Science in One Health 4 (2025) 100104

Contents lists available at ScienceDirect

Science in One Health

journal homepage: www.journals.elsevier.com/science-in-one-health

Review

Risk assessment of emerging infectious diseases in China under the One Health framework

Ne Qiang [a,b,c,1], Tianyun Li [a,b,c,1], Lijun Jia [a,b,c], Zelin Zhu [d], Xinyu Feng [a,b], Jinjun Ran [c,**], Xiaoxi Zhang [a,b], Lefei Han [a,b,*]

[a] School of Global Health, Chinese Center for Tropical Diseases Research, Shanghai Jiao Tong University School of Medicine, Shanghai 200025, China
[b] One Health Center, Shanghai Jiao Tong University-The University of Edinburgh, Shanghai 200025, China
[c] School of Public Health, Shanghai Jiao Tong University School of Medicine, Shanghai 200025, China
[d] National Institute of Parasitic Diseases at Chinese Center for Disease Control and Prevention (Chinese Center for Tropical Diseases Research), NHC Key Laboratory of Parasite and Vector Biology, WHO Collaborating Centre for Tropical Diseases, Shanghai 200025, China

ARTICLE INFO

Keywords:
Risk assessment
Risk mapping
Emerging infectious diseases
One Health
China

ABSTRACT

Background: Emerging infectious diseases (EIDs) pose significant public health challenges due to increasing interactions between humans, animals, and the environment. The One Health framework, an interdisciplinary and collaborative approach, plays a critical role in the risk assessment of EIDs. The study aims to systematically review the risk assessment of EIDs in China under the One Health framework, covering policy support, monitoring and assessment systems, and implementation methods.
Methods: Relevant literature and official documents between 1997 and 2024 were retrieved from Web of Science, PubMed, Scopus, China National Knowledge Infrastructure, Wan Fang, China Science and Technology Journal Database, and government websites. Data were synthesized to analyze progress, challenges, and gaps.
Results: There were 43 academic studies and 31 official documents included in this review. The study found that risk assessment systems existed across human, animal, and environmental health sectors in China, and the government was advancing intelligent monitoring and fostering inter-departmental cooperation. However, several challenges remain in risk assessment of EIDs, including inadequate monitoring systems for unknown EIDs, limited capacity building for risk assessment in ecosystems and environmental systems, insufficiently detailed risk assessment guidance at the county level, and barriers to cross-sectoral information sharing at the international and county levels.
Conclusion: The findings highlighted the need to enhance risk assessment of EIDs at the local level, expand the scope of disease surveillance including aquatic and wild animals, and strengthen inter-departmental data sharing to improve early warning capabilities under the One Health framework.

1. Background

Emerging infectious diseases (EIDs) are those newly emerging diseases that have not yet been detected in humans, or previously known diseases that have been controlled in specific areas while re-emerging or spreading to new geographical areas, hosts, or vectors, such as coronavirus disease 2019 (COVID-19), severe acute respiratory syndrome (SARS), avian influenza A (H7N9), and dengue fever [1]. The causes of EIDs can have zoonotic origins, arising from animals, or stem from other environmental sources [2]. Driven by frequent interactions among populations of wildlife, livestock, and humans, EIDs are posing significant threats to public health and the problem can be complex and multi-factorial [3]. Various risk factors, including urbanization, intensive agriculture, growing livestock production, wildlife farming and trade, microbial adaptation, and climate change, provide opportunities for microbes circulating in animal hosts or reservoirs to “spillover” into new susceptible host populations [4].

* Corresponding author. School of Global Health, Chinese Center for Tropical Diseases Research, Shanghai Jiao Tong University School of Medicine, Shanghai, 200025, China.
** Corresponding author.
E-mail addresses: qiangne123@sjtu.edu.cn (N. Qiang), litianyun@sjtu.edu.cn (T. Li), jelly5160@sjtu.edu.cn (L. Jia), zhuzl@nipd.chinacdc.cn (Z. Zhu), fengxy@shsmu.edu.cn (X. Feng), jinjunr@sjtu.edu.cn (J. Ran), zhangxiaoxi@sjtu.edu.cn (X. Zhang), lfhan@sjtu.edu.cn (L. Han).
[1] These authors contributed equally.

https://doi.org/10.1016/j.soh.2025.100104
Received 20 November 2024; Accepted 10 January 2025

Abbreviations

EIDs	emerging infectious diseases
COVID-19	coronavirus disease 2019
SARS	severe acute respiratory syndrome
H7N9	avian influenza A
WoS	Web of Science
CNKI	China National Knowledge Infrastructure
WHO	World Health Organization
NPCSC	Standing Committee of the National People's Congress
MARA	Ministry of Agriculture and Rural Affairs, PRC
NHC	National Health Commission, PRC
CCDC	Chinese Center for Disease Control and Prevention
CADC	Animal Disease Control Center
CDC	center for disease control and prevention
PCSC	Provincial and municipal People's Congress
IPC	infection prevention and control
JPCM	Joint Prevention and Control Mechanism
GIS	Geographic Information Systems
IHR	International Health Regulations
WOAH	World Organisation for Animal Health
FAO	Food and Agriculture Organization of the United Nations
UNEP	United Nations Environment Program

In response to the increasing risks posed by EIDs, risk assessment and mapping play crucial roles in the early identification of potential pathogens and provide essential evidence to support timely interventions that mitigate infection risks. Specifically, risk assessments aim to identify actual or potential infection risks for regions and populations, optimize resource allocation, and develop targeted intervention strategies [5]. Risk mapping quantifies the risk of EIDs in different locations and provides a basis for identifying high-risk areas and helping governments track and manage diseases in the most vulnerable regions [6].

Since EIDs could make cross-species spillover events, timely risk assessments of EIDs require multi-sectoral collaboration across human, animal, and environmental systems. This characteristic aligns with the widely recognized concept of One Health, which aims to address health threats at the human–animal–environment interface in an integrated approach with a relatively modest cost [7,8]. Under the One Health framework, joint risk assessments with multiple sectors generate comprehensive insights to guide targeted preventive and control strategies, facilitate early identification of spillover events and reduce the transmission risk of EIDs [9,10].

Recognizing its importance, China has prioritized risk assessment of infectious diseases, supported by advancements in legislation, policy frameworks, and strengthened capacities. In 2023, the *Risk Assessment and Management Measures of Infectious Diseases (Trial)* was issued, requiring regular assessments and dynamic adjustments based on disease trends. The measures also emphasize multi-departmental collaboration, with various government sectors working together to improve risk assessment mechanisms and information sharing. These efforts aim to systematically identify and evaluate EIDs risks and provide actionable recommendations for public health decisions [11,12].

Despite considerable support and efforts, the status of risk assessment in China remains unclear, particularly for EIDs, which often occur in blind corners for the relevant human and animal prevention and control departments. This review aims to understand the current status of EIDs risk assessment in China under the One Health concept, identifying key gaps and challenges in implementation of risk assessments. By exploring factors associated with these gaps, this review would support more evidence and recommendations in implementation of joint risk management from the One Health perspective, bolstering the capacity of short-term and long-term defenses against EIDs threats in China.

2. Methods

2.1. Search strategy

This scoping review systematically searched the literature and official documents related to risk assessment of EIDs in China from the electronic databases of Web of Science (WoS), PubMed, Scopus, China National Knowledge Infrastructure (CNKI), Wan Fang, and China Science and Technology Journal Database (VIP). Since the release of the first relevant official document related to risk assessment of infectious diseases in 1997 and the subsequent release of a series of key policies for infectious diseases control, the search period was set between January 1997 and December 2024. The keywords entered in "All fields" were "emerging infectious disease*", "zoono*", "risk assessment", "One Health", "natural focus disease", and "animal health". Boolean logic ("AND", "OR") was applied to combine keywords, ensuring a comprehensive search, and search terms were listed in Table S1. Articles from the reference lists of the extracted studies were also retrieved to identify more relevant studies. Meanwhile, open-source official information that related to the risk assessment of EIDs in China, such as legislation, publicly available data, press releases, policies and technical guidelines issued from the official website of each system, National Bureau of Statistics, etc., was also collected.

2.2. Inclusion and exclusion criteria

The following inclusion criteria were applied when selecting studies and official documents for review: (1) subjects that were related to the surveillance and risk assessment of EIDs in China in either human, animal, and environment interface (the dynamic interactions and intersections between humans, animals, and their surrounding environments, including ecosystems, biodiversity, and natural habitats); (2) document types that involved policy documents, reviews, original research, technical reports, and risk assessment and mapping guidelines; (3) sources of publication from authoritative academic databases or official government websites; (4) information in either English or Chinese. The following documents were excluded: (1) documents that were inaccessible in full text or lacked essential information; (2) studies that lacked clear data support; (3) conference abstracts, reports or non-official blog content that have not been peer-reviewed or were from unclear sources.

2.3. Screening process and data extraction

The detailed method of the scoping review followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews with the following steps [13]: (1) all the studies from the primary search were imported into reference management software (*EndNote* 20) to remove duplicate literature; (2) three researchers (T.Y. Li, N. Qiang, and L.J. Jia) screened titles and abstracts that were relevant to the topic; (3) researchers reviewed the full text to further confirm the eligibility of the studies/documents; (4) all studies or documents that met the criteria for analysis were included and reasons for exclusion during the screening process were recorded (Fig. 1). The study extracted the following information for review, including the year, region, and types of documents (i.e., policy document, original research, or technical guideline), types of diseases, methods used in risk assessments (i.e., qualitative, quantitative, or semi-quantitative analysis), any departments involved, cross-sectoral cooperation, and risk management strategies. The extracted information was categorized and analyzed

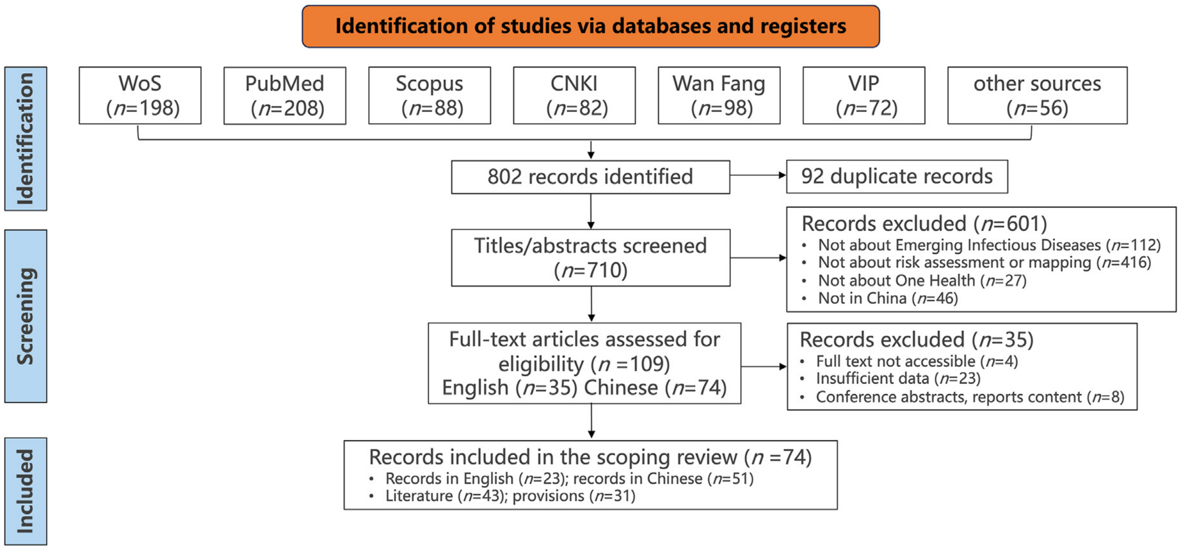

Fig. 1. Scoping review flowchart. Other sources ($n = 56$): Data from official websites including the Chinese Government, National Health Commission, China CDC, Ministry of Agriculture and Rural Affairs, China Digital Space, National Bureau of Statistics, and WHO. Abbreviations: WoS, Web of Science; CNKI, China National Knowledge Infrastructure; CDC, center for disease control and prevention; WHO, World Health Organization.

based on assessment methods, capacity building, and cross-sectoral cooperation to identify the weaknesses of the current risk assessment system. In addition to identifying weaknesses, successful case studies and practices were summarized to provide a framework for understanding effective risk assessment strategies. These measures were used to identify gaps in the current system, and a qualitative comparison was used to understand existing successful approaches of risk assessments.

3. Results

3.1. Basic characteristics of included documents

This scoping review initially identified 802 records, including 208 from PubMed, 88 from Scopus, 198 from WoS, 82 from CNKI, 98 from Wan Fang, 72 from VIP, and 56 from the government websites. After removing 92 duplicate records, 710 unique records were screened. After the screening process, a total of 109 full-text documents were assessed for eligibility. Of these, 35 records were excluded due to inaccessible full text ($n = 4$), insufficient data ($n = 23$), being non-academic or official sources ($n = 8$). Ultimately, 74 records (23 in English and 51 in Chinese), including 43 academic studies and 31 official documents, met the inclusion criteria (Fig. 1). Of them, the year of 2020 had the largest number of publications with 9 studies/documents, followed by the year of 2024, with 8 studies/documents. The included studies/documents addressed diverse topics of risk assessment, including policy support on EIDs, duties of corresponding departments, implementation and strategies of risk assessment. Among the 43 academic studies, 21 applied qualitative methods, 19 used quantitative methods, and 3 combined mixed approaches.

3.2. Policy for risk assessment in China

The included studies of legal provisions have revealed that legislation serves as foundation to translate One Health goals into tangible, sustainable and enforceable actions that foster inter-sectoral collaboration [14]. Over recent decades, China has implemented distinct risk assessment legislation, including laws, administrative regulations, and bylaws, for known diseases of human, animal, and environment interfaces, which has established a comprehensive policy framework to address EIDs (Table S2, and Fig. 2).

Laws regarding risk assessment of EIDs are formulated by the Standing Committee of the National People's Congress (NPCSC). *The Biosecurity Law of the People's Republic of China* (2024 Revision) and the *Animal Epidemic Prevention Law* (2021 Revision) provide overarching legal frameworks for the surveillance, response, and risk assessment of EIDs, integrating them into national biosafety and disease control systems [15,16].

Administrative regulations are made by the State Council, local legislatures, ethnic region authorities, and special economic zone congresses. In 2020, the State Council released *Guiding Opinions on Scientific Prevention and Control, Precise Policy Implementation, and Zoned and Graded Epidemic Prevention and Control of COVID-19*, stating targeted medical service management plans based on risk levels [17]. Meanwhile, *Measures for the Administration of the Evaluation of the Areas without Prescribed Animal Epidemics* released in 2017 standardizes disease-free assessments and control measures for animal diseases [18].

Bylaws are standard documents released by various government bodies, including those under the State Council, provincial and city governments, and certain cities approved by the State Council. Regarding human health, *Guiding Opinions on Establishing and Improving the Intelligent Multi-point Triggered Infectious Disease Surveillance and Early Warning System* released in 2024 advances smart infectious disease surveillance, and defines departmental roles in monitoring and risk assessment for EIDs [19]. Regarding animal health, the *Charter of the National Animal Health Risk Assessment Expert Committee* issued in 2009, defines the primary body responsible for conducting animal health risk assessments [20]. Concerning the environment, the Ministry of Ecology and Environment issued the *General Guidelines for Ecological and Environmental Health Risk Assessment Technical Guidelines* in 2020, stipulating general principles, procedures, contents, methods, and technical requirements for ecological and environmental health risk assessment [21,22].

There are also laws for risk assessment of unknown diseases. For instance, the COVID-19 response was guided by laws like the *Law of the People's Republic of China on Prevention and Treatment of Infectious Diseases* (2013 Amendment), the *Emergency Response Law of the People's Republic of China* (2024 Revision), and *Frontier Health and Quarantine Law of the People's Republic of China* (2024 Revision), which established legal frameworks for swift government action in public health crises, including measures like isolation, lockdowns, and resource allocation.

The COVID-19 pandemic in Shanghai in March 2022 exemplifies how the city aligned its risk management efforts with policy planning through regular risk assessments to effectively address the emergency. During the period, the health authorities developed a dynamic systems model to analyze and compare how and to what extent policies of infection

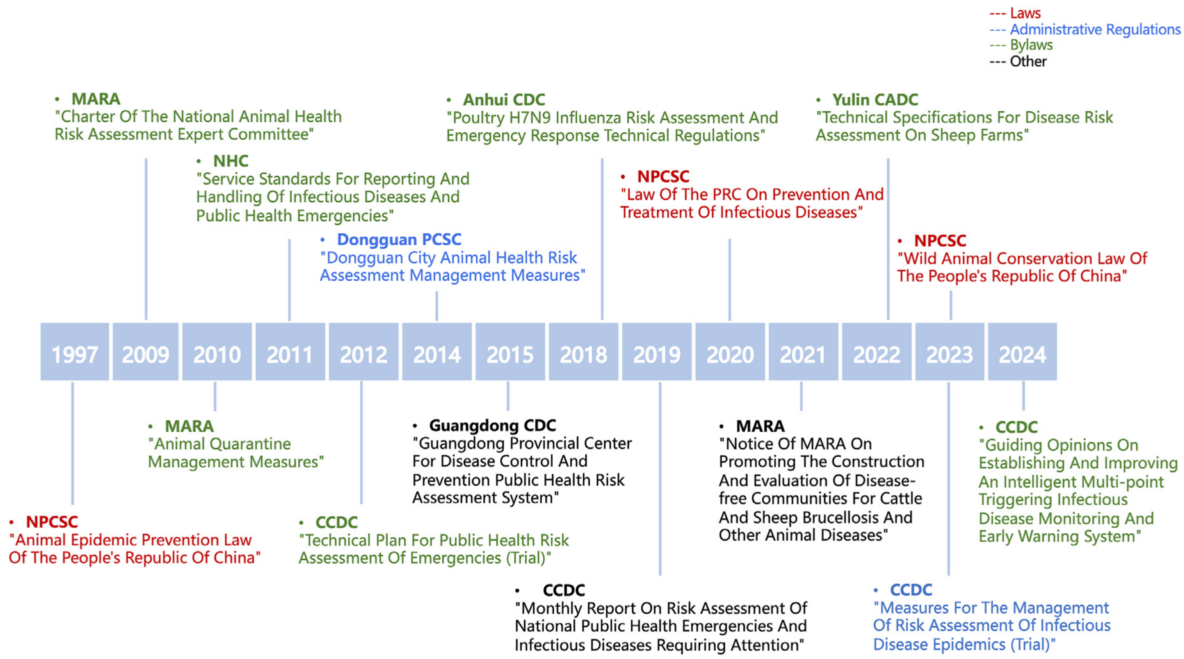

Fig. 2. Relevant policies implemented by multiple government authorities in response to EIDs in China, from 1997 to 2024. Abbreviations: EIDs, emerging infectious diseases; NPCSC, Standing Committee of the National People's Congress; MARA, Ministry of Agriculture and Rural Affairs, PRC; NHC, National Health Commission, PRC; CCDC, Chinese Center for Disease Control and Prevention; CADC, Animal Disease Control Center; CDC, Disease prevention and control center; PCSC, Provincial and municipal People's Congress.

prevention and control (IPC) affect the spread of an epidemic. Results revealed that conservative IPC policies can prevent a second outbreak of COVID-19 during work resumption, thus reducing the risk of EIDs occurrence [23]. Another study in China, which evaluated the risk communication knowledge and application among public health professionals, found that the majority of respondents (18/20) reported the presence of written regulations or policies that guide the accurate and timely release of information. These regulations had a significant impact on their risk communication processes, ensuring that information was disseminated efficiently during EIDs [24].

3.3. Duties of departments in risk assessment

Effective implementation of risk assessment requires coordinated efforts across multiple sectors, including the public health sector [11,25], agriculture sector [26], market regulation sector [27], ecology sector [21], animal sector [28], forestry sector, and others (Table S3). The process necessitates identifying key points of surveillance, collecting data systematically from these points, analyzing the severity of potential risks, making decisions on subsequent interventions, facilitating inter-sectoral communication within local regions, and notifying international organizations or relevant countries or regions.

National and provincial health authorities have established expert groups comprising specialists in public health, clinical medicine, biosecurity, emergency management, communications, information science, economics, statistics, meteorology, and veterinary medicine. These experts, commissioned by the disease prevention and control authorities, assess risks related to specific infectious diseases outbreaks that may pose significant public health threats or review assessments from subordinate institutions.

For human health sectors, provincial and municipal health commissions are responsible for establishing and coordinating risk assessment systems, supervising the process, and guiding subordinate institutions. They also oversee information dissemination to ensure timely communication of risk assessment outcomes. Provincial departments for disease control develop technical plans for infectious disease surveillance, including surveillance implementation, information collection, risk assessment practices, and providing early warnings and technical guidance.

For animal health sectors, the Ministry of Agriculture and Rural Affairs (MARA) is in charge of national risk assessment, responsible for formulating and adjusting regulations, specifying the scope, objects, and procedures of animal risk assessment. Additionally, the MARA establishes a unified national animal quarantine management information system to achieve traceability. The National Animal Health Risk Assessment Expert Committee, under the leadership of the MARA, undertakes risk assessment for major, exotic and emerging animal diseases, providing decision-making consultation and technical support for national animal health risk management.

Environmental protection departments are responsible for assessing ecological environment and biodiversity. The wildlife protection authority monitors disease sources in wild animals, while customs and wildlife authorities share data on animal infections with agricultural authorities to facilitate coordinated responses.

Cross-sectoral collaboration is essential for enhancing the effectiveness of EIDs risk assessment. To facilitate this, health and agriculture departments have established comprehensive collaborative mechanisms, including epidemic reporting and sharing, joint epidemiological investigations, surveillance cooperation, resource sharing among technical personnel and experts, collaborative research efforts, multi-departmental risk assessment and consultation mechanisms, and inter-departmental sharing of surveillance data and information. Meanwhile, coordination expert teams have been established for the prevention and control of zoonotic infectious diseases to facilitate regular inter-departmental meetings, and monthly reporting of national human and animal epidemics of zoonotic infectious diseases. During zoonotic infectious diseases outbreaks, relevant information is quickly exchanged between the departments. Collaborative mechanisms also involve organizing joint expert teams for epidemiological investigations, laboratory testing, as well as jointly developing detection and diagnostic methods. Furthermore, multi-departmental joint consultations are held regularly to assess the risks of EIDs outbreaks, ensuring that rapid and effective response measures can be implemented when outbreaks occur, and jointly safeguarding the security of public health and animal health [29].

A successful case can be found during the COVID-19 epidemic when various departments worked together under the Joint Prevention and Control Mechanism (JPCM) in response to the pandemic. During the period, the health department was responsible for monitoring the epidemic, formulating and implementing prevention and control measures, and allocating medical resources and treatment. The education department ensured normal teaching activities in schools without an epidemic and emergency handling during an outbreak. The transportation department was in charge of traffic control and transportation security to ensure the orderly movement of people and materials during the epidemic. The public security department participated in law enforcement and order maintenance for epidemic prevention and control, ensuring social stability and public safety. Disease control institutions were responsible for epidemiological investigations, tracking and managing close contacts, and scientifically assessing prevention and control measures.

3.4. Implementation of risk assessment and mapping in China

In China, risk assessment of EIDs encompasses routine and thematic risk assessments, emphasizing inter-departmental collaboration and data sharing to ensure a seamless transition from routine surveillance to emergency response during urgent situations (Table 1) [11]. The key processes include risk identification, risk analysis, risk evaluation, and risk management [30].

3.4.1. Routine and thematic risk assessments

Routine risk assessments are implemented at the national, provincial, city, and county levels, with frequencies ranging from weekly for national and provincial levels to monthly for city and county levels. These assessments cover 41 notifiable infectious diseases for humans and hosts listed in *the National Medium- and Long-term Animal Disease Prevention and Control Plan (2012–2020)* for animals (Table 2). The process requires the collection of surveillance data from health, agriculture, and ecological environment departments to ensure comprehensive coverage across human, animal, and environmental sectors. For example, the National Health Commission (NHC) and the MARA regularly conduct joint assessments of zoonotic diseases, such as brucellosis, and issue risk notifications to the public [31].

Thematic risk assessments aim to address significant public health events, natural disasters, accidents, catastrophes, or unknown diseases within a specific period, focusing on early detection and testing of patient samples. In the event of a public health emergency such as floods or earthquakes, the initial risk assessments should be completed within 24 hours. Additionally, data support is crucial, requiring the collection of information on the public health status of affected areas, the health status of vulnerable populations, and the capabilities of emergency response teams (Table 3).

In both routine and thematic assessments, China emphasizes the importance of cross-departmental collaboration, technical support, and the establishment of robust protocols to ensure a swift and effective response to emerging risks.

Table 1
Routine and thematic assessments in China.

Category	Content	Requirements
Routine assessment	Routine risk assessment is mainly based on a comprehensive analysis of information from routine surveillance, departmental notifications, notifications from international organizations and relevant countries (regions), etc., to carry out an assessment of public health risks	Disease prevention and control agencies at all levels should carry out routine risk assessments on a regular basis.Disease prevention and control organizations at the national and provincial levels conduct routine risk assessments once a week, and those at the municipal and county levels once a month. The frequency of routine risk assessment can be dynamically adjusted according to the development of the epidemic and the needs of the work
Thematic assessment	Thematic risk assessment is categorized into the following three situations: Assessment of specific outbreaks identified in routine risk assessment that may lead to significant public health risks; assessment of infectious disease outbreaks within a specific time and area; and other situations requiring thematic assessment, such as large-scale events, accidents and natural disasters	Disease prevention and control organizations at all levels and other relevant health care institutions should, as needed, carry out thematic risk assessments within their areas of responsibility; national-level disease prevention and control organizations should carry out thematic risk assessments for particularly significant public health emergencies; provincial, prefectural and municipal, and county-level disease prevention and control agencies should carry out thematic risk assessment of major, major and general public health emergencies under their jurisdiction respectively

Table 2
Animal diseases listed in routine risk assessment.

Domestic animal diseases (16 types)	Category I animal diseases (5 types): foot-and-mouth disease (type A, Asian type I, type O), highly pathogenic avian influenza, highly pathogenic blue ear disease, swine fever, newcastle disease Category II animal diseases (11 types): brucellosis, bovine tuberculosis, rabies, schistosomiasis, echinococcosis, glanders, equine infectious anemia, salmonellosis, avian leukosis, pseudorabies, porcine reproductive and respiratory syndrome (classical blue ear disease)
Foreign animal diseases (9 types)	Category I animal diseases (9 types): bovine spongiform encephalopathy, African swine fever, scrapie, peste des petits ruminants, contagious bovine pleuropneumonia, foot-and-mouth disease (type C, SAT1, SAT2, SAT3), swine vesicular disease, African horse sickness, H7 subtype avian influenza

Abbreviation: SAT, Southern African Territories.

3.4.2. Key processes of risk assessment

The risk assessment process for EIDs in China consists of four stages—risk identification, risk analysis, risk evaluation, and risk communication and management. Risk identification involves discovering, recognizing, and describing potential risks based on surveillance data, particularly focusing on positive cases, new pathogens, and unexplained mass disease occurrences. Risk analysis assesses these identified risks by

Table 3
List of information to be collected for risk assessment of EIDs.

Hazardous factors	Post-disaster impact on affected areas Duration and intensity of public health emergencies that can be sustained Overview of infectious diseases and public health emergencies in the affected areas Characterization of vector organisms in the affected area Other risk factors
Vulnerability	Background information on the affected area Health status of the population in the affected areas Immunization of the population in the affected areas Health literacy of the population in the affected areas
Response capability	Status of emergency relief in disaster areas Medical and health resources in the affected areas Status of public health facilities in the affected areas Health emergency response capacity Government capacity to integrate health resources Safeguarded capacity to cope with public health emergencies in the affected areas

Abbreviation: EIDs, emerging infectious diseases.

evaluating the probability of occurrence, analyzing the severity of potential consequences, and conducting vulnerability assessments. Risk evaluation follows, where the analyzed risks are compared against established criteria to determine their ranging across five levels from low to high and to facilitate risk mapping. Finally, risk communication and risk management entail the development of mitigation strategies based on the risk level, including interdepartmental information sharing, public risk reporting, and emergency response preparations. The process addresses both known infectious diseases that have re-emerged or spread to new areas, hosts, or vectors, and newly identified EIDs within human populations, producing a comprehensive risk (Fig. 3).

In China, the commonly used methods for risk analysis include qualitative, quantitative, and semi-quantitative approaches. The qualitative approach often draws on experts' insights and past experiences to assess systemic risks, which is often used for risk analysis of potential zoonotic outbreaks [32]. For instance, a qualitative method was used to evaluate the risk of foot-and-mouth disease caused by bull introduction in 2017 from Hubei, showing that the risk was "very low" with medium uncertainty [33]. The quantitative approach is known for its clarity and objectivity but demands extensive and high-quality data [34]. In practice, there are two primary ways to quantify events in China: one is through Monte Carlo models to describe risk issues, and another is to use algebra and probability theory to establish models that describe risk events [35]. Semi-quantitative risk analysis assigns numerical values to qualitative factors to gauge overall risk, estimating the likelihood and severity of risks. It involves categorizing and scoring these risks for systematic comparison against unacceptable levels, creating a policy framework to minimize hazard scores. Additionally, the expert consultation method, the risk matrix method, and the analytical flowchart method are also widely applied in all steps of risk analysis.

Risk evaluation of EIDs is conducted using specific classification criteria. For humans, risks are categorized from "extremely low" to "extremely high" based on the likelihood of occurrence, potential impact, and vulnerability [30]. For animals, the risk levels range from "negligible" to "very high", considering the frequency of occurrence and the extent of damage caused [36]. These criteria aid in aligning the outcomes of risk analysis with the acceptable levels of risk to ascertain the precise risk level.

Risk management of EIDs in China includes emergency preparedness and response. Preparedness encompasses pre-outbreak activities such as information gathering, planning, supply readiness, and staffing, while response includes post-outbreak measures like infected area delineation, epidemic source investigation, patient treatment, animal culling, environmental decontamination, and emergency supply deployment. For human health, the China's legal framework requires government-funded efforts for disease prevention and control, including epidemiological investigations and measures such as halting business operations [37]. For animals, diseases are classified with specific control methods that may involve culling and disinfection [16]. Additionally, environmental health guidelines address the protection of water sources and management of environmental hygiene following natural disasters [38]. These measures are designed to contain the spread of infectious diseases and mitigate their effects on public health.

3.4.3. *Risk mapping*

Risk mapping, a critical tool in assessing the potential threats of EIDs, often involves Geographic Information Systems (GIS) and the application of probability models at the national level.

GIS combines geospatial data with computer technology to collect, store, manage, statistically analyze, and display spatial data. They are characterized by their ability to manage large amounts of spatial data, perform quantitative analysis, visualize results, and aid in decision-making [39]. In the phase of risk identification, GIS helps to identify hotspots with high vulnerability to EIDs by integrating data on population density, environmental factors, and healthcare infrastructure. During the COVID-19 outbreak, GIS was used to map areas of high transmission risk based on mobility data and population density, which helped to identify high-risk zones [40]. Once risks are identified, risk analysis begins. GIS models, including spatial probability models, are used to quantify the likelihood of an EID occurring in a given area. A study on the spread of H7N9 in China used GIS to analyze the risk of disease spread across different provinces, factoring in ecological, environmental and meteorological at the county level. This approach facilitated the identification of regions most vulnerable to an outbreak. In risk evaluation, health officials can assess the relative importance of different risks, considering their potential impact by using risk mapping. When

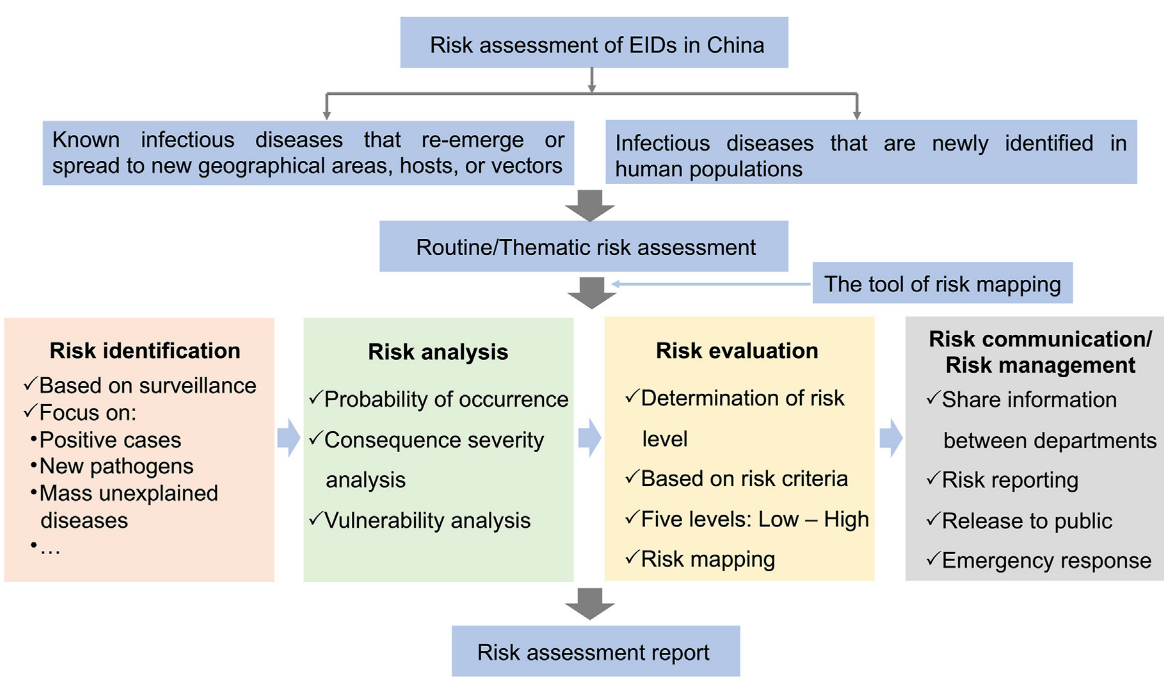

Fig. 3. The process of risk assessment of EIDs in China. Abbreviation: EIDs, emerging infectious diseases.

evaluating the transmission risk of COVID-19 in China, a susceptible-exposed-infectious-recovered metapopulation model was used to evaluate the spread of the disease based on case information and population density, helping health authorities allocate resources more effectively [41]. Finally, GIS provides decision-makers with the tools needed to visualize different intervention strategies and assess their effectiveness. Whether it's planning for disease surveillance, vaccination campaigns, or emergency response measures, GIS allows for spatial visualization of the impact of different actions, enabling quick adaptation of strategies as the situation evolves.

In recent years, the application of GIS has expanded rapidly and has been successfully applied in the prevention and control of avian influenza [42], and malaria [39]. Probabilistic risk mapping models can simulate and evaluate the risks of EIDs in different regions globally and their potential importation into various regions of China via air travel [43].

4. Discussion

This study comprehensively reviewed the current status of EIDs risk assessment in China, covering national policy support, surveillance and evaluation systems, and specific implementation methods. So far, China has established a risk assessment system covering human, animal, and environmental health through legislation, policy documents, and administrative guidelines, and actively promotes intelligent surveillance and inter-departmental collaboration. However, several gaps were identified in the implementation of risk assessment.

4.1. Gaps and challenges

4.1.1. Policy

EIDs risk assessment policies in China have two main gaps: unknown diseases, and risk mapping at county levels. So far, most policies set clear processes for known diseases, while few policies target risk assessment for unknown diseases. The lack of clear guidance for unknown diseases can be attributed to several factors, including the unpredictable nature of EIDs and the challenges in anticipating new pathogens. Current policies often rely on historical data and established frameworks, which may not be adaptable enough to address the rapidly evolving nature of unknown diseases. Moreover, the limited flexibility of existing policies and the absence of real-time, adaptive risk assessment mechanisms hinder the timely and effective response to unknown threats. Developing policies and technical guidelines for unknown diseases in risk assessments would be a significant improvement. In addition, there is a noticeable absence of risk mapping at the municipal or county level; the center for disease control and prevention (CDC)'s monthly assessments predominantly offer national-level risk maps, lacking granular local data. This shortfall may stem from an absence of comprehensive laws and regulations that bolster the risk assessment process, as well as challenges in translating national policies into actionable local measures.

4.1.2. Duties of departments

EIDs risk assessment in China suffers from poor inter-departmental collaboration. So far, there's a lack of specialized departments for assessing unknown diseases across human and animal health, and environmental departments are excluded from the process. Despite *The Guiding Opinions on the Establishment and Improvement of an Intelligent Multi-point Trigger for Infectious Disease Surveillance and Early Warning System (2024)* calling for defined responsibilities and cross-sectoral cooperation, current progress is far from the ideal goal. Meanwhile, health departments may focus more on the impact of diseases on human health, while agricultural departments are concerned with animal health and food safety. This difference may lead to conceptual and methodological differences in the design and implementation of early warning systems. For example, most early warning systems are managed by human health experts rather than veterinarians or ecologists, which affects the conceptualization of the problem and the design of the early warning system, as well as the subsequent response measures issued [44]. Furthermore, risk assessment is further impeded by limited data sharing between health, animal, and environmental departments, which is crucial for effective risk analysis. There is an urgent need to clarify and realign departmental roles and responsibilities in infectious disease risk assessment.

4.1.3. Implementation process

China faces several challenges during the implementation of risk assessment, including insufficient scientific data for evaluation and the complexity of animal disease risk assessment. Firstly, risk assessments are only scientifically valid when they integrate the epidemiological characteristics of infectious diseases, surveillance data, statistical data, and experimental methods [45]. Currently, China lacks large-scale, practical datasets at country levels. Additionally, the quality of surveillance data from grassroots veterinary systems is significantly affected by factors such as the sensitivity and specificity of reagents, the sensitivity of online reporting systems, and veterinary laboratory quality management, which greatly undermines the scientific reliability of the data [46]. Secondly, under the One Health framework, animal disease risk assessment requires a high level of expertise. This complexity is particularly evident in semi-quantitative and quantitative risk analyses, which demand specialized knowledge. Moreover, the wide variety of animal diseases and the recurrent nature of pathogen invasions add to the challenges. While adhering to general principles of risk analysis, animal disease risk assessments also exhibit unique characteristics [46].

4.1.4. Capacity building

In China, the capacity for EIDs risk assessment faces several challenges including a shortage of personnel, heavy workload, and insufficient professionalism. Firstly, the risk assessment work for animal diseases in various regions is overseen by local animal husbandry and veterinary authorities at the county level and above, with the specific implementation carried out by animal health supervision institutions. The assessment work requires the establishment of an expert group consisting of at least three members to review materials and conduct on-site evaluations and scoring as required. A study pointed out that during the implementation of animal disease risk assessment work in Hebei Province, local animal health supervision institutions suffer from a lack of personnel, and from having multiple functions, which severely affected the progress of this work [47]. Additionally, the large number of regulatory targets slows down the advancement of the assessment work. Furthermore, the risk assessment for EIDs lacks professional depth. A study on hospitals' response to EIDs events pointed out issues such as low warning capabilities, inadequate preparedness, and weak response capabilities, emphasizing the importance of strengthening hospitals' surveillance, early warning, and response capabilities for EIDs [48].

4.2. Recommendations

To further enhance the risk management capabilities for EIDs, the following strategies and actions can be considered.

4.2.1. Strengthening policy frameworks for unknown diseases

To address the current gaps in EIDs risk assessment policies, policymakers should focus on: (1) establishing real-time, adaptive risk assessment mechanisms, which involve integrating predictive models and flexible frameworks that allow for adjustments based on new data; (2) developing clear guidelines for the assessment of unknown diseases, considering their unpredictable nature. Policies should account for the rapid evolution of pathogens and allow for the swift adaptation of existing risk management strategies; (3) enhancing local-level risk mapping, especially at the municipal or county level. This would ensure that risk management strategies are better tailored to local contexts.

4.2.2. Improving inter-departmental collaboration

To address the issue, the following measures should be considered: (1) establishing cross-sectoral coordination mechanisms, which can be achieved through joint task forces or advisory committees that bring together experts from each sector [49]; (2) defining clear responsibilities for each department, particularly regarding the assessment of unknown diseases; (3) promoting data sharing and integration between public health, veterinary, and environmental agencies [50].

4.2.3. Strengthening implementation and data integration

It is crucial to overcome the challenges related to scientific data and animal disease risk evaluation. Key actions may include: (1) developing large-scale, practical datasets at both national and local levels, focusing on integrating epidemiological data, surveillance data, and experimental results into a unified database [51]; (2) improving the quality and reliability of grassroots veterinary data; (3) providing specialized training and building expertise in semi-quantitative and quantitative methods to enhance expertise in animal disease risk assessment.

4.2.4. Building capacity for EIDs risk assessment

Recommendations to strengthen capacity include: (1) more resources should be allocated to hire additional qualified personnel, and the workload of existing staff should be managed more effectively; (2) enhancing professional depth and expertise, particularly in animal health and epidemiology. Strengthening the professional training and certification of personnel involved in risk assessments is critical to improving the overall quality of the assessments [52]; (3) improving preparedness and response capabilities in hospitals, which should be equipped with better surveillance, early warning, and rapid response systems.

4.3. Comparison with international communities

China has comprehensive legislative frameworks for EIDs. For instance, *Biosecurity Law of the People's Republic of China* (2024 Amendment) mandates the inclusion of EIDs in the national surveillance and early warning systems, a level of coverage that may not be achieved in some low-income countries [53,54]. In addition, China has established a rapid response mechanism that includes a routine-emergency conversion system and tiered prevention and control measures based on risk levels, similar to strategies employed by the Republic of Korea and Singapore, but with stronger coordination and resource readiness compared to developing nations [55,56].

However, there are areas where China's approach falls short. For instance, county and township governments have less autonomy and data collection capabilities in risk assessment compared to countries like Germany and Australia [57,58]. Most counties in China only follow the national guidance for risk identification, while they lack the capacity to create risk maps based on county-level data and make dynamic adjustments. Furthermore, while China has joined global platforms such as the Global Initiative on Sharing All Influenza Data to share epidemic data with the international communities, there remain delays in sharing surveillance data for some highly pathogenic pathogens, resulting in less transparency compared to the United States and some European countries [59]. This issue may be due to data barriers between departments and slow information exchange.

When comparing with international organizations, it is evident that China has strengthened its cooperation with the WHO and actively participated in the revision and implementation of the International Health Regulations (IHR 2005) [60,61]. However, China still needs to improve its response and information disclosure in the early stages of an epidemic, aligning more closely with WHO's recommendations for transparent and timely data sharing [62]. In the field of animal health, China's cooperation with the World Organisation for Animal Health (WOAH) is close, but the surveillance and reporting system for wild and aquatic animals is still not fully developed, contrasting with some European countries that have established systematic wildlife surveillance systems to prevent the spread of zoonotic diseases [63].

Under the One Health framework, various international organizations and countries had implemented specific risk assessment practices, offering valuable insights. In 2022, WHO, Food and Agriculture Organization of the United Nations (FAO), WOAH, and United Nations Environment Programme (UNEP) jointly launched the "One Health Joint Plan of Action". The plan supports countries in conducting joint risk assessments and baseline surveys under the One Health approach, thereby enabling evidence-based and targeted risk management and communication [64]. Additionally, WHO's Joint Risk Assessment Operational Tool provides standardized procedures for cross-sectoral risk assessment, aiding countries in identifying and assessing risks early in an outbreak to enable effective responses [65]. In practice, countries such as France and the United States had promoted the implementation of One Health framework. France had implemented a One Health approach for dengue fever risk assessment, addressing climate change-driven expansion of the *Aedes albopictus* mosquito vector. France established the Committee for Monitoring and Anticipating Health Risks, a multidisciplinary body supported by health and research ministries [66]. In the United States, machine learning algorithms were utilized to predict cases of West Nile virus neuroinvasive disease across nine climatic regions under the One Health framework, incorporating factors like historical case counts and population density [67]. These international case studies provide a strong foundation for enhancing China's EIDs risk assessment under the One Health framework, particularly in strengthening interdepartmental information sharing, improving wildlife and vector surveillance, and ensuring transparent data flow.

4.4. Limitations

There are several limitations to this study. First, the study relied on existing policies and academic documents and publicly available data, making it challenging to fully capture variations and dynamics at the local level. This may lead to an underestimation of regional differences. Field studies should be conducted to gather more comprehensive local data, revealing regional differences in risk assessment and response strategies in the future. Second, this review focused solely on literature retrieved from the WoS, PubMed, Scopus, CNKI, Wan Fang, and VIP databases, which may have led to the omission of relevant data sources or research findings. Further research is needed to follow closely additional databases or unpublished literature, which could potentially contain more granular local studies or recent policy developments. Third, as a scoping review, this study lacked quantitative data analysis, which may restrict the ability to compare specific EIDs risk levels among various regions within China. Future research will incorporate quantitative metrics and risk assessment models, such as seeding time and doubling time models, to conduct predictive quantitative analysis on existing data [68]. This approach can help identify high-risk areas and provide a more comprehensive risk comparison, thereby supporting informed policy-making.

4.5. Conclusion

In summary, this study summarizes the policies and implementation processes of risk assessment for EIDs in China under the One Health framework and proposes actionable recommendations, such as strengthening the risk assessment capabilities at the local level and expanding the coverage of surveillance. There is a clear need for continued improvement and adaptation in the implementation of risk assessment. By addressing the identified gaps and challenges, China can further refine its One Health approach, ensuring a more resilient and effective public health response to EIDs.

CRediT authorship contribution statement

Ne Qiang: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Conceptualization. **Tianyun Li:** Writing – review & editing, Writing – original draft, Visualization, Validation. **Lijun Jia:** Writing – review & editing, Visualization, Validation. **Zelin Zhu:** Writing – review & editing, Visualization, Validation. **Xinyu Feng:** Writing – review & editing. **Jinjun Ran:** Writing – review & editing, Visualization, Validation, Formal analysis, Data curation. **Xiaoxi Zhang:** Writing – review & editing, Validation. **Lefei Han:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Formal analysis, Data curation, Conceptualization.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Funding

This work was supported by the International Joint Laboratory on Tropical Diseases Control in Greater Mekong Subregion [grant number 21410750200], National Natural Science Foundation of China [grant number 82304102], Natural Science Foundation of Shanghai [grant number 23ZR1436200], Shanghai Science and Technology Development Foundation [grant number 22YF1421100, 23YF1421200].

Declaration of competing interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.soh.2025.100104.

References

[1] World Health Organization, A Brief Guide to Emerging Infectious Diseases and Zoonoses 2014, 2014. https://iris.who.int/handle/10665/204722. (Accessed 19 December 2024).
[2] IUCN Species Survival Commission (SSC), Situation Analysis on the Roles and Risks of Wildlife in the Emergence of Human Infectious Diseases, 2022. https://portals.iucn.org/library/node/49880. (Accessed 19 December 2024).
[3] D. Morens, G. Folkers, A. Fauci, The challenge of emerging and re-emerging infectious diseases, Nature 430 (2004) 242–249, https://doi.org/10.1038/nature02759.
[4] N.M. Vora, L. Hannah, C. Walzer, M.M. Vale, S. Lieberman, A. Emerson, et al., Interventions to reduce risk for pathogen spillover and early disease spread to prevent outbreaks, epidemics, and pandemics, Emerg. Infect. Dis. 29 (3) (2023) 1–9, https://doi.org/10.3201/eid2903.221079.
[5] Y. Wang, Intelligent monitoring and evaluation of emerging infectious diseases risks, Chin. Digital Med. 18 (10) (2023) 6–10, https://doi.org/10.3969/j.issn.1673-7571.2023.10.002.
[6] J. Shaman, Pandemic preparedness and forecast, Nat Microbiol 3 (2018) 265–267, https://doi.org/10.1038/s41564-018-0117-7.
[7] N. Qiang, S.Y. Gu, X.Y. Wang, X.X. Zhang, S. Xia, J.X. Zheng, et al., A One Health information database based on standard bibliometric analysis, Sci. One Health 1 (2022) 100012, https://doi.org/10.1016/j.soh.2023.100012.
[8] J.H. Ellwanger, J.A.B. Chies, Zoonotic spillover and emerging viral diseases - time to intensify zoonoses surveillance in Brazil, Braz. J. Infect. Dis. 22 (1) (2018) 76–78, https://doi.org/10.1016/j.bjid.2017.11.003.
[9] S.S. Morse, J.A. Mazet, M. Woolhouse, C.R. Parrish, D. Carroll, W.B. Karesh, et al., Prediction and prevention of the next pandemic zoonosis, Lancet 380 (9857) (2012) 1956–1965, https://doi.org/10.1016/S0140-6736(12)61684-5.
[10] R. Chatterjee, S. Bajwa, D. Dwivedi, R. Kanji, M. Ahammed, R. Shaw, COVID-19 Risk Assessment Tool: dual application of risk communication and risk governance, Prog. Disaster Sci. 7 (2020) 100109, https://doi.org/10.1016/j.pdisas.2020.100109.
[11] National Center for Disease Control and Prevention, Measures for the Administration of Infectious Disease Epidemic Risk Assessment (Trial Implementation), 2023. https://www.ndcpa.gov.cn/jbkzzx/c100081/common/content/content_1715172781702115328.html. (Accessed 19 December 2024).
[12] The People's Republic of China, Regulations on the Functional Allocation, Internal Structure, and Staffing of the National Bureau of Disease Control and Prevention, 2022. https://www.gov.cn/zhengce/2022-02/16/content_5674041.htm. (Accessed 19 December 2024).
[13] A.C. Tricco, E. Lillie, W. Zarin, K.K. O'Brien, H. Colquhoun, D. Levac, et al., PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation, Ann. Intern. Med. 169 (2018) 467–473, https://doi.org/10.7326/M18-0850.
[14] Food and Agriculture Organization of the United Nations, One Health Legislation, 2020. https://www.fao.org/documents/card/en/c/ca9729en. (Accessed 19 December 2024).
[15] The People's Republic of China, Biosecurity Law of the People's Republic of China, 2020. https://www.gov.cn/xinwen/2020-10/18/content_5552108.htm. (Accessed 19 December 2024).
[16] The People's Republic of China, The Animal Epidemic Prevention Law of the People's Republic of China, 2021. https://www.gov.cn/xinwen/2021-01/23/content_5582023.htm. (Accessed 19 December 2024).
[17] The People's Republic of China, The Joint Prevention and Control Mechanism of the State Council Issued the "Guiding Opinions on Scientific Prevention and Control, Accurate Measures, and Regional and Graded Prevention and Control of the New Coronavirus Pneumonia Epidemic", 2020. https://www.gov.cn/xinwen/2020-02/18/content_5480514.htm. (Accessed 19 December 2024).
[18] The People's Republic of China, Measures for the Assessment and Management of Areas Free of Specified Animal Diseases, 2017. https://www.gov.cn/gongbao/content/2017/content_5234530.htm. (Accessed 19 December 2024).
[19] The People's Republic of China, Notice on Issuing the Guiding Opinions on Establishing and Improving an Intelligent Multi-point Triggering Infectious Disease Surveillance and Early Warning System, 2024. https://www.gov.cn/zhengce/zhengceku/202408/content_6971481.htm. (Accessed 19 December 2024).
[20] Ministry of Agriculture and Rural Affairs of the People's Republic of China, Charter of the National Animal Health Risk Assessment Expert Committee, 2009. http://www.moa.gov.cn/gk/zcfg/nybgz/200904/t20090408_1249990.htm. (Accessed 19 December 2024).
[21] Ministry of Agriculture and Rural Affairs of the People's Republic of China, Technical Guidelines for Eco-Environmental Health Risk Assessment —General Principles, 2020. https://www.mee.gov.cn/ywgz/fgbz/bz/bzwb/other/qt/202003/W020200320573467891627.pdf. (Accessed 19 December 2024).
[22] Ministry of Ecology and Environment of the People's Republic of China, Technical Guidelines for Eco-Environmental Health Risk Assessment—General Principles, 2020. https://www.mee.gov.cn/ywgz/fgbz/bz/bzwb/other/qt/202003/t20200320_769859.shtml. (Accessed 19 December 2024).
[23] J. Zhao, J. Jia, Y. Qian, L. Zhong, J. Wang, Y. Cai, et al., COVID-19 in Shanghai: IPC policy exploration in support of work resumption through system dynamics modeling, Risk Manag. Healthc. Pol. 13 (2020) 1951–1963, https://doi.org/10.2147/RMHP.S265992.
[24] J.R. Cope, M. Frost, L. Richun, R. Xie, Assessing knowledge and application of emergency risk communication principles among public health workers in China, Disaster Med. Public Health Prep. 8 (3) (2014) 199–205, https://doi.org/10.1017/dmp.2014.29.
[25] National Center for Disease Control and Prevention, The National Administration of Disease Control and Prevention Issued the Measures for the Risk Assessment and Management of Infectious Disease Epidemics, 2023. https://www.gov.cn/lianbo/bumen/202308/content_6901324.htm. (Accessed 19 December 2024).
[26] The Ministry of Agriculture and Rural Affairs of the PRC, Animal Quarantine Management Measures, 2022. https://www.gov.cn/zhengce/zhengceku/2022-09/10/content_5709311.htm. (Accessed 19 December 2024).
[27] The State Administration for Market Regulation of the PRC. Risk management—Risk assessment techniques. https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=24F78E0E234DAD43C06579F9A39DFC1A, 2023 (accessed 19 December 2024).
[28] Chongqing Animal Disease Prevention and Control Center, Technical Specifications for the Prevention and Control of Brucellosis in Cattle and Sheep Part 4: Risk Assessment of Cattle and Sheep Farms, 2023. https://std.samr.gov.cn/db/search/stdDBDetailed?id=08226F136D8648ABE06397BE0A0AF131. (Accessed 19 December 2024).
[29] The Central People's Government of the People's Republic of China, The Ministry of Health and the Ministry of Agriculture Have Established a Cooperation Mechanism for the Prevention and Control of Zoonotic Infectious Diseases, 2005. https://www.gov.cn/zlzt/gzqlg/content_104136.htm. (Accessed 19 December 2024).
[30] Chinese Center for Disease Control and Prevention, Technical Program for Public Health Risk Assessment of Emergencies (For Trial Implementation), 2017. https://www.chinacdc.cn/jkzt/tfggwssj/zt/ynlddzjzfb_10023/yskzjzjszn_10032/201708/t20170810_149318.html. (Accessed 19 December 2024).
[31] Ministry of Agriculture and Rural Affairs of the People's Republic of China, Communiqué of the Ministry of Agriculture and Rural Affairs of the People's Republic of China, 2022. http://www.moa.gov.cn/nybgb/2022/202204/202206/P020220608343607927153.pdf. (Accessed 19 December 2024).
[32] C.H. Lu, K.W. He, Y.N. Hu, Y.P. Tan, D.W. Yu, Construction and development of animal disease risk analysis system in China, J. Agric. Sci. Technol. 18 (5) (2016) 8, https://doi.org/10.13304/j.nykjdb.2016.112.
[33] J. Pei, N.N. Guo, P. Fu, H.L. Liu, H.M. Zhang, N.H. Song, Qualitative risk assessment of food-and-mouth disease introduction into a bull breeding station in Hubei province, China Animal Quarantine 34 (7) (2017) 6–10, https://doi.org/10.3969/j.issn.1005-944X.2017.07.002.
[34] C. Starr, Social benefit versus technological risk, Science 165 (3899) (1969) 1232–1238, https://doi.org/10.1126/science.165.3899.1232.
[35] T. Ding, Y.Y. Yu, D.W. Schaffner, S.G. Chen, X.Q. Ye, D.H. Liu, Farm to consumption risk assessment for Staphylococcus aureus and staphylococcal enterotoxins in fluid milk in China, Food Control 59 (2016) 636–643, https://doi.org/10.1016/j.foodcont.2015.06.049.
[36] T. Zheng, T. Zhang, H.Y. Tang, W.Z. Li, Z.D. Zhang, Q.Y. Bai, et al., Import risk analysis on animal diseases of beef and its products imported from taiwan, China

Animal Quarantine 34 (9) (2017) 46–49, https://doi.org/10.3969/j.issn.1005-944X.2017.09.012.

[37] National Center for Disease Control and Prevention, The Law of the People's Republic of China on Prevention and Control of Infectious Diseases, 2018. http://www.nhc.gov.cn/fzs/s3576/201808/6d00c158844f42c5bcf94993bffa665a.shtml. (Accessed 19 December 2024).

[38] Chinese Center for Disease Control and Prevention, The Guidelines for Health Emergency Response to Natural Disasters, 2020 Edition, 2021. https://www.chinacdc.cn/jkzt/tfggwssj/zt/ynlddzjzfb_10023/yskzjzjszn_10032/202109/t20210916_246074.html. (Accessed 19 December 2024).

[39] T. Jiang, J.Q. Zhang, Y.L. Fang, B. Gao, Application of geographic information system in the study of vector-borne infectious diseases, Port, Health Control 24 (3) (2019) 55–58, https://doi.org/10.3969/j.issn.1008-5777.2019.03.014.

[40] M.N. Kamel Boulos, E.M. Geraghty, Geographical tracking and mapping of coronavirus disease COVID-19/severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) epidemic and associated events around the world: how 21st century GIS technologies are supporting the global fight against outbreaks and epidemics, Int. J. Health Geogr. 19 (1) (2020) 8, https://doi.org/10.1186/s12942-020-00202-8.

[41] J. Pan, J. Tian, H. Xiong, Z. Liu, Y. Yao, Y. Wang, et al., Risk assessment and evaluation of China's policy to prevent COVID-19 cases imported by plane, PLoS Neglected Trop. Dis. 14 (12) (2020) e0008908, https://doi.org/10.1371/journal.pntd.0008908.

[42] L.Q. Fang, X.L. Li, K. Liu, Y.J. Li, H.W. Yao, S. Liang, et al., Mapping spread and risk of avian influenza A (H7N9) in China, Sci. Rep. 3 (2013) 2722, https://doi.org/10.1038/srep02722.

[43] Y. Ji, Z.W. Fan, G.P. Zhao, J.J. Chen, H.W. Yao, X.L. Li, et al., Establishment of Geographic Information System on risk assessment regarding infectious diseases imported to China, Chin. J. Epidemiol. 40 (6) (2019) 719–725, https://doi.org/10.3760/cma.j.issn.0254-6450.2019.06.022.

[44] K.T. Chen, Emerging infectious diseases and one health: implication for public health, Int. J. Environ. Res. Publ. Health 19 (15) (2022) 9081, https://doi.org/10.3390/ijerph19159081.

[45] C.H. Lu, K.W. He, Y.N. Hu, Y.P. Tan, D.W. Yu, Construction and development of animal disease risk analysis system in my country, Chinese Journal of Agricultural Sciences 18 (5) (2016) 8–16, https://doi.org/10.13304/j.nykjdb.2016.112.

[46] S.H. Zhan, H. Liu, G. Wang, J. Tu, C.S. He, Y. Shao, et al., Issues on the application of animal disease risk assessment in anhui province and relevant suggestions, Veterinary Management 37 (6) (2020) 35–39, https://doi.org/10.3969/j.issn.1005-944X.2020.06.009.

[47] Z. Shi, J. Li, X. Hu, Risk assessment and response strategy for pig epidemics in China, Vet. Sci. 10 (8) (2023) 485, https://doi.org/10.3390/vetsci10080485.

[48] F. Deng, Advances in monitoring early warning and response of emerging infectious diseases in hospitals, Chin. J. Infect. Control (2021) 90–93, https://doi.org/10.12138/j.issn.1671-9638.20217366.

[49] E. Tambo, O.T. Adetunde, O.A. Olalubi, Re-emerging Lassa fever outbreaks in Nigeria: Re-enforcing “One Health” community surveillance and emergency response practice, Infect. Dis. Poverty 7 (37) (2018), https://doi.org/10.1186/s40249-018-0421-8.

[50] X.Y. Feng, N. Jiang, J.X. Zheng, Z. Zhu, J. Chen, L. Duan, et al., Advancing knowledge of One Health in China: lessons for One Health from China’s dengue control and prevention programs, Sci One Health (2024) 100087, https://doi.org/10.1016/j.soh.2024.100087.

[51] Y. Li, Y. Bao, N. Qiang, M. Zhong, Z. Han, Y. Li, et al., Long-term exposure to ambient benzene and brain disorders among urban adults, Nature Cities 1 (2024) 830–841, https://doi.org/10.1038/s44284-024-00156-z.

[52] M.J. Olivera, C.Y. Rincón Acevedo, A.J. Olivera, S. Mendez-Cardona, M.J. Vera Soto, Addressing Chagas disease from a One Health perspective: risk factors, lessons learned and prevention of oral transmission outbreaks in Colombia, Sci. One Health 3 (2024) 100066, https://doi.org/10.1016/j.soh.2024.100066.

[53] H. Liang, C. Huang, X. Zhu, Z. Yuan, Significance of and outlook for the biosecurity law of the People’s Republic of China, Journal of Biosafety and Biosecurity 2 (1) (2021) 46–50, https://doi.org/10.1016/j.jobb.2021.06.004.

[54] C. Cao, China’s evolving biosafety/biosecurity legislations, Journal of Law and the Biosciences 8 (1) (2021) lsab020, https://doi.org/10.1093/jlb/lsab020.

[55] H. Lee, Risk Management in South Korea, Springer, Singapore, 2021, pp. 231–242, https://doi.org/10.1007/978-981-16-3468-0_17.

[56] World Bank China: New Project to Reduce Risks of Emerging Infectious Diseases through a Multisectoral Approach, 2020. https://www.worldbank.org/en/news/press-release/2020/06/18/china-new-project-to-reduce-risks-of-emerging-infectious-diseases-through-a-multisectoral-approach. (Accessed 19 December 2024).

[57] T. Li, T. Du, Vertical fiscal imbalance, transfer payments, and fiscal sustainability of local governments in China, Int. Rev. Econ. Finance 74 (2021) 392–404, https://doi.org/10.1016/j.iref.2021.03.019.

[58] S. Kuhlmann, J. Bogumil, The digitalisation of local public services, Evidence from the German Case. The Future of Local Self-Government (2021) 101–113, https://doi.org/10.1007/978-3-030-56059-1_8.

[59] A.M. Riyadh, T.J. Cova, S.C. Brewer, T.W. Collins, R.M. Medina, L. Siebeneck, et al., Spatial analysis of disaster resilience research: a bibliometric study, Int. J. Disaster Risk Reduc. 113 (2024) 104896, https://doi.org/10.1016/j.ijdrr.2024.104896.

[60] D.P. Fidler, From international sanitary conventions to global health security: the new international health regulations, Chin. J. Int. Law 4 (2) (2005) 325–392, https://doi.org/10.1093/chinesejil/jmi029.

[61] World Health Organization, China-WHO Country Cooperation Strategy 2022–2026, 2023. https://www.who.int/publications/i/item/WPRO-2023-DPM-001. (Accessed 21 October 2024).

[62] M. Li, Public health crises in comparison: China's epidemic response policies from SARS to COVID-19, Global Publ. Health 16 (8–9) (2021) 1223–1236, https://doi.org/10.1080/17441692.2021.1919735.

[63] The National People’ s Congress of the People’ s Republic of Health, Implement the Animal Epidemic Prevention Law to Promote the Improvement of Public Health Safety and Human Health Protection, 2024. http://www.npc.gov.cn/c2/c30834/202102/t20210204_310006.html. (Accessed 21 October 2024).

[64] World Health Organization, One Health Joint Plan of Action Launched to Address Health Threats to Humans, Animals, Plants and Environment, 2022. https://www.who.int/news/item/17-10-2022-one-health-joint-plan-of-action-launched-to-address-health-threats-to-humans–animals–plants-and-environment. (Accessed 19 December 2024).

[65] World Health Organization, Joint Risk Assessment Operational Tool (JRA OT): An Operational Tool of the Tripartite Zoonoses Guide: Taking a Multisectoral, One Health Approach: a Tripartite Guide to Addressing Zoonotic Diseases in Countries, 2021. https://www.who.int/publications/i/item/9789240015142. (Accessed 19 December 2024).

[66] T. Lefrançois, B. Lina, Covars, B. Autran, One Health approach at the heart of the French Committee for monitoring and anticipating health risks, Nat. Commun. 14 (2023) 7540, https://doi.org/10.1038/s41467-023-43089-2.

[67] K.M. Holcomb, J.E. Staples, R.J. Nett, C.B. Beard, L.R. Petersen, S.G. Benjamin, et al., Multi-model prediction of West Nile Virus neuroinvasive disease with machine learning for identification of important regional climatic drivers, GeoHealth 7 (11) (2023) e2023GH000906, https://doi.org/10.1029/2023GH000906.

[68] L. Zhou, J.M. Liu, X.P. Dong, J.M. McGoogan, Z.Y. Wu, COVID-19 seeding time and doubling time model: an early epidemic risk assessment tool, Infect. Dis. Poverty 9 (76) (2020), https://doi.org/10.1186/s40249-020-00685-4.