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Review

A Review and Future Directions for Global Public Health Security Assessment Tools

Fangyu Cheng[1]; Chunping Wang[1]; Yueyuan Li[1]; Hongtao Wu[2,3,4,#]

ABSTRACT

In the context of globalization, national capacities for responding to public health emergencies are evaluated using various global assessment tools, most notably the externally derived Global Health Security Index (GHSI), the peer-reviewed Joint External Evaluation (JEE), and the self-reported States Parties Self-Assessment Annual Report (SPAR). These instruments are designed to strengthen emergency response systems worldwide. However, the dynamic transmission characteristics of the COVID-19 pandemic exposed significant discrepancies, as assessment scores from these tools did not consistently align with countries' actual pandemic response performance. This review examines the performance of these assessment tools throughout the pandemic and identifies three fundamental issues that undermined the effectiveness of GHSI, JEE, and SPAR evaluations. Although indicators across eight technical areas were revised following the pandemic, substantial modifications remain necessary to address the identified limitations. To enhance the utility of these assessment frameworks, systematic revisions are required in multiple domains: restructuring the indicator system architecture, diversifying data sources while expanding indicator dimensions, strengthening data verification protocols, refining weight allocation methodologies, incorporating real-time data streams, and ultimately establishing a dynamic monitoring and assessment system.

To address global public health security challenges and strengthen emergency preparedness, the international community has developed 13 assessment tools, spanning four major domains: national governance and health security preparedness, risk assessment and management, health system capacity and emergency response, and dynamic monitoring (Table 1). Among these instruments, the Global Health Security Index (GHSI), Joint External Evaluation (JEE), and State Party Annual Reporting tool (SPAR) have gained widespread adoption due to their comprehensive indicator frameworks and multi-tiered structures. The GHSI, developed through collaboration between the Nuclear Threat Initiative and the Johns Hopkins University, evaluates epidemic response capabilities across 195 countries (*1*). In 2016, the World Health Organization (WHO) launched the JEE, a collaborative process combining internal country self-assessment with external peer review by multidisciplinary expert teams to evaluate national capacities for preventing, detecting, and responding to health threats (*2*). The annual report survey questionnaire, in use since 2010, underwent revision in 2018 and was renamed SPAR. This tool monitors States Parties' progress in implementing core capacities of the International Health Regulations (IHR) through annual self-assessment (*3*). However, because these three tools were designed based on historical pandemic experiences, they inadequately captured the unique complexities of the COVID-19 pandemic, resulting in flawed indicator design and inappropriate weight allocations. This limitation manifested in the paradoxical observation that countries ranking highly in pre-pandemic assessments often performed poorly in their actual pandemic responses (*4*–*7*). Although academic studies have evaluated individual aspects of these tools, comprehensive systematic reviews examining their collective performance during the pandemic remain scarce.

To address this gap, we conducted a systematic literature search of Web of Science, Embase, and PubMed databases for publications related to GHSI, JEE, and SPAR through August 30, 2025. The screening process is illustrated in Figure 1. Through critical analysis of this literature, we examined the performance of these tools during the pandemic, identified inherent structural flaws and factors contributing to their limited predictive validity, and evaluated post-pandemic indicator revisions. Our

TABLE 1. Overview of 13 global public health security relevant assessment tools.

Tool	Issuing Organization	Release Time	Indicator Changes	Indicator Type	Scope of Application
Worldwide Governance Indicators (WGI)	World Bank	1996	Updated in 2025	Third-party review	Assess governance quality and national stability
Toolkit for Assessing Health-System Capacity for Crisis Management (THCCM)	WHO Regional Office for Europe	2007	None	Self-assessment	Assess the crisis management capabilities of the healthcare system
INFORM Global Risk Index	JRC	2015	Transformation into INFORM COVID-19 Risk	Third-party review	Assess the risk of humanitarian crises and disasters in countries around the world
Joint External Evaluation (JEE)	WHO	2016	First update: 2018 Second update: 2021	Self-assessment/peer review	Assess the capabilities of the national public health security system
Health Emergency Preparedness Self-Assessment Tool (HEPSA)	ECDC	2018	None	Self-assessment	Self-assess the level and capability of health emergency preparedness
IHR States Parties Self-Assessment Annual Report (SPAR)	WHO	2018	Revised as SPAR in 2018, updated in 2021.	Self-assessment	Measuring a country's public health preparedness and response capacity
Global Health Security Index (GHSI)	Johns Hopkins Bloomberg School of Public Health	2019	Updated in 2021	Third-party review	Assessment of global health security preparedness by country
Epidemic Preparedness Index (EPI)	WEF	2019	None	Third-party review	Assess the country's preparedness for responding to the pandemic
INFORM COVID-19 Risk	JRC	2020	Created after COVID-19	Third-party review	Assess the risk of the pandemic and the country's response capabilities
COVID-19 Regional Safety Index (RASI)	In-Depth Knowledge Think Tank	2020	Created after COVID-19	Third-party review	Assess regional security and prevention capabilities during the pandemic
COVID-19 Overall Government Response Index (CGRI)	Oxford University Pandemic Policy Global Group	2022	Created after COVID-19	Third-party review	Assess the strictness of various governments' responses to the pandemic
Global Preparedness Monitoring Board (GPMB)	WHO and World Bank	2023	Created after COVID-19	Third-party review/ Peer review	Assessment of global health emergency preparedness and response capabilities
WHO Dynamic Preparedness Metric (DPM)	WHO, World Bank, and UNICEF	2024	Created after COVID-19	Third-party review	Assess the country's capacity to respond to public health emergencies

Abbreviations: WHO=World Health Organization; JRC=European Union Joint Research Centre; ECDC=European Centre for Disease Prevention and Control; WEF=World Economic Forum; UNICEF=United Nations Children's Fund.

findings clarify future research priorities and provide evidence-based recommendations for enhancing global public health security assessment tools.

LIMITATIONS OF ASSESSMENT TOOLS DURING THE PANDEMIC

Data Authenticity and Accessibility

SPAR self-reporting limitations: The SPAR mechanism faces a fundamental data integrity challenge. Although SPAR emphasizes transparency and government accountability, its dependence on self-reported data introduces systematic bias (*8*). The absence of robust verification mechanisms on online platforms creates opportunities for countries to inflate their ratings, whether to preserve international reputation or secure development funding (*7*,*9*). Paradoxically, when subjected to external JEE evaluations, some countries strategically deflate their self-assessment scores, further compromising data objectivity and reliability (*3*,*10*). Moreover, despite the World Health Assembly (WHA) requirements for timely SPAR report submission by contracting state parties, weak enforcement mechanisms have resulted in delayed reporting by numerous countries (*9*).

JEE expert-driven model constraints: While the JEE employs peer review by expert groups and WHO authorization to ensure data authenticity and accountability, expert subjectivity remains a critical limitation. The JEE framework integrates external expert evaluation with internal self-assessment, yet the internal component remains vulnerable to subjective biases comparable to those affecting SPAR (*11*).

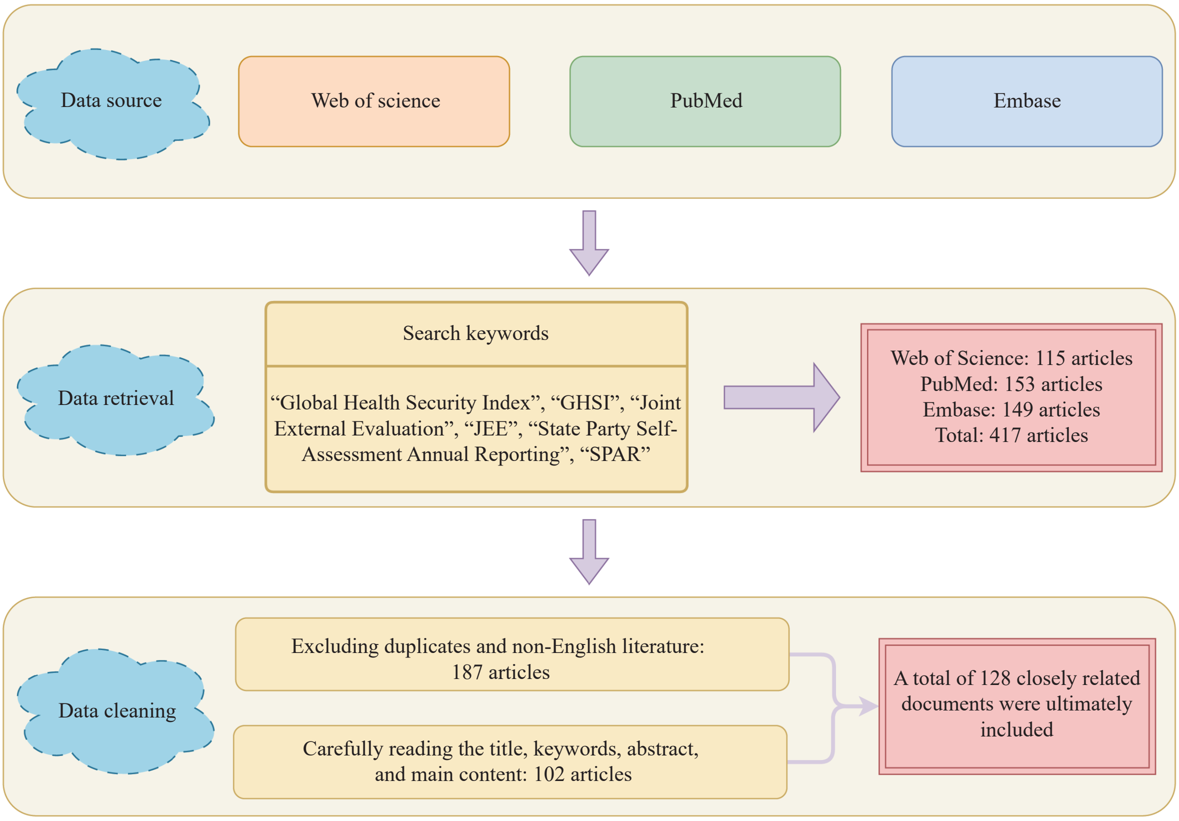

FIGURE 1. Literature screening process.
Abbreviations: GHSI=Global Health Security Index; JEE=Joint External Evaluation; SPAR=States Parties Self-Assessment Annual Report.

Although external evaluations are conducted by independent expert teams following WHO training protocols, variations in evaluators' professional backgrounds, indicator interpretation, and assessment approaches consistently diminish result reliability (*12–13*). Furthermore, the voluntary nature of JEE participation resulted in only 50% of States Parties completing assessments in 2021, substantially undermining both the universality of global health security evaluations and comprehensive data coverage (*2*).

GHSI public data dependency issues: Despite the transparency of GHSI indicator data, significant limitations constrain its utility. Data quality, completeness, and timeliness vary considerably across the 195 participating countries, directly affecting assessment scores. High-income countries typically maintain more accurate reporting systems, creating systematic assessment biases across development levels (*1*,*14*). Delays in public data updates further restrict effective data collection (*1*). Although the GHSI methodology demonstrates greater rigor than JEE and SPAR approaches, its heavy reliance on publicly available information creates particular challenges. In low- and middle-income countries, pandemic preparedness and policy documents frequently remain undisclosed or incompletely published, complicating data collection and systematically depressing scores for affected nations (*15–16*). Low-income regions, particularly in Africa, face technological and resource constraints that compound data acquisition difficulties (*17*). Additionally, the absence of standardized global data frameworks has substantially increased the complexity of obtaining consistent, comparable data across countries (*18*).

Indicator Weight Allocation

Improper allocation of indicator weights substantially compromises the accuracy of assessment outcomes. The GHSI applies uniform weighting (0.167) across all categories, failing to capture the varying importance of different indicators for public health security (*16*,*19*). Chang CL and colleagues demonstrated that Detection and Reporting carries the greatest weight in determining overall preparedness (*20*). Similarly, Abroon Q et al., employing a Bayesian network model, identified Emergency Preparedness and Response Planning as the most influential factor in GHSI scoring (*21*).

Both JEE and SPAR employ a five-level color-coded system to qualitatively assess capability levels across indicators, then aggregate these ratings into total scores (*22–23*). Under SPAR compilation rules, for example, if indicator 2.1 achieves level 3 and indicator 2.2 reaches level 4, the composite percentage for indicator 2 equals [(3/5 × 100) + (4/5 × 100)] / 2 = 70%. This equal-weighting approach inadequately reflects the differential contributions of individual capabilities to overall preparedness (*24*).

The Static Characteristics of Indicator Design

By design, GHSI, JEE, and SPAR function as cross-sectional assessment tools rather than predictive instruments, capturing a country's health security capabilities at a single point in time (*25–26*). This static nature fundamentally limits their ability to track the dynamic progression of epidemics, where virus transmission patterns and response measures evolve continuously, rendering real-time indicator updates challenging (*12*). A more critical limitation stems from the indicator systems' narrow emphasis on technical capabilities and health infrastructure, which fails to adequately incorporate broader public value dimensions including socio-political contexts, governance structures, and cultural factors that shape pandemic responses (*14*,*27–29*). Supporting this observation, research by David BD and colleagues demonstrates that the correlation between GHSI/SPAR scores and COVID-19 outcomes weakens progressively over time, as non-technical factors such as social behavior patterns and public trust in government institutions assume greater importance during later pandemic stages (*30*).

ANALYSIS OF INDICATOR CHANGES AFTER THE PANDEMIC

Following the COVID-19 pandemic, the organizations responsible for JEE, GHSI, and SPAR undertook comprehensive revisions of their assessment frameworks. Our review of the third edition of JEE, the 2021 edition of GHSI, and the second edition of SPAR identified key indicators that were added, modified, or removed across multiple technical domains. The most substantial revisions occurred in three critical areas: legal policy and government coordination, surveillance and laboratory capacity building, and emergency response and management. Figure 2 illustrates the additions, updates, and deletions of tertiary indicators across these three technical fields.

The newly introduced indicators in legal policies and government coordination address two previously underrepresented dimensions: gender equity in public health emergencies and international risk management metrics. The pandemic exposed significant gaps in women's health protection, particularly given that women constitute a substantial proportion of the healthcare workforce and consequently faced elevated infection risks during epidemic prevention and control phases. Despite this vulnerability, governments historically neglected gender-disaggregated data collection, failed to recognize women's unique status in emergency response, and lacked targeted protective measures (*31*). Additionally, the revised indicators incorporate terrorism risk assessment, recognizing its intersection with international travel restrictions and epidemic prevention efforts. Evidence from the early stages of COVID-19 demonstrated that restrictions on international travel and public gatherings were among the most effective containment measures (*32–33*).

The updated indicators in surveillance and laboratory capacity building encompass laboratory testing efficiency, diagnostic reliability, and rapid response capability. During the COVID-19 pandemic, rapid testing and case isolation proved essential for viral containment and for identifying optimal intervention windows. However, global laboratory testing capacity failed to meet escalating demands, highlighting critical infrastructure gaps (*34*). Ecuador's experience illustrates this challenge: insufficient testing capacity caused the country to miss the optimal prevention and control window, resulting in incomplete surveillance data on COVID-19 infections and mortality rates (*35*). The newly added indicators for data transparency and international data sharing reflect the health surveillance community's growing recognition that open data exchange is fundamental to effective emergency response. Timely and accurate data sharing enhances the precision of dynamic epidemiological reporting, such as infection counts in heavily affected regions, thereby reducing errors in government decision-making (*36–37*).

The field of public health emergency response and management encompasses human resource reserves, logistical support, case investigation, contact tracing,

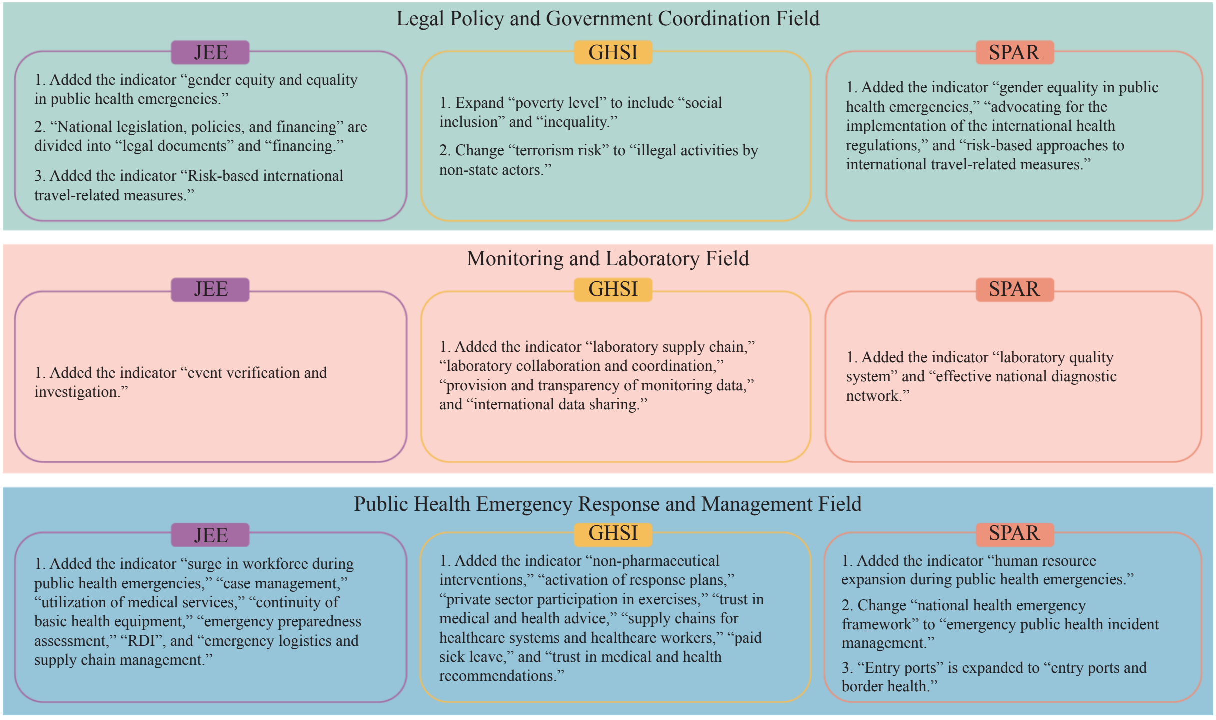

FIGURE 2. Addition, deletion, and updating of tertiary indicators in three global public health security relevant assessment tools.
Abbreviations: GHSI=Global Health Security Index; JEE=Joint External Evaluation; SPAR=States Parties Self-Assessment Annual Report; RDI=research, development, and innovation.

and non-pharmaceutical interventions, all aimed at building an efficient, multi-departmental collaborative emergency system. During the pandemic, Italy enhanced flexibility in resource allocation and continuity of medical services through multi-departmental human resource distribution and cross-training, which became a key factor in responding to the pandemic and future disasters (*38*). China and South Korea ensure the supply of medical human resources through strict administrative procedures and on-the-job training (*39–40*). Additionally, countries such as China and Chile have effectively curbed the spread of the epidemic by combining non-pharmaceutical interventions with vaccination (*41–42*).

SUMMARY AND OUTLOOK

Following the COVID-19 pandemic, organizations responsible for the three types of assessment tools expanded and refined their indicators based on experience; however, these revisions have not fully addressed the fundamental issue of low evaluation effectiveness. To meet global health security challenges in the post-pandemic era, future assessment tools should focus on improving: 1) expanding data sources and improving data accessibility for low- and middle-income countries. Utilize independent public health expert teams from various institutions and countries to conduct multiple rounds of verification and validation on publicly available and self-reported data, enhancing the overall quality of the data; 2) the indicator system and weight allocation by comprehensively incorporating factors such as policy implementation, historical culture, socioeconomics, public trust, community engagement, and environmental ecology, while reasonably adjusting weights to reflect their relative importance in different contexts; 3) overcoming the limitations of existing global public health security assessment tools that focus on static evaluation by developing a dynamic risk monitoring and assessment system. The core foundation of this goal lies in ensuring the accuracy, timeliness, and comprehensiveness of data input, which can be efficiently obtained and preprocessed using methods such as machine learning and geographic information systems (GIS). Building on this, system modeling approaches like dynamic Bayesian networks, complex network analysis, and spatiotemporal epidemiological models can effectively integrate this dynamic information to construct a dynamic risk assessment and monitoring system, thereby enhancing the sensitivity and precision of early warning and response (*43–44*).

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REFERENCES

1. Alhassan RK, Nketiah-Amponsah E, Afaya A, Salia SM, Abuosi AA, Nutor JJ. Global Health Security Index not a proven surrogate for health systems capacity to respond to pandemics: the case of COVID-19. J Infect Public Health 2023;16(2):196 – 205. https://doi.org/10.1016/j.jiph.2022.12.011.
2. de Vázquez CC, Jou YC, Nyan HHL, Asakura M, Watanabe K, Lowbridge C. Estimating Joint External Evaluation scores using country data from 77 countries, 2016-2018. Health Secur 2021;19(2):150 – 62. https://doi.org/10.1089/hs.2019.0135.
3. Tsai FJ, Katz R. Measuring global health security: comparison of self-and external evaluations for IHR core capacity. Health Secur 2018;16(5):304 – 10. https://doi.org/10.1089/hs.2018.0019.
4. Khalifa BA, Abbey EJ, Ayeh SK, Yusuf HE, Nudotor RD, Osuji N, et al. The Global Health Security Index is not predictive of vaccine rollout responses among OECD countries. Int J Infect Dis 2021;113:7 – 11. https://doi.org/10.1016/j.ijid.2021.09.034.
5. Kumru S, Yiğit P, Hayran O. Demography, inequalities and Global Health Security Index as correlates of COVID-19 morbidity and mortality. Int J Health Plann Manage 2022;37(2):944 – 62. https://doi.org/10.1002/hpm.3384.
6. Haider N, Yavlinsky A, Chang YM, Hasan MN, Benfield C, Osman AY, et al. The Global Health Security index and Joint External Evaluation score for health preparedness are not correlated with countries' COVID-19 detection response time and mortality outcome. Epidemiol Infect 2020;148:e210. https://doi.org/10.1017/S0950268820002046.
7. Kentikelenis A, Seabrooke L. Organising knowledge to prevent global health crises: a comparative analysis of pandemic preparedness indicators. BMJ Glob Health 2021;6(8):e006864. https://doi.org/10.1136/bmjgh-2021-006864.
8. Lakoff A. Preparedness indicators: measuring the condition of global health security. Sociologica 2021;15(3):25 – 43. https://doi.org/10.6092/issn.1971-8853/13604.
9. Stoto MA, Nelson CD, Kraemer JD. Does it matter that standard preparedness indices did not predict COVID-19 outcomes? Global Health 2023;19(1):72. http://dx.doi.org/10.1186/s12992-023-00973-2.
10. Tsai FJ, Turbat B. Is countries' transparency associated with gaps between countries' self and external evaluations for IHR core capacity? Global Health 2020;16(1):10. http://dx.doi.org/10.1186/s12992-020-0541-3.
11. Boyd MJ, Wilson N, Nelson C. Validation analysis of Global Health Security Index (GHSI) scores 2019. BMJ Glob Health 2020;5(10):e003276. https://doi.org/10.1136/bmjgh-2020-003276.
12. Stone AB, Weg AL, Petzing SR, Rollings A, Perdue CL. Lack of alignment between WHO joint external evaluation and state party self-assessment scores undermines utility as evaluation tools for the department of defense. Health Secur 2022;20(4):321 – 30. https://doi.org/10.1089/hs.2021.0209.
13. Craig AT, Sio AR. The value of joint external evaluation as a tool for country-level health security monitoring. Health Secur 2019;17(2):166 – 7. https://doi.org/10.1089/hs.2018.0130.
14. Hu AQ, Wang D, Shi J, Liu C, Su P, Tian LL, et al. Effectiveness analysis of global health security index (GHSI) assessment. Chin J Dis Control Prev 2022;26(10):1217 – 23. https://doi.org/10.16462/j.cnki.zhjbkz.2022.10.018.
15. Prasiska DI, Osei KM, Chapagain DD, Rajaguru V, Kim TH, Kang SJ, et al. The global health security index and its role in Shaping national COVID-19 response capacities: a scoping review. Ann Glob Health 2025;91(1):15. https://doi.org/10.5334/aogh.4625.
16. Bulut T, Top M, Atan M, Genç B. Comparison of the Bulut Index-Beta method and Global Health Security Index: results from the world's countries. Turk J Med Sci 2024;54(4):822 – 37. https://doi.org/10.55730/1300-0144.5854.
17. Okoroiwu HU, Ogar CO, Abunimye DA, Okafor IM, Uchendu IK. COVID-19 in WHO African region: account and correlation of epidemiological indices with some selected health-related metrics. Ethiop J Health Sci 2021;31(6):1075 – 88. https://doi.org/10.4314/ejhs.v31i6.2.
18. Sodjinou VD, Ayelo PA, Douba A, Ouendo DEM. Main challenges of the detection in the context of global health security: systematic review of Joint External Evaluation (JEE) reports. Pan Afr Med J 2022;42:243. https://doi.org/10.11604/pamj.2022.42.243.26563.
19. Abbey EJ, Khalifa BAA, Oduwole MO, Ayeh SK, Nudotor RD, Salia EL, et al. The Global Health Security Index is not predictive of coronavirus pandemic responses among Organization for Economic Cooperation and Development countries. PLoS One 2020;15(10):e0239398. https://doi.org/10.1371/journal.pone.0239398.
20. Chang CL, McAleer M. Alternative global health security indexes for risk analysis of COVID-19. Int J Environ Res Public Health 2020;17(9):3161. https://doi.org/10.3390/ijerph17093161.
21. Qazi A, Simsekler MCE, Al-Mhdawi MKS. Prioritizing indicators for rapid response in global health security: a Bayesian network approach. Int J Disaster Risk Sci 2024;15(4):536 – 51. https://doi.org/10.1007/s13753-024-00570-w.
22. Amadu I, Ahinkorah BO, Afitiri AR, Seidu AA, Ameyaw EK, Hagan JE Jr, et al. Assessing sub-regional-specific strengths of healthcare systems associated with COVID-19 prevalence, deaths and recoveries in Africa. PLoS One 2021;16(3):e0247274. https://doi.org/10.1371/journal.pone.0247274.
23. World Health Organization. Joint external evaluation tool: international health regulations (2005) - third edition. 2022. https://www.who.int/publications/i/item/9789240051980. [2025-3-16].
24. World Health Organization. IHR (2005): States Parties self-assessment annual reporting tool, 1st ed. 2018. https://www.who.int/zh/publications/i/item/WHO-WHE-CPI-2018-16. [2025-3-27]. (In

Chinese).
25. Ravi SJ, Warmbrod KL, Mullen L, Meyer D, Cameron E, Bell J, et al. The value proposition of the Global Health Security Index. BMJ Glob Health 2020;5(10):e003648. https://doi.org/10.1136/bmjgh-2020-003648.
26. Razavi A, Collins S, Wilson A, Okereke E. Evaluating implementation of International Health Regulations core capacities: using the Electronic States Parties Self-Assessment Annual Reporting Tool (e-SPAR) to monitor progress with Joint External Evaluation indicators. Global Health 2021;17(1):69. https://doi.org/10.1186/s12992-021-00720-5.
27. Ren T, Fan M, Xue EC, Yang J, Liu XY, Liu J, et al. Summary of tools for assessment of public health emergency response capability. Chin J Epidemiol 2022;43(3):397 – 402. https://doi.org/10.3760/cma.j.cn112338-20220112-00029.
28. Ji Y, Shao J, Tao BL, Song H, Li ZQ, Wang JM. Are we ready to deal with a global COVID-19 pandemic? Rethinking countries' capacity based on the Global Health Security Index. Int J Infect Dis 2021;106:289 – 94. https://doi.org/10.1016/j.ijid.2021.03.089.
29. Mahajan M. Casualties of preparedness: the Global Health Security Index and COVID-19. Int J Law Context 2021;17(2):204 – 14. https://doi.org/10.1017/S1744552321000288.
30. Duong DB, King AJ, Grépin KA, Hsu LY, Lim JF, Phillips C, et al. Strengthening national capacities for pandemic preparedness: a cross-country analysis of COVID-19 cases and deaths. Health Policy Plann 2022;37(1):55 – 64. https://doi.org/10.1093/heapol/czab122.
31. Johnson C. What COVID-19 revealed about gender equality policy framing. Aust J Polit Sci 2022;57(1):93 – 112. https://doi.org/10.1080/10361146.2021.2023094.
32. Chang CP, Feng GF, Zheng MB. Government fighting pandemic, stock market return, and COVID-19 virus outbreak. Emerging Markets Finance and Trade 2021;57(8):2389-406. http://dx.doi.org/10.1080/1540496X.2021.1873129.
33. Murukutla N, Gupta AK, Maharjan M, Fabrizio C, Myers EW, Johnson A, et al. Psychosocial determinants of adherence to public health and social measures (PHSMs) in 18 African Union Member States during the early phase of the COVID-19 pandemic: results of a cross-sectional survey. BMJ Open 2022;12(6):e054839. https://doi.org/10.1136/bmjopen-2021-054839.
34. Mourya DT, Sapkal G, Yadav PD, Belani SKM, Shete A, Gupta N. Biorisk assessment for infrastructure & biosafety requirements for the laboratories providing coronavirus SARS-CoV-2/(COVID-19) diagnosis. Indian J Med Res 2020;151(2-3):172 – 6. https://doi.org/10.4103/ijmr.IJMR_763_20.
35. Torres I, Sippy R, Sacoto F. Assessing critical gaps in COVID-19 testing capacity: the case of delayed results in Ecuador. BMC Public Health 2021;21(1):637. https://doi.org/10.1186/s12889-021-10715-x.
36. Gøtzsche PC. Why we need easy access to all data from all clinical trials and how to accomplish it. Trials 2011;12(1):249. https://doi.org/10.1186/1745-6215-12-249.
37. Amit AML, Pepito VCF, Gutierrez B, Rawson T. Data sharing in southeast Asia during the first wave of the COVID-19 pandemic. Front Public Health 2021;9:662842. https://doi.org/10.3389/fpubh.2021.662842.
38. Lamberti-Castronuovo A, Parotto E, Della Corte F, Hubloue I, Ragazzoni L, Valente M. The COVID-19 pandemic response and its impact on post-corona health emergency and disaster risk management in Italy. Front Public Health 2022;10:1034196. https://doi.org/10.3389/fpubh.2022.1034196.
39. Tse DMS, Li Z, Lu Y, Li Y, Liu Y, Wong WCW. Fighting against COVID-19: preparedness and implications on clinical practice in primary care in Shenzhen, China. BMC Fam Pract 2020;21(1):271. https://doi.org/10.1186/s12875-020-01343-2.
40. Park J, Min J, Song JH, Park MY, Yoo H, Kwon O, et al. The COVID-19 pandemic response and its impact on post-corona health emergency and disaster risk management in Republic of Korea. Sustainability 2023;15(4):3175. https://doi.org/10.3390/su15043175.
41. Hu LJ, Shi MS, Li ML, Ma JL. The effectiveness of control measures during the 2022 COVID-19 outbreak in Shanghai, China. PLoS One 2023;18(5):e0285937. https://doi.org/10.1371/journal.pone.0285937.
42. Urquidi C, Santelices E, Lagomarcino AJ, Valenzuela MT, Larrañaga N, Gonzalez E, et al. The added effect of non-pharmaceutical interventions and lifestyle behaviors on vaccine effectiveness against severe COVID-19 in Chile: a matched case-double control study. Vaccine 2023;41(18):2947 – 55. https://doi.org/10.1016/j.vaccine.2023.03.060.
43. Ma JY, Wang ZD, Zhou YL, Han XY, Wang CN, Li B, et al. Comparative analysis on the results from different global health security-related evaluation tools. Chin Prev Med 2023;24(3):198 – 204. https://doi.org/10.16506/j.1009-6639.2023.03.006.
44. Prakash Nayak P, Pai BJ, Govindan S. Leveraging geographic information system for dengue surveillance: a scoping review. Trop Med Health 2025;53(1):102. https://doi.org/10.1186/s41182-025-00783-9.

Preplanned Studies

A Comprehensive Analysis of Capability Enhancement in National Emergency Response Teams for Infectious Diseases — China, 2023

Jing Zhao[1,&]; Yuqun Wang[2,&]; Bing Li[1]; Guoqing Shi[1,#]

Summary

What is already known on this topic?

As a critical component of China's public health emergency response infrastructure, the National Emergency Response Team of Infectious Disease (NERID) currently lacks comprehensive documentation regarding its management practices and capacity-building initiatives.

What is added by this report?

This study provides the first nationwide comprehensive evaluation of NERID development and management, encompassing 20 teams distributed across seven geographic regions. Principal findings identified significant challenges in full-time staffing allocation, equipment standardization protocols, and pronounced regional disparities in training and drill implementation.

What are the implications for public health practice?

This study provides a comprehensive assessment of the current management status and capacity-building levels of NERID. Public health practice urgently needs to strengthen dedicated personnel management, accelerate digital infrastructure development, intensify training and drill programs, and ensure comprehensive preparedness for future major public health emergencies.

ABSTRACT

Introduction: The National Emergency Response Team of Infectious Disease (NERID) constitutes the cornerstone of China's public health emergency response infrastructure. This study systematically evaluates NERID's current management practices and capacity-building initiatives, examining regional variations to establish an evidence base for advancing team modernization and standardization.

Methods: We conducted a comprehensive questionnaire survey of all 20 NERID teams in China during November 2023. Descriptive analyses examined four core domains: team construction, management systems, capacity building, and emergency response operations. Two novel metrics were developed to quantify preparedness activities: the Training Intensity Index and the Drill Intensity Index.

Results: This investigation represents the first nationwide assessment of NERID development and management, encompassing 20 teams distributed across seven geographic regions. Critical findings demonstrated that full-time staff comprised only 21.1% of management personnel, while equipment standardization remained insufficient, with unified coding systems implemented in merely 45% of teams. Substantial regional disparities emerged in training and drill activities. Teams averaged two training sessions and three drills annually, with mean participation of 79 and 45 individuals per session, respectively. These metrics yielded a Training Intensity Index of 125 person-times per year and a Drill Intensity Index of 121 person-times per year.

Conclusion: China has established a national-level health emergency response team network with nationwide coverage, achieving unified command and resource coordination. Beyond strengthening routine training and drills, implementing comprehensive multi-scenario and multi-mode exercises is essential to enhance operational readiness and response capabilities.

Acute infectious disease outbreaks and major public health emergencies present substantial challenges to China's public health infrastructure and population health. Strengthening and standardizing the National Emergency Response Team of Infectious Disease (NERID) construction and management systems is critical for enhancing the professionalization of infectious disease emergency response and ensuring efficient operation of China's public health emergency system (*1*). Understanding NERID's current development status is therefore essential to inform future improvements. To address this need, the China CDC, commissioned by the National Disease Control and Prevention Administration, launched a nationwide investigation in November 2023. This study represents the first comprehensive assessment of China's NERID and aims to provide an evidence base for enhancing management systems and strengthening emergency response capabilities.

This investigation employed a census design, surveying all 20 NERIDs with a structured questionnaire validated through expert review and pilot testing. The questionnaire encompassed core domains including team construction, management frameworks, and capacity-building initiatives. To ensure data quality, implementing units conducted a dual-review verification process — comprising independent review and double data entry — before submitting data to China CDC. We analyzed data using Excel (version 2019, Microsoft, WA, USA). To quantify training and drill activities, we developed two novel indices: the "Training Intensity Index," calculated as the product of average participants per training session and average annual training frequency, and the "Drill Intensity Index," calculated analogously for drills. These indices integrate both activity frequency and participant engagement, offering a more comprehensive assessment of training intensity in emergency response teams (*2–3*) (Supplementary Material, available at https://weekly.chinacdc.cn/).

This study examined 20 NERID across China, comprising 18 vehicle-mounted units and 2 mobile epidemic prevention teams distributed across seven geographic regions (Northeast, East, North, Central, South, Southwest, and Northwest China) and spanning 17 provincial-level administrative divisions (PLADs) (Supplementary Figure S1, available at https://weekly.chinacdc.cn/). Teams averaged 87 members each, predominantly male with a mean age of 39 years. Members held primarily bachelor's and master's degrees across multiple disciplines. Each team was equipped with an average of 15 vehicles and an integrated equipment system supporting command, technical, and logistical operations. These findings demonstrate that all NERID have achieved standardized staffing levels and equipment configurations (Table 1).

The management survey revealed that 17 teams had established formal management institutions: 50% operated independent management departments, while the remainder functioned under health emergency offices. Personnel adjustments occurred triennially in 85% of teams. Several areas met standardization requirements, including dedicated personnel for archive management (80% of teams), material and equipment management (90%), and equipment operation and maintenance (85%). Institutional development achieved standardization in team management regulations (95%), equipment and vehicle management documentation (85%), operation and maintenance support systems (85%), and emergency duty systems (80%). However, challenges remained evident in three key areas. First, personnel management remained inadequate: only 75% of teams had dedicated information management staff, 77.8% had dedicated vehicle management personnel, and merely 21.1% of all management positions were filled by full-time staff. Second, equipment standardization lagged substantially, with only 55% establishing comprehensive material and equipment management systems and 45% implementing unified coding systems. Third, institutional mechanisms showed deficiencies: only 60% had established incentive programs, and while official media coverage reached 100%, just 40% maintained professional communication teams. Emergency plan management also required strengthening, as only 65% regularly revised management regulations and 70% had developed on-site operational procedures. These findings underscore the need for NERID to advance standardized management system development across all operational domains.

Training and drills serve as critical mechanisms for strengthening professional competencies and operational readiness within NERID teams. By the end of 2023, 18 teams had established dedicated training departments. Analysis of activities from 2018 to 2023 revealed that each team conducted an average of 2 training sessions annually, with 79 participants per session, yielding a Training Intensity Index of 125 person-times per year. Training curricula encompassed health emergency theory, operational skills, infectious disease prevention and control, wilderness rescue, and natural disaster response. During the same period, teams performed an average of 3 drills annually, with 45 participants per drill, producing a Drill Intensity Index of 121 person-times per year. These drills predominantly employed tabletop exercises and field simulations, with scenarios centered on post-disaster epidemic prevention and infectious disease outbreak response (Figure 1).

TABLE 1. Development status of the National Emergency Response Team of Infectious Disease in China.

Regions in China	Number of teams	FI (10 k CNY)	H	Age	Gender		Education			Vehicles (units)	Vehicle configuration		
					M	F	Bachelor & below	Master	Doctor		Communications & command	Technical support	Logistics support
Nationwide	20	2,019.00± 822.56	87.30± 33.74	38.50± 3.81	61.50± 22.11	25.80± 18.22	41.05± 24.91	40.25± 24.65	6.00± 10.46	15.39± 4.78	1.83± 1.04	5.94± 2.88	7.44± 2.71
Northeast	1	2,130	45	39	34	11	35	9	1	14	2	6	6
East	5	2,443.20± 1,211.36	87.40± 16.09	37.80± 2.59	72.00± 15.96	15.40± 5.27	29.60± 20.27	52.80± 16.48	5.00± 2.35	17.40± 7.48	1.60± 0.55	6.60± 4.51	9.20± 2.95
North	4	1,873.00± 323.78	90.25± 25.59	39.75± 4.11	53.25± 18.89	37.00± 19.77	31.75± 18.55	43.00± 19.17	15.50± 21.33	14.75± 4.86	2.00± 1.41	5.50± 1.29	7.25± 3.30
Central	1	3,903	42	40	32	10	0	42	0	12	2	4	6
South	2	1,501.50± 2,121	130.00± 63.64	39.00± 1.41	82.00± 41.01	48.00± 22.63	49.00± 15.56	72.50± 37.48	8.50± 10.61	18.50± 0.71	3.50± 0.71	9.00± 0.00	6.00± 1.41
Southwest	3	1,468.67± 59.47	79.67± 36.30	42.67± 4.51	61.33± 30.01	18.33± 8.51	59.67± 37.45	16.33± 14.64	3.67± 3.22	16.33± 1.12	1.33± 1.16	6.00± 1.732	9.00± 1.732
Northwest	4	1,807.50± 406.04	90.50± 35.22	34.25± 2.63	60.75± 11.84	29.75± 23.39	58.50± 17.92	31.00± 22.98	1.00± 0.82	12.00± 0.82	1.25± 0.50	3.25± 1.89	7.50± 1.73

Note: Data represent the average values for individual teams within their respective regions. For regions containing multiple teams, values are expressed as mean ± standard deviation; for regions with a single team, the specific value is reported directly.

Abbreviations: FI=Funding Input; H=Headcount; M=Male; F=Female; CNY=Chinese Yuan.

DISCUSSION

The establishment of NERID represents a critical milestone in China's modernization of public health infrastructure, marking a significant enhancement in the nation's emergency response capabilities for infectious disease outbreaks. By the end of 2023, 20 NERID teams had been deployed nationwide, strategically positioned across seven major geographic regions and spanning 17 PLADs. This distribution reflects careful consideration of regional risk profiles and ensures comprehensive national coverage for rapid emergency response.

Effective public health emergency response teams require coordinated integration of personnel, equipment, protocols, and training to establish a comprehensive capability framework (*4*). Our findings reveal three critical gaps in current NERID management. First, personnel management shows a fundamental mismatch between formal structures and operational capacity. Although most teams have established management systems, the shortage of full-time staff forces reliance on part-time personnel, compromising standardization in file management and equipment maintenance. This gap between institutional design and implementation capacity reflects broader challenges in resource allocation (*5*). Compounding this issue, inadequate incentive structures and absent performance evaluation systems weaken staff motivation and organizational commitment, consistent with equity theory principles that emphasize the importance of balanced reward systems (*6*). Second, information management and equipment standardization remain underdeveloped. Despite dedicated personnel for material and equipment oversight, the lack of specialized information management staff has created systemic deficiencies. These include unstandardized equipment coding systems, delayed data updates, and outdated management guidelines that inadequately address critical on-site response procedures. The absence of regular protocol revisions further exacerbates these gaps. Additionally, inconsistent maintenance schedules for vehicles and equipment — both within and across teams — likely stem from insufficient dedicated vehicle management personnel. While teams have achieved broad media coverage for public communication, the lack of specialized communication teams limits message depth and effectiveness.

Based on these findings, we propose three strategic priorities. First, strengthen full-time management

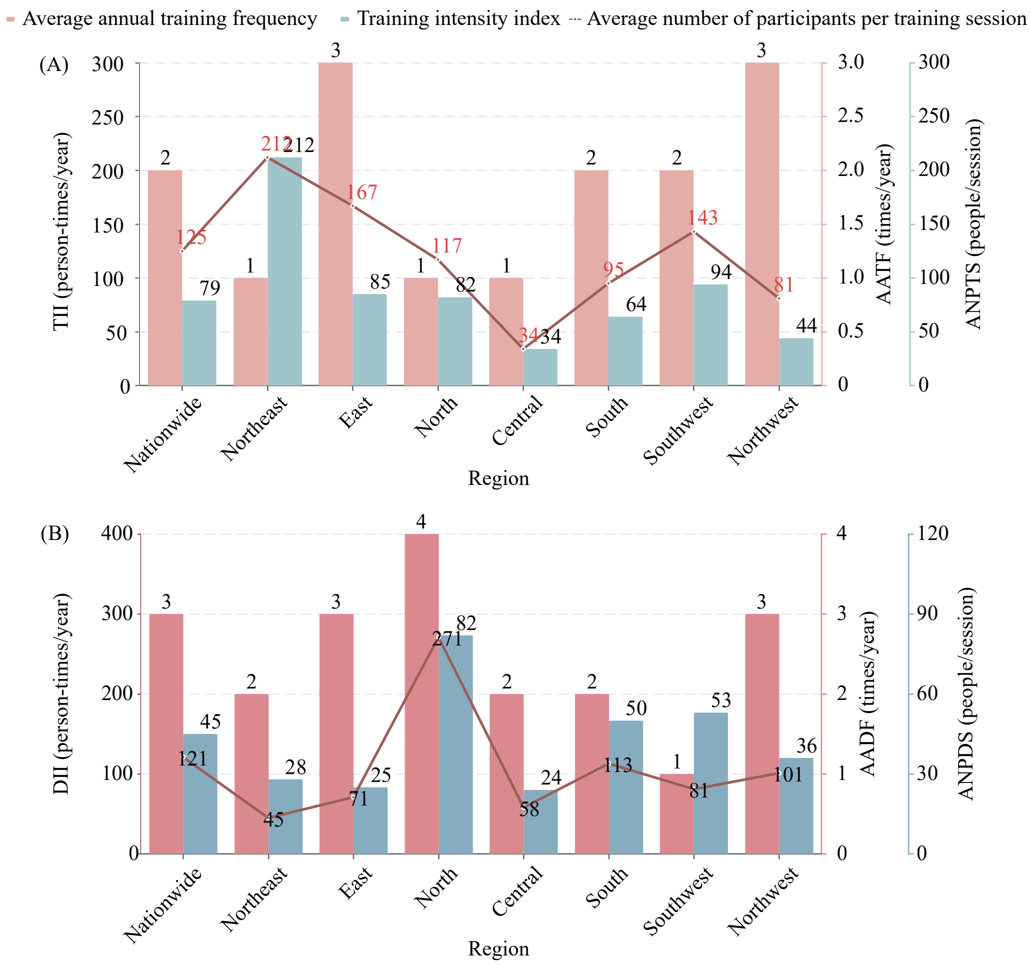

FIGURE 1. Comparative analysis of capacity-building activities for the National Emergency Response Team of Infectious Disease (2018–2023). (A) Trends in training frequency, participation, and intensity index for NERID. (B) Trends in drill frequency, participation, and intensity index for NERID.

Note: Data represent the average performance levels of individual teams within their respective geographic regions. Abbreviations: AATF=Average Annual Training Frequency; ANPTS=Average Number of Participants per Training Session; TII=Training Intensity Index; AADF=Average Annual Drill Frequency; ANPDS=Average Number of Participants per Drill Session; DII=Drill Intensity Index.

capacity by expanding dedicated staff positions, implementing robust incentive mechanisms, and establishing comprehensive performance evaluation systems. Second, advance digital infrastructure through systematic development of information management systems, standardized equipment coding, and dynamic protocol update mechanisms tailored to regional contexts. Teams should explore artificial intelligence applications for both information management and operational decision support. Third, enhance regional coordination by establishing shared platforms for equipment dispatch and maintenance, improving resource utilization efficiency and promoting standardized operational procedures across geographic areas.

The operational shortcomings identified above reflect a deeper systemic challenge: China's emergency management system has not fully transitioned from a "static organizational framework" to a "dynamic operational capability" in its top-level design and resource coordination. Comparative analysis reveals that regional disparities in NERID capabilities arise from multiple interconnected structural factors. Economic development imbalances and uneven fiscal investment across regions directly constrain sustainable resource allocation. Variations in professional talent pools, infrastructure maturity, and inter-agency collaboration networks further compromise system-wide resilience. Additionally, inconsistent training frequency and quality, combined with disparate field experience levels, compound these capability gaps. Critically, the heterogeneous public health risk profiles across regions — such as infectious disease threats in port cities versus inland areas — shape each team's strategic priorities for capacity building and resource deployment. This regional variation creates inherent tension between achieving national standardization and enabling context-appropriate local adaptation.

Based on the foregoing analysis, we propose three strategic priorities for NERID development. First, implement differentiated and dynamic resource-allocation standards. National authorities should establish both "minimum configuration standards" and "recommended configuration standards" for team development, with periodic updates to reflect evolving needs. A linkage mechanism between central transfer payments and local emergency-capacity assessment outcomes would incentivize performance improvements. Priority funding should target central and western regions and other underdeveloped areas to systematically reduce capacity disparities and establish a nationwide baseline of protection. Second, High-intensity, practice-oriented training for key NERID personnel should cultivate advanced competencies in rapid decision-making under complex circumstances, rigorous data analysis, and effective public health communication. Such programs would create a stable talent pool to support more precise national and local decision-making. Third, advance the modularization and standardization of core operational elements. Following a unified national standard framework, norms should be established for capability assessment, team composition, identification and signage, equipment interfaces, and management procedures. Achieving the "five standardizations" — standardized personnel allocation, identification, equipment configuration, capacity building, and management systems — will break down regional barriers, enabling resources from different regions to be rapidly integrated and efficiently coordinated when responding to emergencies of varying scales.

This study has several limitations that warrant consideration. First, reliance on self-reported data introduces potential biases. Although team leaders completed the questionnaire following detailed instructions, responses may have been influenced by social desirability bias — the tendency to present teams favorably — and recall bias concerning past activities. These biases could lead to systematic overestimation or underestimation of certain capabilities, particularly in subjective assessments of management systems. The absence of external validation through independent audits or observational records prevents full calibration of these biases, potentially affecting the absolute accuracy of reported metrics. Second, the cross-sectional design captures only a single time point, precluding analysis of dynamic trends in team capability development over time. Third, the Training Intensity Index and Drill Intensity Index quantify only frequency and participation, without capturing critical dimensions such as training quality, learning outcomes, or resource allocation efficiency. This limitation may constrain the comprehensiveness of our capacity assessment. To address these methodological gaps, future research should incorporate multiple data collection methods, including field observations, in-depth interviews with team members, and expert evaluations, to identify key factors and underlying mechanisms that influence team effectiveness.

NERID has successfully responded to numerous domestic and international public health emergencies while providing critical support for major events. Complementing this national capacity, provinces have progressively established municipal and county-level infectious disease emergency response teams, creating a four-tiered joint prevention and control system. This hierarchical structure exemplifies China's distinctive approach to public health governance, balancing centralized coordination with operational flexibility at multiple administrative levels. To build upon this foundation, several strategic enhancements are recommended. First, a comprehensive multi-level exercise system should be developed that integrates cross-sectoral and cross-regional collaboration. These exercises must incorporate realistic scenario simulations paired with rigorous evaluation and debriefing protocols to refine operational procedures continuously. Second, response capabilities should be tailored to regional risk profiles, emphasizing multi-task and multi-scenario preparedness. The integration of virtual simulation technologies and establishment of unified training platforms would systematically strengthen competencies in both post-disaster disease prevention and infectious disease outbreak management. Implementing these targeted improvements will elevate response quality, operational efficiency, and standardization across all teams, thereby ensuring robust preparedness for future public health challenges and effectively protecting population health and safety.

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[1] National Key Laboratory of Intelligent Tracking and Forecasting for

TABLE 2. Management practices and institutional development of the National Emergency Response Teams of Infectious Disease in China.

Management dimensions	Nationwide		Northeast		East		North		Central		South		Southwest		Northwest	
	N	***P***	***N***	***P***	***N***	***P***	***N***	***P***	***N***	***P***	***N***	***P***	***N***	***P***	***N***	***P***
Personnel management																
Personnel adjustment every 3 years	17	85.0	1	100.0	5	100.0	2	50.0	1	100.0	2	100.0	2	67.0	4	100.0
Establishment of incentive mechanisms	12	60.0	0	0	3	60.0	3	75.0	1	100.0	1	50.0	2	67.0	2	50.0
Incorporation into performance evaluation system	8	40.0	0	0	2	40.0	1	25.0	1	100.0	1	50.0	2	67.0	1	25.0
Information management																
Establishment of team archives	15	75.0	0	0	4	80.0	3	75.0	1	100.0	1	50.0	2	67.0	4	100.0
Dedicated personnel for managing team archives	16	80.0	1	100.0	4	80.0	4	100.0	1	100.0	2	100.0	3	100.0	1	25.0
Dedicated personnel for managing team information	15	75.0	0	0	4	80.0	4	100.0	1	100.0	2	100.0	3	100.0	1	25.0
Dedicated personnel for managing team publicity	8	40.0	0	0	4	80.0	0	0	0	0	1	50.0	0	0	3	75.0
Publicity through print media	1	5.0	0	0	0	0	0	0	1	100.0	0	0	0	0	0	0
Publicity through television	8	40.0	1	100.0	2	40.0	1	25.0	1	100.0	1	50.0	0	0	2	50.0
Publicity through radio	2	10.0	0	0	1	20.0	0	0	1	100.0	0	0	0	0	0	0
Publicity through social media	20	100.0	1	100.0	5	100.0	4	100.0	1	100.0	2	100.0	3	100.0	4	100.0
Vehicle management (*n*=18)																
Establishment of dedicated personnel for vehicle management	14	77.8	0	0	4	80.0	2	50.0	1	100.0	2	100.0	2	100.0	3	100.0
Routine maintenance of vehicles (*n*=18)																
Once every 1–3 weeks	5	27.8	0	0	1	20.0	1	25.0	1	100.0	0	0	1	50.0	1	33.0
Once every 1–2 months	8	44.4	0	0	2	40.0	2	50.0	0	0	2	100.0	1	50.0	1	33.0
Once every 3–5 months	2	11.1	0	0	2	40.0	0	0	0	0	0	0	0	0	0	0
Once every 6 months	3	16.7	1	100.0	0	0	1	25.0	0	0	0	0	0	0	1	33.0
Routine maintenance of vehicle-mounted equipment (*n*=18)																
Once every 1–3 weeks	1	5.6	0	0	0	0	0	0	0	0	0	0	1	50.0	0	0
Once every 1–2 months	8	44.4	0	0	1	20.0	2	50.0	0	0	2	100.0	1	50.0	2	67.0
Once every 3–5 months	5	27.8	0	0	4	80.0	0	0	0	0	0	0	0	0	1	33.0
Once every 6 months	4	22.2	1	100.0	0	0	2	50.0	1	100.0	0	0	0	0	0	0
Material and equipment management																
Establishment of dedicated personnel for material and equipment management	18	90.0	1	100.0	4	80.0	3	75.0	1	100.0	2	100.0	3	100.0	4	100.0
Establishment of a material and equipment management system	11	55.0	0	0	3	60.0	0	0	1	100.0	1	50.0	2	67.0	4	100.0
Establishment of a unified coding system for materials and equipment	9	45.0	0	0	2	40.0	2	50.0	0	0	1	50.0	0	0	4	100.0

Continued

Management dimensions	Nationwide		Northeast		East		North		Central		South		Southwest		Northwest	
	N	*P*	*N*	*P*	*N*	*P*	*N*	*P*	*N*	*P*	*N*	*P*	*N*	*P*	*N*	*P*
Establishment of storage facilities for materials and equipment	19	95.0	1	100.0	5	100.0	3	75.0	1	100.0	2	100.0	3	100.0	4	100.0
Dedicated personnel management of material and equipment operation and maintenance	17	85.0	0	0	5	100.0	3	75.0	0	0.0	2	100.0	3	100.0	4	100.0
Operational workflow for material and equipment maintenance	15	75.0	0	0	3	60.0	3	75.0	1	100.0	2	100.0	2	67.0	4	100.0
Institutional development																
Issuance of team management regulations	19	95.0	1	100.0	4	80.0	4	100.0	1	100.0	2	100.0	2	67.0	4	100.0
Regular revision of team management regulations	13	65.0	1	100.0	4	80.0	3	75.0	0	0.0	2	100.0	0	0	3	75.0
Issuance of equipment, vehicle, and material management regulations/manuals	17	85.0	1	100.0	3	60.0	4	100.0	1	100.0	2	100.0	2	67.0	4	100.0
Formulation of equipment and vehicle operation and maintenance support systems	17	85.0	0	0.0	5	100.0	3	75.0	1	100.0	2	100.0	2	67.0	4	100.0
Development of on-site work procedures/guidelines/ manuals	14	70.0	1	100.0	4	80.0	3	75.0	1	100.0	2	100.0	1	33.0	2	50.0
Establishment of an emergency duty system	16	80.0	1	100.0	4	80.0	3	75.0	1	100.0	2	100.0	2	67.0	3	75.0

Note: Data represent the average values for individual teams within their respective regions.
Abbreviations: *N*=Number; P=Proportion.

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REFERENCES

1. Zhou J, Xu SJ. Study on China's public health workforce construction under the perspective of public health emergency prevention and control. Soc Sci Rev 2021;36(5):88 – 95. https://doi.org/10.3969/j.issn.1007-9106.2021.05.016.
2. Potter MA, Miner KR, Barnett DJ, Cadigan R, Lloyd L, Olson DK, et al. The evidence base for effectiveness of preparedness training: a retrospective analysis. Public Health Rep 2010;125 Suppl 5(Suppl 5):15-23. http://dx.doi.org/10.1177/00333549101250S504.
3. Skryabina EA, Betts N, Reedy G, Riley P, Amlôt R. Evaluation of emergency preparedness exercises: the design of a questionnaire to measure staff perceptions. Int J Emerg Manage 2020;16(4):317. https://doi.org/10.1504/IJEM.2020.117209.
4. Zhao J, Wang YP, Zhao YQ, Yao JY. Discussion on the construction and management of national health emergency team of China CDC. Pract Prev Med 2022;29(4):502-5. http://dx.doi.org/10.3969/j.issn.1006-3110.2022.04.032. (In Chinese).
5. Tolbert PS, Zucker LG. Institutional sources of change in the formal structure of organizations: the diffusion of civil service reform, 1880-1935. Admin Sci Quart 1983;28(1):22 – 39. https://doi.org/10.2307/2392383.
6. Adams JS. Inequity in social exchange. Adv Exp Soc Psychol 1965;2: 267 – 99. https://doi.org/10.1016/S0065-2601(08)60108-2.

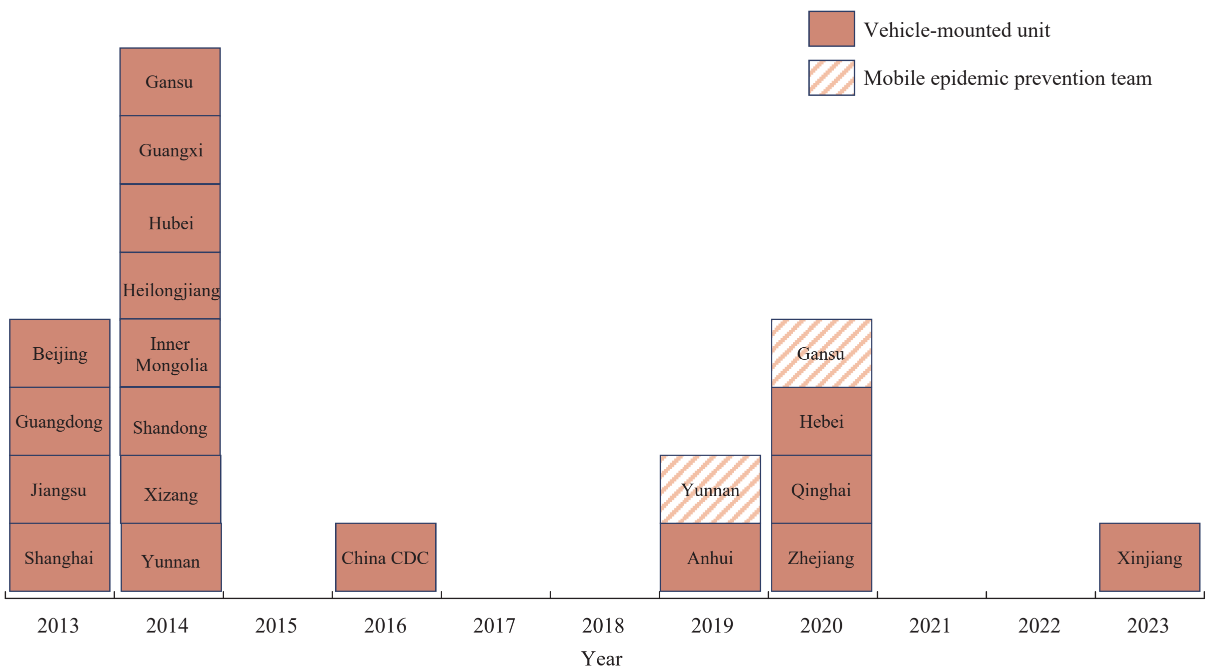
SUPPLEMENTARY MATERIAL

Detailed Methodology

This study employed a cross-sectional census design to comprehensively assess all National Emergency Response Teams of Infectious Disease (NERID) established by the end of 2023. The Chinese Center for Disease Control and Prevention administered the survey, distributing structured questionnaires to the designated team leaders of all 20 operational teams. Data collection occurred between November 2023 and April 2024, yielding 20 valid responses and achieving a 100% response rate.

Building upon findings from a 2016 national survey on emergency response capacity building, the research team developed the National Emergency Response Team of Infectious Disease Survey Questionnaire. This structured instrument encompasses four core domains: 1) team establishment and strategic deployment; 2) infrastructure construction and operational maintenance; 3) team management and operational procedures; and 4) training and drill exercises. To establish content validity, two public health emergency management experts reviewed the preliminary draft, and their feedback regarding relevance, clarity, and comprehensiveness was incorporated into subsequent revisions. Additionally, a pilot test involving two teams was conducted to refine questionnaire items and enhance overall applicability. Because the instrument was designed primarily to collect factual, descriptive information and resource allocation data — rather than to measure latent psychological constructs — structural validity tests such as factor analysis were not performed. Instead, validity was ensured through the expert review and pilot testing procedures described above.

During data collection, each team designated a liaison officer to coordinate questionnaire completion. To ensure data quality, a dual-review verification process was implemented. Following initial completion, each unit's questionnaire underwent internal review by a second team member. Subsequently, all forms were submitted to the research team for centralized verification by two independent researchers (authors: Yuqun Wang and Bing Li), who examined data consistency, completeness, and logical coherence, and performed double data entry using EpiData software (version 4.6, EpiData Association, Odense, Denmark). When discrepancies or ambiguities were identified during centralized review, a third senior researcher (author: Jing Zhao) was consulted to reach consensus resolution. This multistep procedure effectively minimized data entry and interpretive errors, thereby enhancing the reliability of the final dataset.



SUPPLEMENTARY FIGURE S1. NERID Distribution Dynamics, 2013–2023.
Abbreviation: NERID=National Emergency Response Team of Infectious Disease.

Data analysis was performed using Microsoft Excel 2019 (version 2019, Microsoft Corp., WA, USA) and SPSS (version 26.0, IBM SPSS Inc., Armonk, NY, USA). Following initial data cleaning, core data fields demonstrated completeness, with only minor, non-systematic missing responses observed in a limited subset of open-ended items. Descriptive statistics were subsequently calculated for all relevant variables, encompassing frequencies, percentages, means, and standard deviations. To provide a comprehensive assessment of training and drill intensity, two composite indices were developed: the Training Intensity Index and the Drill Intensity Index. Each index was operationalized as the product of the annual average frequency of the respective activity and the mean number of participants per session, thereby capturing both the regularity and scale of capacity-building efforts.

Seven Geographic Regions

Northeast China: Heilongjiang provincial-level administrative division (PLAD); East China: Anhui, Jiangsu, Shanghai, Shandong, Zhejiang PLADs; North China: Beijing, Hebei, Inner Mongolia PLADs; Central China: Hubei PLAD; South: Guangdong, Guangxi PLADs; Southwest China: Xizang, Yunnan PLADs; Northwest China: Gansu, Qinghai, Xinjiang PLADs

Preplanned Studies

Construction of Evaluation Indicators for the Public Health System in Primary and Secondary Schools — Beijing, China, 2024–2025

Xinyu Hou[1]; Mei Gu[1]; Jingxuan Zhao[1]; Jia Yang[1,#]

Summary

What is already known about this topic?

International frameworks for evaluating school public health primarily emphasize enhancing student health literacy, whereas domestic research tends to focus on isolated domains, resulting in a fragmented system lacking comprehensive integration.

What is added by this report?

Through two rounds of expert consultations, this study developed a three-tier evaluation indicator system for Beijing's primary and secondary school public health system, comprising 59 indicators. The results demonstrated strong expert consensus and high reliability.

What are the implications for public health practice?

The indicator system developed in this study demonstrates high levels of expert participation, authority, and coordination, which supports its practical applicability. It provides actionable guidance for strengthening and improving public health systems in primary and secondary schools.

ABSTRACT

Introduction: To construct a set of evaluation indicators suitable for the public health system in primary and secondary schools in Beijing, this study aimed to provide a basis for objectively assessing the current status of system development and identifying future directions for improvement.

Methods: An indicator pool was established based on literature reviews and expert consultation. The indicator system was then refined and finalized through two rounds of the Delphi method, and the weights of the indicators were determined using the analytic hierarchy process.

Results: The expert participation rate reached 100%, and the average expert authority coefficient was 0.87. The indicator coordination coefficient W was statistically significant (*P*<0.001). Ultimately, an evaluation system comprising 5 first-level indicators, 15 second-level indicators, and 39 third-level indicators was developed.

Conclusion: The indicator system constructed in this study shows good expert consistency and credibility. It can effectively pinpoint key components of system development, providing a scientific foundation for optimizing resource allocation and supporting ongoing improvement.

School public health is a key part of the public health system, responsible for promoting healthy habits and improving adolescent health literacy, and has now been elevated to a national strategic level. In 2023, the General Offices of the CPC Central Committee and the State Council issued the "Opinions on Building a High-Quality and Balanced Basic Public Education Service System," clearly emphasizing the need to strengthen school health systems and signaling a new stage in the development of school public health capacity. Various international frameworks for evaluating school health have been developed, such as the WHO's Health-Promoting Schools framework, the United States' Comprehensive School Health Program, and Germany's Health-Literate Schools model. These frameworks primarily focus on student health literacy and do not comprehensively assess the full scope of school health work. In China, school health services cover multiple areas (*1–2*), but evaluation research remains fragmented (*3–5*), as there is no comprehensive system that integrates multiple components and considers both internal and external factors. To address this gap, this study applied the Delphi method combined with the Analytic Hierarchy Process (AHP) to construct an evaluation indicator system for the public health infrastructure in primary and secondary schools, aiming to assess current conditions and support the physical and mental development of adolescents.

This study began in October 2024 and completed two rounds of the Delphi method within six months. Twenty experts of primary and secondary school public health system were selected, based on representativeness and professional expertise. The group included: 1) Policymakers and administrators holding (deputy) section-level or (deputy) senior titles, ensuring alignment between indicators and policy frameworks as well as practical feasibility; 2) Technical professionals with (deputy) senior titles, contributing clinical and disease prevention expertise to inform indicator development; 3) Researchers with (deputy) senior titles, providing scientific and theoretical support; and 4) Frontline practitioners with more than 10 years of school health experience, ensuring that the indicators reflect real-world operational needs (Table 1).

A Delphi expert evaluation system using a five-point Likert scale was employed to assess each indicator in

TABLE 1. Basic information of the experts in the Delphi method.

Basic information	Number	Percentage (%)
Gender		
Male	4	20
Female	16	80
Age (years)		
≤40	3	15
41–45	7	35
46–50	2	10
≥51	8	40
Educational qualifications		
Undergraduate degree	10	50
Master’s degree	6	30
Doctoral degree	4	20
Professional title		
Intermediate level	8	40
Associate senior level	6	30
Advanced level	4	20
Other	2	10
Years of working (years)		
5–10	2	10
11–15	5	25
16–20	4	20
≥21	9	45
Work direction/research field		
School health	12	60
Children and adolescents nutrition and health care (management)	6	30
Social medicine and health service management	2	10
Organization in which one works		
Primary and secondary schools	5	25
Higher medical colleges and research institutions	2	10
Medical institutions (hospitals, centers for disease control, physical examination centers)	5	25
School health care system	7	35
Administrative departments for education	1	5

terms of importance, operability, and sensitivity. Statistical analysis was performed using SPSS (version 26.0), which generated arithmetic means, full-score frequencies, coefficients of variation, and Kendall's W concordance coefficients for each indicator. Indicators that ranked in the bottom 10% across any two or more dimensions were marked for elimination after expert deliberation (*6*). Finally, an AHP judgment matrix was constructed to calculate the weights of indicators at all levels.

Drawing on the *Guiding Opinions on Strengthening the Construction of Public Health System in Schools in Beijing*, issued by the Beijing Municipal Education Commission and the Beijing Municipal Health Commission, a review of the literature on school health services, student healthcare, and health education — combined with expert input — resulted in the development of an initial indicator pool of 67 items (Table 2).

This study conducted two rounds of expert consultations. The questionnaire response rate was 100%, indicating strong expert engagement. The average Cr value for first-level indicators was 0.87, reflecting good reliability. All first-level indicators scored above 4.0 points for importance, operability, and sensitivity. Their coefficients of variation were below 0.25, and full-score frequencies exceeded 20%. Kendall's W concordance coefficient reached statistical significance (P<0.001), with an upward trend (importance: 0.167→0.239; operability: 0.207→0.230; sensitivity: 0.199→0.317), indicating increasing expert consensus and high reliability on results.

TABLE 2. Construction and modification of evaluation indicators for the public health system in primary and secondary schools.

Initial indicator system	Final indicator system (after the 2nd-round)
A Public health governance	**A Public health governance system**
A1 Work system and mechanism	A1 Work system and mechanism
A11 Leading group	A11 Leading group
A12 Development plan	A12 Development plan
A2 Healthy school (bonus point)	A2 Healthy school (bonus point)
A21 Characteristic health school	A21 Specialized health school (bonus point)
A3 Cooperative education mechanism	A3 Cooperative education mechanism
A31 Home–school collaboration	A31 Home-school collaboration
A32 School–community collaboration (vice principal for health)	A32 School-community collaboration (vice principal for health)
B Public health emergency management and infectious disease prevention and control capabilities	**B Public health emergency management and infectious disease prevention and control capabilities**
B1 Emergency management	B1 Emergency management
B11 Emergency response plan	B11 Emergency response plan
B12 Emergency drill	B12 Emergency drill
B13 Temporary observation place	B13 Establishment of temporary observation places
B14 Infectious disease epidemic report	B14 Infectious disease epidemic report
B2 Monitoring and early warning	B2 Monitoring and early warning
B21 Morning, noon (evening) health check	B21 Morning, noon, and evening health checks
B22 Absent from class or attendance due to illness	B22 Follow-up visits due to absence from school or attendance due to illness
B23 Verification of the certificate for resuming classes	B23 Certificate/record of resumption of classes
B3 Daily prevention and control	B3 Daily prevention and control
B31 Vaccination	B31 Vaccination
B32 Disinfection and ventilation	B32 Disinfection and ventilation
C Prevention and control of common diseases	**C Capacity for prevention and control of common diseases**
C1 Monitoring of common diseases	C1 Monitoring of common diseases
C11 Student physical examination (physical test)	C11 Student physical examination (physical test)
C12 Inform students of their physical health	C12 Inform students of their physical health

Continued

Initial indicator system	Final indicator system (after the 2nd-round)
C13 Student physical examination results	C13 Student physical examination results
C14 Faculty and staff physical examination (bonus point)	C14 Faculty and staff physical examination (bonus point)
C2 Intervention for common diseases	C2 Intervention for common diseases
C21 Physical exercise	C21 Physical exercise
C22 Break between classes	C22 Break between classes
C23 Sports activities (bonus point)	C23 Sports activities (bonus point)
C3 Myopia prevention and control	C24 Myopia prevention and control
C31 Vision examination	
C32 Eye exercises	
C33 Classroom equipment and facilities	
C34 Poor vision file	
C4 Mental health services	C3 Mental health services
C41 Mental health education resources	C31 Mental health education resources
C42 Mental health assessment	C32 Mental health assessment
C43 Psychological counseling room	C33 Psychological counseling room
C44 Psychology teaching and research group (bonus point)	C34 Psychology teaching and research group (bonus point)
C45 Psychological referral green channel (bonus point)	
D Health education	**D Health education system**
D1 Health education course	D1 Health education resources
D11 Health education course	D11 Health education course
D12 Full-time and part-time health education teachers (bonus point)	D12 Health education publicity and training
D13 Health education publicity and training	D13 Establishment of health institutions (bonus point)
D2 Evaluation of health literacy	D2 Evaluation of health literacy (bonus point)
D21 Evaluation of students' health literacy	D21 Student health literacy evaluation (bonus point)
D22 Student first aid education and training (bonus point)	D22 First aid education and training (bonus point)
D3 Health education resources	
D31 Establishment of health institutions (bonus point)	
E Public health resource	**E Guarantee of public health resource**
E1 Construction of hygiene (health care) rooms	E1 Construction of hygiene (health care) rooms
E11 Hygiene (health care) room qualifications	E11 Qualification of hygiene (health care) room
E12 Number of health professionals (health care teachers)	E12 The number of health professionals (health care teachers)
E13 Qualifications of health professionals (health care teachers)	E13 Qualification of health professionals (health care teachers)
E14 Skills training for health professionals (health care teachers) (bonus point)	E14 Skills training for health professionals (health care teachers) (bonus point)
E2 Funding guarantee for the construction of the public health system	E2 Funding guarantee for the construction of the public health system
E21 Use of funds	E21 Use of funds
E3 Other infrastructure guarantees	E3 Other infrastructure guarantees
E31 Track and field venue	E31 First aid equipment and facilities
E32 First aid equipment and facilities	
E4 Technological support (bonus point)	E4 Technological support
E41 Establish an information platform for students' health check-ups and physical fitness tests	E41 Report students' health check-ups and physical fitness tests to the information platform
E42 Applying big data and ai to school health and wellness services	E42 Applying big data, AI, and other technologies to support serve the construction and innovation of school health and hygiene (bonus point)

Note: X represents a first-level indicator, Xn a second-level indicator, and Xnn a third-level indicator.

After two screening rounds, the evaluation index system for the public health system in primary and secondary schools in Beijing included five first-level indicators, 15 second-level indicators, and 39 third-level indicators (Table 2). The first-level indicators comprised the public health governance system; public health emergency management and infectious disease prevention and control capabilities; capacity for prevention and control of common diseases; health education system; and guarantee of public health resources.

Indicator weights were calculated using the AHP. An analysis model was built with four layers: the target layer (I), the criterion layers (II and III), and the solution layer (IV). Based on the mean importance scores from the second round of expert evaluations, a judgment matrix was constructed using Saaty's scale and tested for consistency (CR<0.10). The weights of indicators at each level were calculated based on the mean importance scores from pairwise comparisons. Composite weights were obtained through multiplicative hierarchical aggregation. The results are shown in Table 3.

DISCUSSION

The Chinese school health system currently faces systemic challenges, including weak institutional mechanisms, limited capacity to prevent and control common and infectious diseases, insufficient health-behavior promotion, and uneven resource allocation, which hinders the transition from "passive response" to "active prevention and control" (*7–8*). To address the lack of a comprehensive evaluation framework, this study integrated the Delphi method and AHP to develop an evaluation index system for public health in primary and secondary schools. The active coefficients of both expert rounds were 100%, the expert authority coefficient (Cr=0.87) exceeded 0.70, and Kendall's W values were statistically significant (P<0.001), indicating strong consensus, high reliability, and solid scientific and practical validity.

The five first-level indicators were weighted as follows: B (0.417), A (0.265), C (0.177), E (0.094), and D (0.048). This distribution aligns with national priorities for school health. In 2021, the Ministry of Education and four other departments issued the "Opinions on Comprehensively Strengthening and Improving School Health and Health Education in the New Era," emphasizing stronger emergency response capabilities in schools based on lessons from COVID-19. The high weight of indicator B reflects schools' role as key sites for infectious disease transmission in China (*9*), where density and mobility increase risk. As emerging infectious diseases remain a global threat, school-based prevention is essential. Persistent

TABLE 3. Evaluation indicators of the public health system in primary and secondary schools in Beijing Municipality.

First-level indicator	Indicator weight	Second-level indicator	Weight	Third-level indicator	Weight
A Public health governance system	**0.265**	A1 Work system and mechanism	**0.785** (0.208)	A11 Leading group	**0.750** (0.156)
				A12 Development plan	**0.250** (0.052)
		A2 Healthy school (bonus point)	**0.066** (0.017)	A21 Specialized health school (bonus point)	**1.000** (0.017)
		A3 Cooperative education mechanism	**0.149** (0.039)	A31 Home-school collaboration	**0.875** (0.034)
				A32 School-community collaboration (vice principal for health)	**0.125** (0.005)
B Public health emergency management and infectious disease prevention and control capabilities	**0.417**	B1 Emergency management	**0.540** (0.225)	B11 Emergency response plan	**0.245** (0.055)
				B12 Emergency drill	**0.153** (0.034)
				B13 Establishment of temporary observation places	**0.053** (0.012)
				B14 Infectious disease epidemic report	**0.549** (0.124)
		B2 Monitoring and early warning	**0.297** (0.124)	B21 Morning, noon, and evening health checks	**0.333** (0.041)
				B22 Follow-up visits due to absence from school or attendance due to illness	**0.528** (0.065)
				B23 Certificate/record of resumption of classes	**0.140** (0.017)
		B3 Daily prevention and control	**0.163** (0.068)	B31 Vaccination	**0.500** (0.034)
				B32 Disinfection and ventilation	**0.500** (0.034)

Continued

First-level indicator	Indicator weight	Second-level indicator	Weight	Third-level indicator	Weight
C Capacity for prevention and control of common diseases	0.177	C1 Monitoring of common diseases	**0.614** (0.109)	C11 Student physical examination (physical test)	**0.577** (0.063)
				C12 Inform students of their physical health	**0.149** (0.016)
				C13 Student physical examination result	**0.223** (0.024)
				C14 Faculty and staff physical examination (bonus point)	**0.052** (0.006)
		C2 Intervention for common diseases	**0.268** (0.047)	C21 Physical exercise	**0.495** (0.023)
				C22 Break between classes	**0.133** (0.006)
				C23 Sports activities (bonus point)	**0.061** (0.003)
				C24 Myopia prevention and control	**0.311** (0.015)
		C3 Mental health services	**0.117** (0.021)	C31 Mental health education resources	**0.302** (0.006)
				C32 Mental health assessment	**0.473** (0.010)
				C33 Psychological counseling room	**0.187** (0.004)
				C34 Psychology teaching and research group (bonus point)	**0.039** (0.001)
D Health education system	0.048	D1 Health education resources	**0.750** (0.036)	D11 Health education course	**0.699** (0.025)
				D12 Health education publicity and training	**0.237** (0.009)
				D13 Establishment of health institutions (bonus point)	**0.064** (0.002)
		D2 Evaluation of health literacy (bonus point)	**0.250** (0.012)	D21 Student health literacy evaluation (bonus point)	**0.250** (0.003)
				D22 First aid education and training (bonus point)	**0.750** (0.009)
E Guarantee of public health resources	0.094	E1 Construction of hygiene (health care) rooms	**0.515** (0.048)	E11 Qualification of hygiene (health care) room	**0.463** (0.023)
				E12 Number of health professionals (health care teachers)	**0.176** (0.009)
				E13 Qualification of health professionals (health care teachers)	**0.275** (0.014)
				E14 Skills training for health professionals (health care teachers) (bonus point)	**0.085** (0.004)
		E2 Funding guarantee for the construction of the public health system	**0.332** (0.031)	E21 Use of funds	**1.000** (0.031)
		E3 Other infrastructure guarantees	**0.090** (0.008)	E31 First aid equipment and facilities	**1.000** (0.008)
		E4 Technological support	**0.064** (0.006)	E41 Reporting students' health check-ups and physical fitness tests to the information platform	**0.800** (0.005)
				E42 Applying big data, AI, and other technologies to support the construction and innovation of school health and hygiene (bonus point)	**0.200** (0.001)

Note: Bold means the weights of indicators at each level; ( ) means the composite weights

challenges such as fragmented management, weak professional support, and poor coordination underscores the need for improved top-level design (*8*). Indicator A addresses these issues: A1 establishes a principal-led leadership group integrating teaching, logistics, and health functions, while A3 introduces a vice-principal for health and promotes home-school-community collaboration. This strengthens emergency management and governance, therefore forming the core of school health protection.

Among the 15 second-level indicators, the five highest-weighted — B1 (0.225), A1 (0.208), B2 (0.124), C1 (0.109), and B3 (0.068) — account for 73.4% of the total. The prominence of B1 aligns with Ou Qixiang et al.'s emphasis on emergency response capacity (*3*). Although indicator C carries a lower overall weight, C1 ranks fourth overall, highlighting the importance of accurate monitoring for disease prevention. C1 and C32 depend on A1 for institutional support, use B2 for symptom-data sharing, and rely on A3 to facilitate home-school collaboration. Indicator E's weight (0.094), concentrated in E1 (0.048) and E2 (0.031), reflects its supporting role. This suggests that current challenges stem less from hardware shortages than from the need to improve resource allocation — achievable through indicators A (e.g., A1) and B (e.g., B2). Indicator D has the lowest weight because its effects are long-term rather than immediately operational. Health education, represented by D11 (0.025), must be embedded in practical activities such as disease prevention (e.g., C24) and emergency management (e.g., B12). Its evaluation (e.g., D21) serves as an "add-on," combining qualitative and quantitative approaches while avoiding overly rigid metrics. The 2021 National Opinions also call for reorganizing health education to establish a high-quality system. The indicator weights in this study guide schools to promote healthy behavior through multisystem linkage (e.g., C3 and A31). Lower-weighted indicators operate effectively only when supported by higher-weighted governance and emergency-management systems, highlighting that strengthening these foundations is essential for maximizing disease prevention, ensuring resource availability, and improving health education.

The findings in this report are subject to at least two limitations. First, due to differences in organizational structures, management models, and health needs across educational levels, it is difficult to develop a unified public health evaluation system applicable to all settings. The current index system is designed for primary and secondary schools and cannot be directly applied to universities or kindergartens. Second, the system has not yet undergone empirical testing. Future research will use mixed methods to conduct empirical assessments of school public health systems and validate the scientific validity, feasibility, and applicability of the indicators.

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REFERENCES

1. Wang ZY. A centennial review and prospect of school health in China. Chin J Sch Doct 2023;37(1):73 – 8. https://doi.org/10.20161/j.cnki.32-1199/r.2023.01.023.
2. Dong YH, Chen L, Ma J, Song Y. Constructing a high-level school health system to facilitate joint prevention practice of common diseases among students. Chin J Sch Health 2024;45(5):609 – 14. https://doi.org/10.16835/j.cnki.1000-9817.2024160.
3. Ou QX, Liu FG. Strategies to enhance the emergency management system for public health emergencies in schools. Chin J Sch Health 2023;44(4):485 – 8. https://doi.org/10.16835/j.cnki.1000-9817.2023.04.002.
4. Qi TT, Zhu F, Zhu GY, Guo SH, Yang S, Wu HY, et al. Preliminary development with reliability and validity testing of health literacy assessment scale for junior high school students. Chin J Sch Health 2025;46(6):816 – 20,826. https://doi.org/10.16835/j.cnki.1000-9817.2025164.
5. Xiao L, Zhao B. Establishment and application of quantitative evaluation index for risk prevention and control of cluster infectious diseases in the school. Chin Public Health Manage 2021;37(2):237 – 40. https://doi.org/10.19568/j.cnki.23-1318.2021.02.0027.
6. Zhao N, Yang J, Gao GY, Han YL, Sun LG. Research on the construction of medical insurance high-quality development index evaluation system in Beijing. Chin Health Econ 2023;42(4):20-4. http://www.cn-he.cn/ch/reader/view_abstract.aspx?file_no=20230405&flag=1. (In Chinese).
7. Song Y. Guided by the national health strategy, comprehensively promote the high-quality and balanced development of the school health service system. People's Educ 2023(Z2):82-5. https://kns.cnki.net/kcms2/article/abstract?v=zYSMMY9t1sc3-YrmXun7kpAaGXHXEwNq1HZdJZB5Paz7rvw0QX6xSGDf-7VAwfOkVVYJwTPzINuEzhZMAu7lEHMw026Af0ot_Fqyt8N9uG-KOr_7_45GXychsfSDcMFYJszXFECCXZpMfn_XI7RZDF_tTYfWtKO0uCTlbc-cdsVfitQ-_Fy1bQ==&uniplatform=NZKPT&language=CHS. (In Chinese).
8. Liu Y, Liu DS, Tang XZ, Lin LL. School health work situation and tasks in China. Chin Public Health Manage 2021;37(2):191 – 4. https://doi.org/10.19568/j.cnki.23-1318.2021.02.0014.
9. Du MX, Zhu KY, Yang K, Kong QF, Gao J, Meng L, et al. Analysis on characteristics of detections of public health emergencies caused by infectious diseases in China, 2023. Dis Surveill 2025;40(6):745 – 8. https://doi.org/10.3784/jbjc.202503160178.

Perspectives

Student-Oriented Competency Building Module: Implications for the Improvement of Global Health Education

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ABSTRACT

In response to growing uncertainty in global health driven by geopolitical tensions, pandemics, and climate-related challenges, global health education must evolve to equip students with theoretical knowledge and core competencies, such as leadership, cross-cultural communication, and strategic thinking. This study reviews the updates to the International Health Project Management (IHPM) course and examines its three key changes: introducing a student-oriented teaching module, incorporating teamwork and role-play to promote autonomy and accountability; expanding geographic flexibility to encourage broader strategic thinking; and strengthening team dynamics through clearer role definitions and targeted support mechanisms. Students formed project teams, established internal regulations, and selected global health scenarios for project design. This revised approach fostered in-depth discussions that encouraged open-minded thinking, enabling students to move beyond disease-focused content to strategic systemic considerations. Greater group ownership also improved collaboration and accountability, addressing common teamwork challenges such as role confusion and uneven participation. However, the analytical depth varied depending on students' disciplinary backgrounds. Finally, we argue that a tiered curriculum that moves from theory to competency building can better support student growth. Overall, these findings highlight the potential of student-oriented approaches to strengthen leadership, cross-cultural communication, and strategic thinking, competencies essential for contributing to a shared future for global health.

Global health is increasingly shaped by complex, evolving factors, including geopolitical tensions, pandemics, and climate-related threats, which heighten uncertainty (*1–2*). The United States' (US) announcement of its withdrawal from the World Health Organization (WHO) and its decision to cease negotiations on the WHO Pandemic Agreement further complicated global health governance. For this reason, global health education should evolve to address emerging realities and to respond effectively to increasingly complex and uncertain global challenges (*3*).

With a vision of a shared health future, global health education must nurture the next generation not only with knowledge and technical skills but also, importantly, with competencies such as leadership, cross-cultural communication, and strategic thinking (*4*). Accordingly, in 2024, we transitioned our undergraduate International Health Project Management (IHPM) course from conventional, theory-based instruction to a teamwork-focused module incorporating role-play (*5*).

The module integrating teamwork and role-play was conceptually grounded in the Global Health Education Competencies Toolkit (*6*) and WHO guidelines on transformative, interprofessional education (*7–8*). These frameworks emphasize leadership, teamwork, communication, collaborative practice, and systems thinking, which we operationalized in the course through student-centered projects, role-play simulations, and peer-accountability mechanisms.

The course substantially improved students' competencies in global health. However, the teamwork module revealed challenges similar to those reported in prior studies (*9*), including weak leadership, communication breakdowns, and unequal workload distribution. Students also tended to focus narrowly on disease-based scenarios, highlighting gaps in leadership, communication, and strategic thinking. These observations motivated the adoption of a student-oriented teaching approach in 2025, designed specifically to address those issues.

The 2025 course introduced three major changes: 1) a student-oriented management structure to empower students with autonomy and accountability; 2) a simulation scenario based on China's Belt and Road Initiative; and 3) refined teamwork assessment mechanisms to promote fairness and reduce internal conflicts.

This study employed a qualitative design with content analysis to examine students' written reflections and group outputs. Two authors independently coded and analyzed the qualitative materials, having participated in teaching and contributed collectively to the interpretation and synthesis of findings. Any discrepancies were resolved through discussion until consensus was reached.

Student-Oriented Teaching Module: Enhancing Autonomy

The student-oriented module provides students with genuine decision-making authority and ownership while operating within a clearly defined organizational framework that structures their learning. Students are first self-nominated as team leaders, then they serve as project-office directors, and subsequently join teams through a mutual selection process that mirrors real-world recruitment. Each team designs its own internal management system, defines roles and responsibilities, and establishes operating rules. Allowing students to create and govern these structures within a set project framework enables them to practice decision-making, negotiation, and collective rule-setting in an authentic project environment. The processes, organizational arrangements, and decisions are directed by the students rather than the instructors. The students determine team structures, role responsibilities, internal rules, workflows, and task coordination, whereas the instructors clarify core competencies in global health and provide thematic guidance and academic support. This approach ensures that the direction, pace, and mechanisms of learning are shaped by the students' choices and accountability to their peers.

First, students acquired theoretical knowledge through the XueTangX platform, where lecturers provided recorded lessons and complementary materials. The platform also included an online discussion board that allowed students to pose questions, share reflections, and seek clarification. By shifting theoretical instruction to online self-learning, instructors were able to dedicate more in-class time to discussion and process monitoring, thereby supporting the implementation of a student-oriented teaching model.

Second, teamwork within the role-play module was refined to promote student-oriented engagement. All students participated in a simulated program titled *Health System Enhancement for Pandemic Preparedness*, and each group selected a global health scenario of their choice.

As shown in Figure 1, students independently formed their teams, assigned functional roles, such as team leader, finance officer, evaluator, and communication manager, and took full responsibility for defining the duties associated with each role. They also established a project-office structure and developed internal regulations on coordination, accountability, and performance evaluation through self-directed discussion and decision-making.

Third, students submitted a concept note in week 3, and a full project proposal in week 12, each accompanied by a group presentation. Instructors jointly evaluated the quality of these submissions using two criteria: the scope of the selected topic, from disease-specific projects to broader health-system strengthening or whole-of-government approaches, and the extent to which students integrated interdisciplinary knowledge beyond public health, including policy, international relations, and social-science perspectives.

Open Geographic Selection: Encouraging Broader Topics and Strategic Thinking

Students explored a wide range of global health topics and selected field sites across different regions, including two Asian countries chosen by Groups A and C and two African countries participating in the Belt and Road Initiative chosen by Groups B and D (Table 1). For example, Group D adapted its project to the local context by selecting real communities, Ketu, Ikeja, and Alimosho, and by considering local health challenges such as malaria. The group also incorporated locally familiar communication channels, including Yoruba–English materials, and engaged community and religious leaders through SMS and WhatsApp. However, although instructors shared their field experiences in African settings during class discussions, this support may not have been sufficient for students to fully understand local health governance. Students exhibited gaps in understanding system capacities, such as they assume stable electricity and internet infrastructure, and proposing advanced tools such as blockchain or machine-learning platforms. To strengthen cross-regional adaptation,

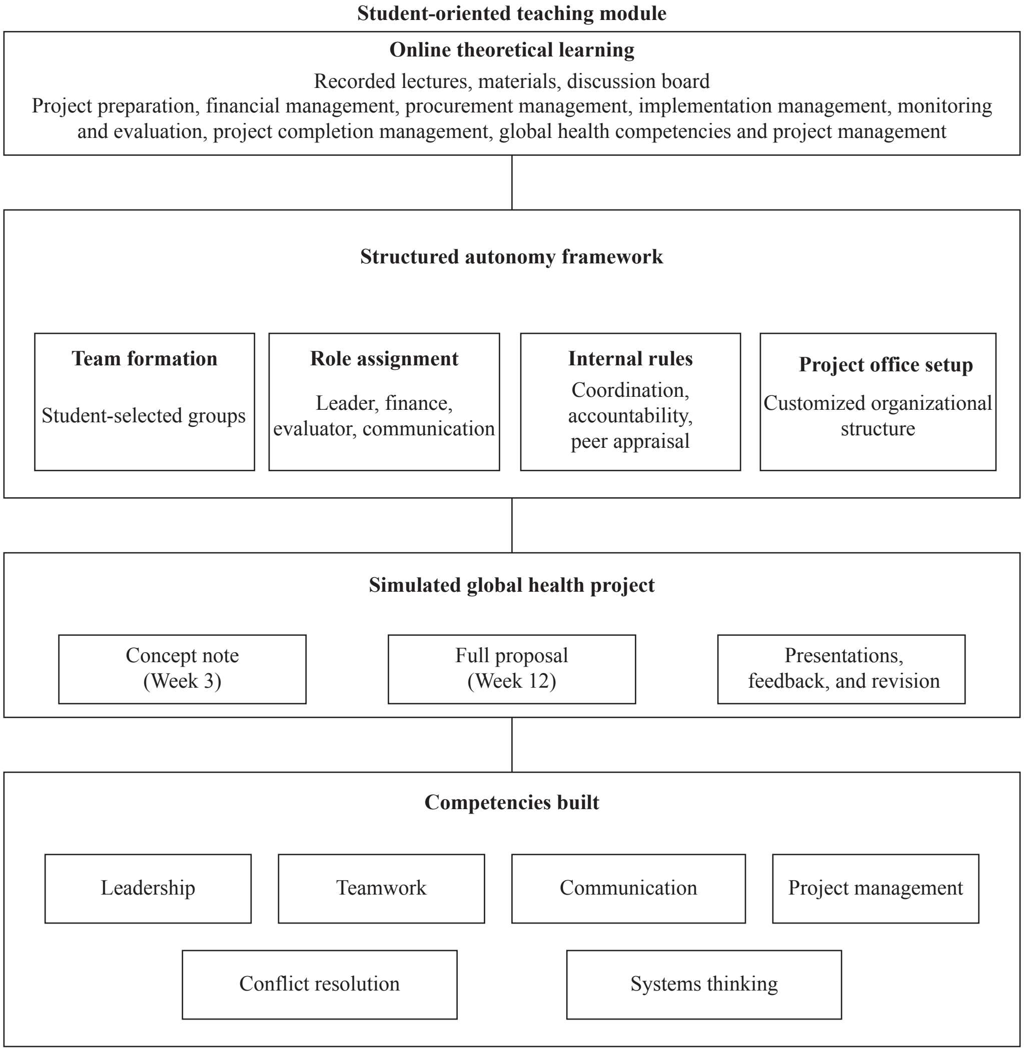

FIGURE 1. Conceptual structure of the teaching module.

future iterations of the course will invite global health practitioners with experience in African and Southeast Asian contexts to provide targeted guidance to each group.

The 2025 cohort also moved beyond disease-focused topics to adopt more strategic approaches, including health-system strengthening and policy planning. For instance, Group B designed a national surveillance strategy focusing on antimicrobial resistance and developed a surveillance system for antimicrobial-resistance monitoring, whereas Group A integrated social-media tools into an HIV-prevention intervention for resource-limited urban communities in India.

Some students demonstrated strong interdisciplinary thinking. For example, Group A combined public health knowledge with communication strategies to design an HIV-prevention project in India, proposing media campaigns and narrative-based tools to reach target populations.

Greater Autonomy and Teaching Assistance Guidance: Promoting Equity and Reducing Conflicts

Several challenges observed in the earlier iterations of the teamwork module, such as uneven participation and excessive competition, were addressed by the 2025 cohort (Table 2). To promote a more balanced engagement, each group developed internal regulations and clearly defined job descriptions. A new *coordinator* role was introduced to facilitate communication and coordination within teams. Smaller group sizes and increased role clarity also strengthened accountability. Teaching assistants actively monitored group discussions to encourage equitable participation. Taken together, these improvements fostered a more

TABLE 1. Students' project presentation topics (2024 *vs*. 2025).

Year	Group (No. of students)	Project topic		
		Health issue	Health intervention	Field site
2025	A (5)	HIV mother-to-child transmission	Integration of social media and traditional healthcare activities	India (Dharavi, Mumbai)
	B (6)	Health strategy development	Strategic planning (Focusing on GLASS-AMR system)	Senegal
	C (6)	Dengue fever	Prevention and competency building in primary care setting	Cambodia (Three provinces)
	D (6)	Malaria	Health system strengthening	Nigeria
2024	E (11)	Dengue fever	Aedes detection	Bali, Indonesia
	F (10)	Healthcare	Developing digital surveillance platform	Vietnam, Thailand, Cambodia
	G (10)	Dengue fever	Prevention competency building through cooperation	The Philippines
	H (9)	Competency building for health institutions	Healthcare aid	Rural areas in Laos
	I (9)	Cervical cancer	Preventive intervention	Kanali province in western Nepal

Abbreviations: HIV=Human immunodeficiency virus; GLASS-AMR=Global antimicrobial resistance and use of a surveillance system for antimicrobial resistance.

TABLE 2. Challenges and solutions of the student-oriented model.

No.	Challenges emerged in 2024	Solutions in 2025	Results observed
1	Conflicts among team members and weak leadership affected collaboration.	Redesigned the role-play module to include 1) A new "coordinator" role; 2) Developing an internal regulation in each group.	No interpersonal conflicts were reported.
2	Unequal task distribution and lack of a shared goal led to "Hitchhiking."	1) Students drafted job descriptions and responsibilities at the beginning; 2) Teaching assistant monitored group discussions; 3) Smaller groups	No complaints of "Hitchhiking" were reported.
3	Difficulties in individual assessment of students.	Supplemented group presentations with individual online learning tasks using online course in the XuetangX platform.	The platform tracked and recorded individual engagement and effort.
4	Excessive competition among students negatively impacted teamwork and peer assessment.	Teaching assistants were more actively involved as facilitators to guide group discussions and reduce competition.	Improved collaboration and more balanced participation were observed across teams.

collaborative and supportive learning environment, enabled students to build practical skills, and enhanced the overall effectiveness of the course.

Reflections on Course Implementation and Global Health Education

This student-oriented approach aligns with China's global health training needs, as many students have limited practical experience in leadership, teamwork, and conflict resolution. By assuming responsibility for team organization and internal coordination, they develop competencies that are rarely cultivated in traditional teacher-led curricula. Drawing on observations from the 2025 IHPM course, this section outlines the new challenges encountered and discusses their implications for strengthening global health education.

Deep discussions foster open-minded thinking. Compared with the traditional disease-centered perspective that dominates global health cooperation, students in the 2024/2025 cohort began examining broader strategic and systemic issues. This shift indicates that student-oriented models, particularly those emphasizing exploration, discussion, and experiential learning, may be more effective for encouraging critical, creative, and open-minded thinking. Relative to instructor-directed approaches, these models appear to better support the development of independent thinking and innovation, which are essential for addressing the evolving challenges of global health (*10*).

Empowering students to take ownership improves group dynamics. Through role-play and clearly defined responsibilities, students were encouraged to assess their strengths and understand the demands of different project roles. This structure fostered accountability and strengthened collaboration. Compared with the previous year, the 2025 cohort experienced fewer instances of group conflict and inequitable task distribution. Encouraging students to conduct self-assessment and take responsibility for their contributions proved effective in reducing common teamwork challenges such as unequal participation and role ambiguity (*11*).

Broadening disciplinary backgrounds enhances analytical depth. Students' ability to conduct in-depth analysis was closely linked to their familiarity with the subject matter. The cohort consisted entirely of students from the School of Public Health, who demonstrated strong analytical skills when addressing traditional public health issues, such as infectious disease prevention. However, they faced challenges when working on more complex or multidisciplinary topics, such as designing the GLASS-AMR system or proposing health system–strengthening strategies, where broader disciplinary knowledge was required. This observation reveals a key implication for global health education: effective global health practitioners need interdisciplinary training and should not be trained solely within public health (*12*). Future talent development may benefit from more structured interdisciplinary preparation. Placing this module later in the curriculum, after students complete foundational courses such as international relations and health economics, may better support advanced analytical work. The updated university training plan will reflect these adjustments.

Increasing IHPM course credits supports a stronger theory-to-practice learning pathway. This year's course improvements strengthened students' competencies in leadership, cross-cultural communication, and strategic thinking. We integrated two instructional approaches: online delivery of theoretical content (including project planning, procurement, and budgeting) and in-class competency building through student-oriented teamwork and role-play. However, because in-class time was limited under the current credit structure, all theoretical instruction was moved online, while classroom sessions focused entirely on discussions and practical exercises. Consequently, students demonstrated weaker theoretical grounding, which was evident in the quality of their assignments. For instance, in procurement management, textbooks describe three standard procurement categories, yet many students were unable to clearly identify these categories or differentiate among them. In 2024, this material was taught during a 2.5-hour in-class session, whereas in 2025 it was condensed into a 45-minute self-paced online module. This reduction in guidance contributed to the weaker justification of procurement choices and less-developed monitoring and evaluation components in the students' proposals.

Although the 2025 cohort produced projects that were slightly weaker in structure and deliverables compared to the previous year, notable improvements were observed in conflict resolution, teamwork, and ethical reasoning.

Based on these findings, we propose organizing the curriculum across three semesters, each emphasizing foundational theoretical instruction, skill development, and competency building. Each semester would include approximately two credits and 16 teaching hours. This arrangement would allow students to first build a solid theoretical base and apply these concepts through structured exercises, before strengthening leadership, communication, and problem-solving capacities in real-world global health scenarios. As the University is currently revising its global health training program, the credit allocation and sequencing of this structure are under development. The results of this curriculum research will be shared in future studies.

Potential barriers to scaling the student-oriented model. Scaling student-oriented modules may face several practical challenges. Effective implementation requires faculty members with international project management experience and the ability to guide student-oriented teams, indicating the need for expanded standardized faculty training. These competency-building activities also depend on cross-departmental coordination and institutional resources that may not be available at all universities. Comprehensive universities may be better positioned to integrate campus resources, and collaboration with other domestic or international global health programs could support the establishment of shared fieldwork sites. In resource-limited settings, faculty training briefs, shared teaching materials, and low-cost online platforms may improve feasibility.

This study also had several limitations. Competency development was assessed primarily through the pre–post comparisons of student assignments and instructors' observations, reflections, and discussions across the two years of implementation, rather than through validated quantitative instruments. Although the comparative table shows reductions in interpersonal conflicts and "hitchhiking" behaviors in 2025, these indicators remain observational and may not fully capture changes in leadership, teamwork, or project-management skills. Furthermore, the absence of validated tools for quantitatively assessing competencies essential for global health practitioners, such as leadership, communication, and strategic thinking, limits our ability to generate systematic evidence. Developing assessment instruments aligned with China's global health strategies and suitable for evaluating practitioners' readiness for international cooperation remains an important direction for future research. We also plan to conduct short-term follow-up and long-term tracking 1–2 years after course completion and subsequently after graduation and employment. External funding will be sought to support follow-up for the 2024, 2025, and future cohorts.

Global health has evolved considerably in recent years, shifting from a disease-focused, project-driven approach concentrated in low- and middle-income countries toward one emphasizing equity, cooperation, and diverse contributions from both the Global South and North (*13*). Different participants contribute in distinct ways, whether through financing and systems support or through local innovation and adaptability (*14*). In response to this shift, our student-oriented education model emphasizes empowering each student to contribute meaningfully to their team, fostering shared responsibility and purpose. In an era defined by uncertainty and complexity, competency building for global health professionals requires not only interdisciplinary knowledge but also strong leadership, cross-cultural communication, strategic thinking, and the ability to collaborate across diverse contexts. The student-centered design and findings from our competency-building module may offer timely insights for China's ongoing strategic health-workforce development initiative (*15*). Developing these competencies is essential to preparing future professionals to contribute meaningfully to a shared global health future.

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REFERENCES

1. Goniewicz K, Burkle FM, Khorram-Manesh A. Transforming global public health: climate collaboration, political challenges, and systemic change. J Infect Public Health 2025;18(1):102615. https://doi.org/10.1016/j.jiph.2024.102615.
2. Romanello M, Walawender M, Hsu SC, Moskeland A, Palmeiro-Silva Y, Scamman D, et al. The 2024 report of the *Lancet* Countdown on health and climate change: facing record-breaking threats from delayed action. Lancet 2024;404(10465):1847 – 96. https://doi.org/10.1016/S0140-6736(24)01822-1.
3. Frenk J, Chen LC, Chandran L, Groff EOH, King R, Meleis A, et al. Challenges and opportunities for educating health professionals after the COVID-19 pandemic. Lancet 2022;400(10362):1539 – 56. https://doi.org/10.1016/S0140-6736(22)02092-X.
4. World Health Organization. Global competency and outcomes framework for universal health coverage. Geneva: WHO; 2022. Licence: CC BY-NC-SA 3.0 IGO. https://www.who.int/publications/i/item/9789240034662.
5. Cai Y, Chen H, Wu CK, Joarder T, Pang JX, Chen C. Implications for developing global health education in China: evidence from an undergraduate teamwork with role-play. BMJ Glob Health 2025;10(2):e017407. https://doi.org/10.1136/bmjgh-2024-017407.
6. Consortium of Universities for Global Health (CUGH) Competency Sub-Committee. CUGH Global Health Education Competencies Tool Kit. 2nd ed. Washington (DC): Consortium of Universities for Global Health; 2018.https://www.cugh.org/wp-content/uploads/sites/95/2020/05/CUGH-Global-Health-Toolkit-Web-Version.pdf/. [2025-07-30].
7. World Health Organization. Transforming and scaling up health professionals' education and training: World Health Organization guidelines 2013. Geneva: World Health Organization; 2013. https://apps.who.int/iris/handle/10665/93635.
8. World Health Organization. Framework for action on interprofessional education and collaborative practice. Geneva: World Health Organization; 2010. https://apps.who.int/iris/handle/10665/70185.
9. Watson HR, Dolley MK, Perwaiz M, Saxelby J, Bertone G, Burr S, et al. 'Everyone is trying to outcompete each other': a qualitative study of medical student attitudes to a novel peer-assessed undergraduate teamwork module. FEBS Open Bio 2022;12(5):900 – 12. https://doi.org/10.1002/2211-5463.13395.
10. Haripottawekul A, Wang LQ. Collaborative, interdisciplinary and student-led approaches in undergraduate research, teaching, and learning. Athens J Educ 2025;12:1 – 18. https://doi.org/10.30958/aje.X-Y-Z.
11. Lenkauskaitė J, Colomer J, Bubnys R. Students' social construction of knowledge through cooperative learning. Sustainability 2020;12(22):

9606. https://doi.org/10.3390/su12229606.
12. Ding W, Guan YY, Peterhans B, Hoffmann A, Zhou XN. Adaptation of the CUGH global health competency framework in the Chinese context: a mixed-methods study. Glob Health Res Policy 2023;8(1):46. https://doi.org/10.1186/s41256-023-00327-w.
13. Chen XG, Li H, Lucero-Prisno III DE, Abdullah AS, Huang JY, Laurence C, et al. What is global health? Key concepts and clarification of misperceptions: report of the 2019 GHRP editorial meeting. Glob Health Res Policy 2020;5:14. https://doi.org/10.1186/s41256-020-00142-7.
14. Elnaiem A, Mohamed-Ahmed O, Zumla A, Mecaskey J, Charron N, Abakar MF, et al. Global and regional governance of One Health and implications for global health security. Lancet 2023;401(10377):688 – 704. https://doi.org/10.1016/S0140-6736(22)01597-5.
15. National Health Commission of the People's Republic of China. Opinions on the development of cross-disciplinary strategic talent teams in medicine, public health, management, and policy [Internet]. Beijing: National Health Commission; 2025 Jun 3. (Document No. [2025] No. 3). https://www.nhc.gov.cn/renshi/c100028/202506/123fb6977dda40128569d08f9760040c.shtml. [2025-7-26]. (In Chinese).

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