly expands the cultural explanatory power and scenario penetration of health communication theory, providing methodological support for the implementation of the precision science popularization strategy outlined in the Healthy China 2030 Planning Outline.

The current CARE-4D model still has three limitations: first, the technical implementation path of the dynamic response mechanism needs to be further refined; second, the cultural sensitivity dimension has not yet achieved a deep deconstruction of differentiated communication strategies for dialect regions and ethnic minority groups; third, the model's effectiveness evaluation needs to break through traditional communication breadth indicators and introduce end-evaluation dimensions such as health behavior conversion rates and umbilical cord blood bank capacity and quality. Future research could quantify the model's intervention efficacy on core indicators such as knowledge conversion rates and voluntary donation rates through multi-center field experiments, and combine neuroscience experiments to deepen the design principles of emotion-driven mechanisms. Additionally, metaverse technology could be explored to build immersive science popularization scenarios, and digital twins could be used to achieve personalized education for high-risk pregnancy groups. It is recommended to strengthen interdisciplinary research between medical communication studies and fields such as bioengineering and health economics, to promote the transformation of theoretical models into industry standards, and ultimately achieve the strategic shift from “disease-centered care to people-centered health.”

The current model remains a conceptual framework, with model construction and preliminary pilot surveys completed, yielding generally positive feedback. Future research will involve further empirical studies and pilot surveys across multiple or even all scenarios to validate its superior efficacy in medical communication, while addressing the three limitations mentioned earlier to further address the shortcomings of the CARE-4D model in medical communication, enabling it to truly contribute to the cause of medical science popularization.

Author Contributions:

Conceptualization, Yueyang Jiang and Tong Wu; methodology, Tong Wu; software, Jianing Liang; validation, Yueyang Jiang, Tong Wu and Jianing Liang; formal analysis, Yueyang Jiang; investigation, Wenjie Cai; resources, Tong Wu; data curation, Yueyang Jiang; writing—original draft preparation, Yueyang Jiang and Tong Wu; writing—review and editing, Jianing Liang; visualization, Wenjie Cai; supervision, Yangyang Zhang; project administration, Yueyang Jiang; All authors have read and agreed to the published version of the manuscript.

Funding:

This research received no external funding.

Institutional Review Board Statement:

Not applicable.

Informed Consent Statement:

Informed consent has been obtained for all subjects participating in the study.

Data Availability Statement:

Not applicable.

Acknowledgments:

Thank you to the research team for their support, to the teachers for their careful guidance, and to all my colleagues for their help. It made me have a deeper understanding of my research direction, and the conditions created by the research group are the foundation of my research, allowing me to conduct research in my favorite field and contribute my own efforts to the development of relevant models.

Conflict of Interest:

The authors declare no conflict of interest.

References

Central Committee of the Communist Party of China, & State Council of the People's Republic of China. (2017). “Healthy China 2030” planning outline [In Chinese]. Chinese Journal of Practical Rural Doctors, 24(7), 1–12.

Chou, W. Y. S., Hunt, Y. M., Beckjord, E. B., Moser, R. P., & Hesse, B. W. (2009). Social media use in the United States: Implications for health communication. Journal of Medical Internet Research, 11(4), e48. https://doi.org/10.2196/jmir.1249

Lin, Z. (1996). Research on the theoretical framework of new traditional studies: An evaluation of the merits and limitations of Lasswell's 5W communication model [In Chinese]. University of Journalism.

Lv, X. (2013). Research on public health communication in the context of digital publishing (Doctoral dissertation, Shaanxi Normal University).

Mills, B., & Barlow, D. M. (2014). Harold D. Lasswell reading: Lasswell, H. D. (1948). The structure and function of communication in society. In L. Bryson (Ed.), The communication of ideas. New York: Harper and Brothers. .

Sapienza, Z. S., Iyer, N., & Veenstra, A. S. (2018). Reading Lasswell's model of communication backward: Three scholarly misconceptions. In Advances in Foundational Mass Communication Theories (pp. 38-61). Routledge.

Wang, W., & Shi, G. (2018). The importance of evidence-based medicine communication for rational medical treatment. Chinese Journal of Evidence-Based Medicine, 18(9), 4.

Yilidana, Y. (2021). Research on Laswell's communication theory (Doctoral dissertation, Xinjiang University). China National Knowledge Infrastructure (CNKI).

Yu, G., & Lu, J. (2011). Current status, issues, and future trends in health communication research in China. In 2011 Annual China Health Communication Conference Excellent Papers Collection.

Zalpour, A., Geraei, E., Hashemian, M., & others. (2025). Health information disorders: Types and origins in health communication – A qualitative study. Journal of Education and Health Promotion, 14(1), e18444–e18479.