Preplanned Studies

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

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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

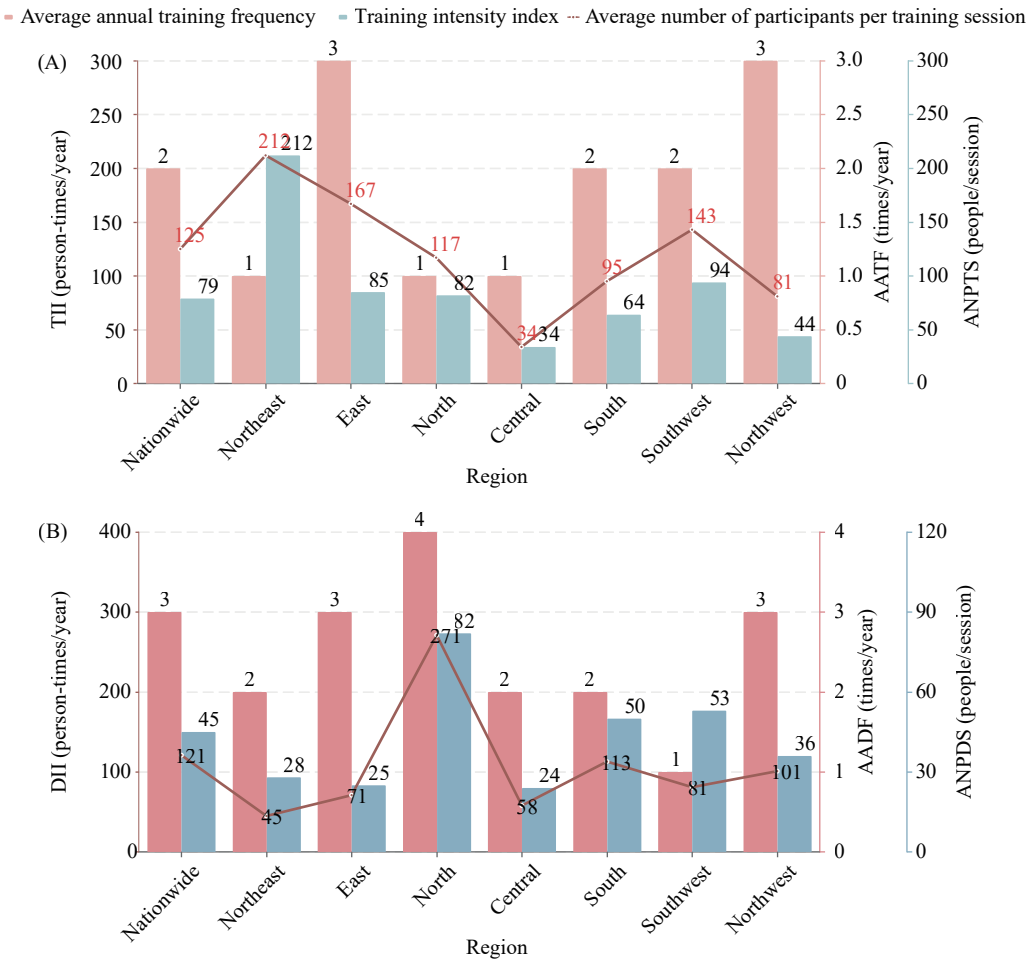

FIGURE 1. Comparative analysis of capacity-building activities for the National Emergency Response Team of Infectious Disease (2018–2023). (A) Trends in training frequency, participation, and intensity index for NERID. (B) Trends in drill frequency, participation, and intensity index for NERID.
Note: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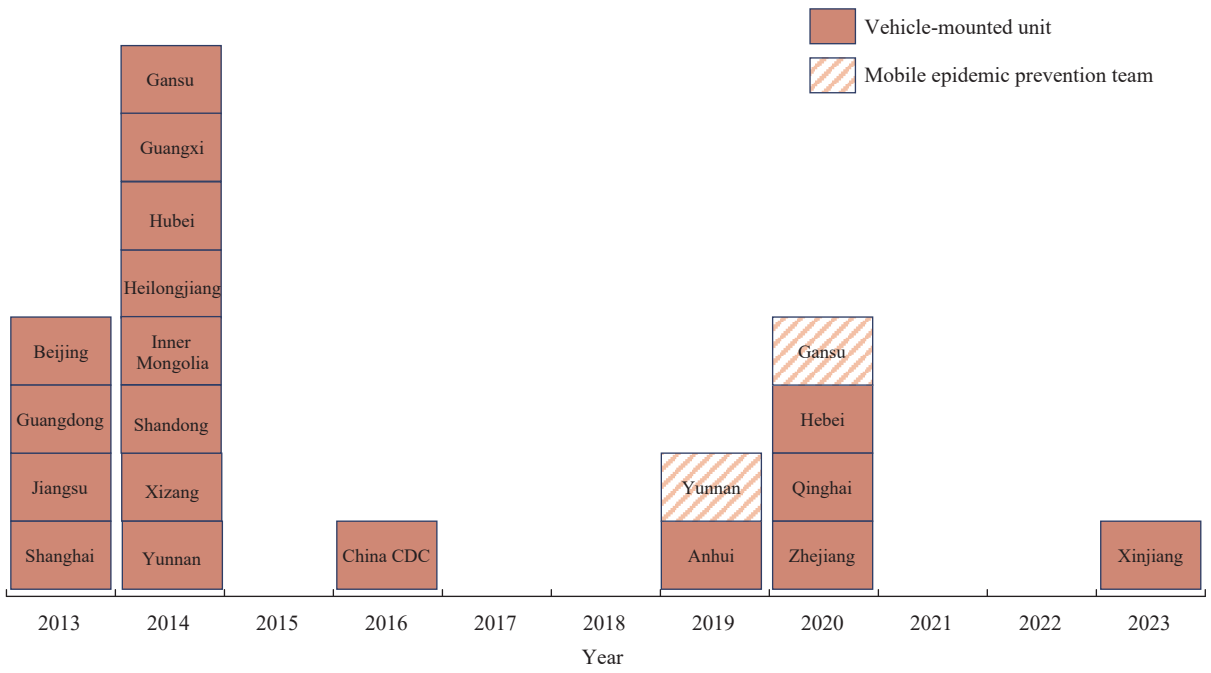
SUPPLEMENTARY MATERIAL

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