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)
		B2 Monitoring and early warning	**0.297** (0.124)	B14 Infectious disease epidemic report	**0.549** (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.

Conflicts of interest: No conflicts of interest.

Ethical statement: Approved by the Research Ethics Committee of the Capital Medical University (Z2023SY093), and all participants provided written informed consent.

Acknowledgments: All individuals who contributed to data collection and participated in this research.

Funding: Supported by an open research project of the Capital Institute of Health Management and Policy (2023JD05).

doi: 10.46234/ccdcw2026.004

Corresponding author: Yang Jia, yangjia@ccmu.edu.cn.

[1] School of Public Health, Capital Medical University, Beijing, China.

Submitted: September 02, 2025
Accepted: December 02, 2025
Issued: January 02, 2026

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