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Community-Based Surveillance (CBS) for Strengthening Early Warning and Epidemic Preparedness in Urban Bangladesh: A Surveillance Protocol and its Implementation in Selected City Corporations of Bangladesh

Md. Omar Qayum
Institute of Epidemiology, Disease Control and Research
Immamul Muntasir
immamulmuntasir@gmail.com

Institute of Epidemiology, Disease Control and Research
Arifa Hasnat Ali
Danish Red Cross, International Federation of Red Cross and Red Crescent Societies
Nazmus Sakib
Bangladesh Red Crescent Society (BDRCS)
Mohammad Rashedul Hassan
Institute of Epidemiology, Disease Control and Research
Mahbubur Rahman
Institute of Epidemiology, Disease Control and Research
Tahmina Shirin
Institute of Epidemiology, Disease Control and Research

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Abstract

Background:

Bangladesh has well established facility based surveillance system for several diseases, but major gaps remain in detecting early signals at the community level. This protocol outlines the design and initial implementation of Community-Based Surveillance (CBS) in Bangladesh to establish an effective early detection and community reporting system for epidemic-prone diseases, to integrate CBS with existing national surveillance systems, and to identify operational challenges and opportunities for scaling CBS nationally. The initiative is being implemented through a collaborative partnership between the Institute of Epidemiology, Disease Control and Research (IEDCR) and the Bangladesh Red Crescent Society (BDRCS).

Methods:

Design of CBS will be initiated with a CBS assessment tool of the International Federation of Red Cross and Red Crescent Societies (IFRC) in 12 wards of three city corporations: Dhaka South, Rajshahi, and Sylhet City Corporations. The surveillance platform will engage trained community volunteers to cover selected community households. Priority disease syndromes such as influenza-like illness (ILI), acute watery diarrhea (AWD), suspected dengue, acute jaundice syndrome (AJS), and unusual human and animal health events are selected using criteria of public health relevance, intervention feasibility, and community detectability. Real-time reporting will be conducted using a mobile application linked to the IEDCR server. Data will be verified by Field Health Officers and escalated as needed. Dashboards will support ongoing analysis, and coordination mechanisms engaging health authorities at local and national levels.

Expected Results:

The CBS is expected to improve the timeliness and sensitivity of outbreak detection with initial focus to urban settings. It will provide community-level data to supplement facility-based surveillance and support rapid public health response. The initiative also aims to identify key operational, technical, and institutional factors needed for nationwide scale-up and integration into existing health emergency response frameworks.

Conclusion:

CBS in Bangladesh represents a promising approach to bridging the gap between communities and facility-based surveillance systems. By integrating CBS with digital tools, training local volunteers, and institutionalizing partnerships between government and non-government stakeholders, the initiative

seeks to strengthen epidemic preparedness and response capacities. Findings from platform will inform future scale-up and contribute to regional and global best practices on community-led surveillance models.

1. Introduction

Bangladesh is a low-lying deltaic nation situated at the intersection of South and Southeast Asia, bordered by India, Myanmar, and the Bay of Bengal[1] Home to approximately 175 million people, it is one of the most densely populated countries in the world, with a population density exceeding 1,350 people per square kilometer[2] The country faces complex public health challenges driven by climate vulnerability, frequent natural disasters (such as cyclones, floods, and riverbank erosion), rapid unplanned urbanization, and a high burden of communicable diseases [3] Urban centers like Dhaka are particularly susceptible to outbreaks of vector-borne and waterborne diseases due to poor drainage and overcrowding [4]. Emerging infectious diseases (e.g., Nipah virus, avian influenza) and zoonotic transmission risks further compound the country's epidemiological profile [5]. Despite progress in health indicators, access to healthcare remains uneven, particularly for people with low-socio-economic status in the urban settings.

Bangladesh has a multi-tiered disease surveillance infrastructure for diseases with public health importance led by the Ministry of Health and Family Welfare (MoHFW), primarily implemented through the Directorate General of Health Services (DGHS) and the Institute of Epidemiology, Disease Control and Research (IEDCR). The surveillance system includes health facility-based passive surveillance, sentinel site-based surveillance, laboratory-based surveillance, and event-based systems. Platforms such as the District Health Information Software 2 (DHIS2), the Early Warning, Alert and Response System (EWARS), and Web-Based Disease Surveillance System (WBDSS) facilitate timely data reporting. Special surveillance initiatives, including hospital-based and occasionally mobile phone-based systems, complement traditional methods for enhanced outbreak detection [6, 7]

The existing surveillance systems in Bangladesh monitor a broad range of communicable diseases and public health threats. These include both indicator-based and event-based surveillance streams targeting disease outbreaks, antimicrobial resistance, zoonoses, and climate-sensitive illnesses. Surveillance platforms such as National Influenza Surveillance, Acute Encephalitis Syndrome (AES), Hospital-Based Rotavirus and Intussusception Surveillance (HBRIS), Nipah virus surveillance, Anthrax and surveillance, and AMR surveillance operate under IEDCR [7].

Key actors in disease surveillance include the MoHFW, DGHS (particularly the Communicable Disease Control [CDC] Unit), and IEDCR, which leads outbreak investigations and national-level disease surveillance. Surveillance activities are supported by MIS-DGHS for data integration through DHIS2, while laboratory support is provided by IEDCR and partner institutions like International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). International collaborators include WHO, US CDC, UNICEF, and the CDC Foundation, who provide technical assistance, funding, and guidance [6].

Data are collected from health facilities, mostly from sentinel sites, and laboratories (e.g, Covid-19, AMR) using paper and digital forms, then uploaded to the DHIS2 system or surveillance specific platforms. Event-based surveillance allows for immediate alerts and rapid mobilization [6, 7]. IEDCR, in collaboration with DGHS and MoHFW, leads public health emergency responses, supported by Public Health Emergency Operation Center (PHEOC) and Health Emergency Operations Center (HEOCs) at national level. However, resource constraints and workforce shortages can hamper response speed and scale, especially at the community level [7].

Bangladesh lacks a nationally integrated CBS system. However, community event reporting has been piloted in humanitarian contexts, particularly in Cox's Bazar among displaced populations using the EWARS platform. This surveillance study, supported by WHO and UNICEF, has demonstrated the value of community-level early warning systems, particularly when integrated with DHIS2. Nevertheless, CBS coverage remains fragmented, only for specialized closed group of population and not formally institutionalized within the national health surveillance architecture [8].

The International Red Cross and Red Crescent (RCRC) Movement, with its extensive network of community-based volunteers, is uniquely positioned to support CBS [9]. Globally, Red Cross and Red Crescent volunteers have demonstrated effectiveness in identifying and reporting unusual health events-often earlier than formal systems can. Their integration into CBS frameworks ensures culturally sensitive, community-trusted surveillance mechanisms. The Bangladesh Red Crescent Society (BDRCS) aims to extend this capability nationally through structured CBS mechanisms.

Established in 1973, BDRCS is the country's largest humanitarian organization and auxiliary to the Government in disaster and health emergencies [10]. With a presence in all 64 districts and metropolitan areas, and facilities including hospitals, blood banks, and primary care centers, BDRCS has played a crucial role in emergency response, disease awareness, and health service delivery. Its volunteers were instrumental during the COVID-19 pandemic and continue to support public health through vaccination campaigns, disaster risk reduction, and community health promotion [11].

Under the Pilot Programmatic Partnership (PPP) funded by the Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO), BDRCS, with technical guidance from IEDCR and support from IFRC and European National Societies, is launching a structured CBS initiative in Bangladesh for the first time [12, 13].

This initiative will reinforce national surveillance coverage and empower communities as frontline contributors in safeguarding public health.

1.1 General Objective:

The goal of CBS is to strengthen the early detection and timely reporting of health threats at the community level.

1.2 Specific Objectives:

- To support the communities to reduce case-load and decrease spread of identified diseases through Community Based Surveillance by house-to-house investigation linking with health promotion.
- To create evidence-based strategy for current and future prevention, control, and response mechanism for outbreaks and epidemics of identified diseases at community level.
- To identify challenges and areas of improvement for the proposed CBS structure through field test.
- To engage communities to take an active role in monitoring their own health and reporting concerns, fostering a sense of ownership and responsibility for public health.

2. Methodology

2.1. Surveillance Design and Setting

CBS will be implemented as a prospective observational platform in Bangladesh, led by the Bangladesh Red Crescent Society (BDRCS) and the Institute of Epidemiology, Disease Control and Research (IEDCR). The CBS approach will build on a mapping and analysis of existing systems for diseases detection and reporting operated by the national authorities or health partners such as WHO to which the CBS mechanisms will be aligned with. Community health workers and volunteers will be mobilised and trained on CBS for timely reporting to the sub national surveillance system on suspected events using contextualized materials that build on national standards, existing tools and related to the concrete risks faced by the targeted communities. The capacities of community members, institutions (e.g., school), organisations and local authorities to identify and report on outbreaks will be supported through household visits, sensitisation sessions, awareness campaigns and engagement of online platforms and community gatekeepers.

2.2. Study population size

The surveillance will cover a pre-defined network rather than a sample for statistical inference. The study will engage 240 volunteers covering all households in 12 wards, totaling 38,400 households. No formal sample-size calculation was performed; the scale was chosen pragmatically to test feasibility and yield enough data for analysis. This coverage is expected to provide meaningful data on community illness rates and outbreak signals.

2.3. Health Stakeholder and Facility Mapping

As part of the implementation planning, a comprehensive stakeholder and facility mapping exercise will be conducted. This will identify government health centers, NGOs, and private sector health service providers within the implementation areas. The mapping will include:

· Government urban health facilities such as Nagar Shasthya Kendras under the Urban Primary Health Care Services Delivery Project (UPHCSDP).

· Major public hospitals including Dhaka Medical College Hospital, Sir Salimullah Medical College Hospital, Rajshahi Medical College Hospital, and Sylhet Osmani Medical College Hospital.

· NGOs (e.g., BRAC, Dhaka Ahsania Mission, Shimantik, Nari Moitry).

· Red Crescent health infrastructure in Rajshahi and Sylhet, and the BDRCS Matrimongol Hospital in Sylhet.

· UN and development partners (e.g., WHO and UNICEF).

· Private clinics and diagnostic centers operating in the three city corporations.

This mapping will inform strategic engagement, referral pathways, and coordination mechanisms.

2.4. Training of Trainers (ToT) for CBS

Following the feasibility study, a Training of Trainers (ToT) will be organized to build CBS capacity within BDRCS and among partners. The objective of the ToT will be to equip selected BDRCS staff and volunteers, as well as relevant government health officials, with knowledge and skills to train community volunteers on CBS.

The training curriculum will be based on the IFRC CBS Toolkit and include modules on:

· Disease identification and case definitions.

· Community-based detection, reporting, and early response.

· Use of CBS data collection tools and reporting systems.

Training participants will include individuals who previously completed training in Epidemic Control for Volunteers (ECV), Community-Based Health and First Aid (CBHFA), or general health promotion. The ToT will also prepare facilitators to conduct advocacy sessions with city authorities and finalize the CBS protocol, ensuring alignment with national surveillance priorities.

2.5. Stakeholder Coordination Mechanisms

A series of stakeholder sensitization workshops and coordination meetings will be conducted throughout the implementation phase. These sessions will aim to engage local health authorities, municipal officials, IEDCR, RCRC Movement partners, and other key actors. The meetings will:

· Clarify CBS objectives and implementation frameworks.

· Define stakeholder roles and responsibilities.

· Facilitate integration with existing surveillance systems and response structures.

· Discuss disease prioritization, data flow mechanisms, and community feedback loops.

These collaborative sessions will ensure multisectoral alignment and encourage institutional support for CBS sustainability.

2.6. Project Area Selection

Bangladesh, with its high population density, tropical climate, and inadequate WASH (Water, Sanitation, and Hygiene) infrastructure, remains highly susceptible to outbreaks of communicable diseases. Historically, the country has experienced several epidemics, including those caused by zoonotic, waterborne, and vector-borne pathogens such as cholera, dengue, Nipah, chikungunya, and malaria. The COVID-19 pandemic, however, has had the most devastating impact to date, resulting in more than 29,000 deaths.

In light of these challenges, CBS will be implemented in 12 wards: 2 in Dhaka South City Corporation, 5 in Rajshahi City Corporation, and 5 in Sylhet City Corporation. These areas have been selected based on population density, outbreak history, and the presence of vulnerable communities including slum dwellers.

2.7. Volunteer Selection

CBS community volunteers will be selected according to specific criteria to ensure effective surveillance coverage at the community level. Volunteers must be aged 18 years or older, reside within the target community, and be literate, with the ability to read and write. They must demonstrate willingness and commitment to serve the community at all times and be able to use a smartphone. Persons with disabilities and older adults will also be eligible to volunteer. A volunteer cannot be assigned to more than one administrative unit. Preference will be given to individuals with previous experience in community health, disease surveillance, or health-related training, while students in health-related fields such as public health, nursing, and medical technology will also be encouraged to participate. These criteria will guide community mobilization efforts and help ensure the selection of capable and committed volunteers

2.8. Identification of Priority Diseases

To determine the diseases and events of outbreak potential in the project sites, the CBS team will consult existing IEDCR outbreak records, conduct interviews with local health authorities, and review disease trends over the past two years. A final list of priority diseases will be established in collaboration with stakeholders.

The selection of diseases for CBS implementation will follow three criteria:

1. **Public Health Concern:** Diseases with high case fatality rates, high prevalence, a history of outbreaks, or those affecting vulnerable populations.

2. **Intervention Feasibility:** Diseases that allow for effective early interventions or treatment at the community level.

3. **Community-Level Detectability:** Diseases for which volunteers can use simple, sensitive, and specific community case definitions.

Only diseases satisfying all three criteria will be included in the CBS system at this stage.

2.9. Community Case Definitions

To facilitate early detection, community volunteers will be trained to use simplified case definitions tailored to local language and context. These will enable volunteers having no formal medical training to identify and report suspected cases based on observable symptoms.

The CBS team will develop and validate simplified definitions with technical input from BDRCS and IEDCR and endorsement from local health authorities. Initially, the following five priority health events will be included, with corresponding community case definitions **(Table 1)**:

Table 1: Community Case Definitions for CBS

Suspected Case	Community Case Definition
Influenza-like Illness (ILI)	Fever ≥ 38°C and cough with onset within the last 10 days
Suspected Dengue	Fever (≥ 100°F) within 10 days and one or more of the following: rash, headache, muscle/joint pain, conjunctivitis, hemorrhagic symptoms, retro-orbital pain
Acute Watery Diarrhea (AWD)	Three or more loose/liquid stools within 24 hours
Suspected Acute Jaundice Syndrome (AJS)	Fever and yellowing of eyes or skin within the past two weeks
Unusual Health Event	Three or more people or animals falling ill or dying with similar unknown symptoms within a 1-km radius or 10-minute walking distance over the past two weeks

As the CBS system evolves, additional diseases or health events may be added to the surveillance scope. New community case definitions will be developed as needed, following the same collaborative process with health authorities.

2.10. Training

2.10.1. Purpose of Training

Training will be a foundational component of CBS implementation. All community volunteers will receive comprehensive training prior to deployment. These trainings will ensure that volunteers acquire the skills needed to recognize symptoms, report diseases accurately, and take appropriate community-level actions. Training will empower volunteers to educate their communities, counter misinformation, and build trust with health authorities.

2.10.2. Training Implementation Plan

Before launching CBS activities, all community volunteers will undergo an initial training covering core surveillance concepts and tools. Regular refresher training will be conducted to reinforce knowledge, update skills, and address any performance gaps. Provision will also be made for ad-hoc or need-based training, particularly when new volunteers are recruited or when a public health emergency arises.

Training will be conducted using a cascade approach, which will include:

· **Training of Trainers (ToT):** Selected technical personnel will be trained to serve as master trainers for CBS roll-out.

· **Training of Supervisors:** Supervisors will be trained to oversee volunteer activities, validate data submissions, and maintain quality control.

· **Training of CBS Master Trainers:** A core group of highly trained personnel will be developed to lead CBS capacity-building nationwide.

2.10.3. CBS Training Content for Community Volunteers

Training sessions for community volunteers will cover the following key topics:

· Introduction to CBS (Definition, Purpose, Integration with National Surveillance)

· Importance of early detection and outbreak prevention

· Coordination with CHWs, local leaders, and health system actors

· Identification of priority diseases and community case definitions (e.g., ILI, AWD)

· Recognition of unusual or clustered health events

· Real-time online reporting and follow-up procedures

· Proper use of the CBS application

· Data protection and ethical considerations

· Building community trust and countering stigma

· Risk communication and community engagement

· Gender, protection, and inclusion considerations

· Behavior change communication techniques

· Mental health and psychosocial support (MHPSS)

· Community-based emergency preparedness and response

2.10.4. Refresher and Additional Training Modules

Refresher training will be conducted annually or as necessary. These will focus on reinforcing key concepts, introducing updated protocols, and solving implementation challenges identified through supervision or data review (Table-2).

In addition to CBS-specific training, volunteers will be encouraged to participate in the following health-related training programs supported by the Bangladesh Red Crescent Society and its partners:

Table 2: Training for volunteers supported by BDRCS

Training Name	Content Focus
Community-Based Health and First Aid (CBHFA)	Community health promotion, participatory health risk analysis, first aid
WASH Training	Safe water access, sanitation, hygiene promotion, diarrheal disease control
Epidemic Control for Volunteers (ECV)	Epidemic response, infection prevention, surveillance, and community engagement
First Aid Training	Emergency first aid and CPR, localized to common community risks
Public Health in Emergencies	Preparedness and response during public health crises, including coordination with national systems

2.11. Data Collection

Community-Level Data Collection:

· CBS community volunteers will collect and report data using the CBS mobile application (“CBS App”), activity book, and Master Code Book.

· Reports will be submitted in real-time through the CBS App for verification.

Volunteer Activities:

· Volunteers will identify potential health events based on agreed community case definitions.

· They will report alerts through the CBS App, triggering verification by Field Health Officers (FHOs).

· Early health promotion and preventive actions will be initiated upon detection of alerts, especially for clusters (A **cluster** is defined as three or more alerts with similar symptoms or suspected illness occurring within a 500-metre radius or of each other, within one epi week , indicating a possible localized outbreak that requires immediate attention).

Field Officer Role:

· FHOs will verify reported alerts within 24 hours via call or visit.

· Verified alerts will be escalated to local health authorities and IEDCR for action.

Reporting Frequency:

· Daily activity or zero reporting will be encouraged.

· Weekly reporting may be practiced during non-outbreak periods (first working day of the week).

Tools and Access:

· Each volunteer will use a unique ID/password to submit reports via any mobile device.

· CBS manuals and tools will be translated into local language for usability.

Data Privacy & Security:

· Verbal or written consent will be obtained from community members to be recruited within the CBS surveillance cohort.

· Data will be encrypted, password-protected, and stored securely at IEDCR.

· Role-based access control will limit data use to authorized personnel only.

· Data retention will follow a 10-year policy, after which unused data will be deleted.

Monitoring & Compliance:

· The system will include regular audits, privacy training, and incident response plans.

· All data practices will comply with national regulations and IFRC data standards.

Data Storage & Backup:

· Primary storage will reside on IEDCR servers with backup systems (secondary server or external drive) in place.

· Data will be backed up periodically per a documented recovery plan.

Data Cleaning & Validation:

· The IEDCR Data Manager will review data daily, remove duplicates, check inconsistencies, and validate entries.

· FHOs will assist in resolving discrepancies.

· Only cleaned data will be shared with stakeholders for analysis.

2.12. Data Analysis

CBS Dashboard & Visualization:

· CBS App data will be analyzed and visualized through an integrated CBS Dashboard hosted by the IEDCR official website.

· Initial automated analyses will identify clustering or anomalies.

· Advanced statistical software will be used for detailed outbreak analysis.

Analytical Focus Areas:

· **Time:** Trends over time, including EPI curves and outbreak timelines.

· **Place:** Geographic clustering, mapping, and transmission tracking.

· **Person:** Demographics, risk factors, and case details for tracing.

· **Trends:** 7-day and 8-week visualizations of health risks/events.

· **Performance:** Monitoring of volunteer engagement and reporting accuracy.

2.13. Roles and Responsibilities

2.13.1. Role of Community Volunteers

Community volunteers will be the frontline actors in CBS implementation. They will be trained to recognize and report suspected priority health events using simplified community case definitions. Volunteers will also play a role in engaging their communities in health education, risk communication, and prevention of stigma. They will use mobile applications to report suspected cases and unusual events in real-time and maintain liaison with Field Health Officers and local authorities.

2.13.2. Role of Field Health Officers

Field Health Officers from the implementing agency will play a vital role in validating and escalating reports. Their responsibilities will include:

· Receiving notifications of potential health threats submitted by volunteers through the CBS application;

· Verifying the reports either through phone or in-person visits and categorizing them as true or false alerts;

· Accepting and submitting validated reports into the Community Health Tracker System;

· Escalating true alerts to the relevant authorities, including local city corporations and the national health surveillance authority (IEDCR), via written reports and phone calls, depending on the priority of the reported disease;

· Coordinating with government agencies to support outbreak investigations and response activities as needed.

2.13.3. Role of the CBS Data Management Team

The CBS Data Management Team, based at IEDCR, will manage the technical and analytical aspects of the surveillance system. Their roles will include:

· Accessing and managing raw data received through the CBS application;

· Conducting data cleaning, transformation, and basic analysis;

· Generating cluster detection alerts and producing daily, weekly, and monthly reports for sharing with CBS focal points;

· Maintaining the functionality of the mobile application and web-based dashboard as per evolving project requirements;

· Addressing any data-related technical issues raised by field volunteers;

· Tracking community volunteer performance, when required;

· Conducting periodic field visits to ensure protocol adherence and provide orientation on updated CBS features.

2.13.4. Role of the CBS Implementing Agency

The implementing agency will mobilize communities and support the end-to-end CBS process. Their responsibilities will include:

· Mobilizing and empowering communities to recognize and report priority diseases and public health events;

· Conducting health promotion campaigns in targeted communities to raise awareness on priority diseases and response pathways;

· Collecting, verifying, and sharing community-based health data through an agreed upon reporting structure for integration into the national surveillance system;

· Supporting local response activities during outbreak events, including rumor tracking, contact tracing, anti-stigma campaigns, and social cohesion initiatives.

2.13.5. Role of the CBS Technical Team at IEDCR

The CBS Technical Team at IEDCR will serve as the key technical advisor for the national CBS framework. They will:

· Provide ongoing technical assistance to the implementing agency in establishing, operating, and expanding CBS in Bangladesh;

· Lead the training, coaching, and mentoring of CBS personnel and volunteers at all levels;

· Guide the development and operationalization of effective data collection, reporting, and analysis systems from the community to the national level;

· Support BDRCS in the development and adaptation of real-time digital information systems;

· Organize workshops, seminars, and training sessions to build technical capacity and promote interagency collaboration;

· Serve as the custodian of CBS data and ensure its use for early warning, outbreak investigation, and timely public health responses, including policy decision making;

· Conduct research, documentation, and dissemination of learnings and innovations generated from CBS implementation.

2.14. Quality Control

To ensure the quality and effectiveness of CBS activities, a multifaceted quality control framework will be implemented. CBS volunteer training will be assessed through both theoretical and practical examinations. A pre- and post-training test design will be employed to evaluate the knowledge acquisition and skill development of trainees. A competency matrix will be used to measure training effectiveness, monitor individual progress, and guide capacity strengthening needs.

Ongoing supervision will be provided by Field Health Officers (FHOs), who will review weekly activity logbooks maintained by CBS volunteers. They will conduct verification of reports and alerts either by direct field visits or by contacting the volunteers via phone. Supervision visits will also include supportive coaching by field supervisors.

To maintain high standards of surveillance quality, refresher training modules such as practical drills, peer group discussions, and periodic simulations will be conducted. Field Health Officers will systematically cross-check CBS alerts against community case definitions to minimize the risk of false alerts or missed health events.

2.15. Coordination Mechanism

2.15.1. Local Government Coordination

The Chief Health Office (CHO)/Civil Surgeon (CS) will receive compiled CBS reports on a fortnightly or monthly basis and will have real-time access to the CBS database. CHOs/CSs will analyze reports to detect trends and will escalate true alerts as needed. They will coordinate closely with the Institute of Epidemiology, Disease Control and Research (IEDCR) and other government authorities during outbreak investigations and responses. Collaboration with Bangladesh Red Crescent Society (BDRCS) and other partners will also be ensured for response planning, health promotion, or immunization campaigns.

2.15.2. Central Coordination at IEDCR

IEDCR and designated partners will receive automated CBS reports through the surveillance platform. The IEDCR team will routinely monitor the system dashboard, cross-check field data, and validate alerts. Based on ongoing field feedback, IEDCR and the CBS Technical Team at BDRCS will revise surveillance protocols and data collection tools as needed.

2.16. Risk Communication and Community Engagement (RCCE)

A risk register specific to the Bangladesh CBS context will be maintained to preempt and manage potential implementation challenges. Operational risks such as delayed decision-making, exposure of staff to health risks, and natural disasters will be continuously monitored. Mitigation strategies will include staff training, dedicated project management structures, area-specific security protocols, coordination platforms, and contingency planning. Risks related to changing political contexts or gaps in government engagement will be addressed through regular stakeholder dialogues and alignment with national policies.

2.17. Integration with National Surveillance Systems

The CBS system will be integrated with existing surveillance frameworks managed by IEDCR. CBS will complement these facility-based systems by detecting early signals from the community before they escalate to healthcare facilities. Data and insights collected by CBS volunteers will inform IEDCR-led outbreak investigations and enrich understanding of unreported or mild cases. Mechanisms for data sharing, joint analysis, and collaborative responses will be established to create a cohesive national surveillance architecture.

2.18. Emergency Preparedness and Response

Upon the detection and confirmation of a disease outbreak by national authorities (e.g., IEDCR or DGHS), the CBS system will transition into an emergency mode. CBS volunteers will be mobilized to conduct intensified active case searches, including household visits, school assessments, and community leader consultations. A brief orientation will be provided to volunteers for additional emergency-specific tasks.

CBS data will be reported daily during emergencies, with zero reports submitted even in the absence of cases. Field Health Officers will compile and escalate these reports to the Coordination Centre (CC), National Headquarters (NHQ), and implementing agency health departments. Rapid deployment of upazila and district rapid response teams (URRT and DRRT) will be coordinated by PHEOC to support overwhelmed areas.

Emergency CBS will include analysis of daily data to detect emerging hotspots and prioritize interventions. Confidentiality and data protection regulations will be strictly adhered to in all stages of data management.

Volunteers will support government-led responses through:

· Community-Based Health and First Aid (CBHFA),

· Epidemic Control for Volunteers (ECV),

· Psychological First Aid (PFA),

· Operation of oral rehydration and water treatment points,

· Social mobilization for immunization,

· Vector control and environmental health measures,

· Distribution of emergency supplies.

Referral pathways to local health services will be communicated clearly, adjusting as needed during the course of an emergency. Personal protection measures such as masks, gloves, and sanitizers will be provided based on volunteers' exposure risk and task type. Training on emergency surveillance tasks will be mandatory before deployment, including periodic refreshers.

2.19. Handover and Sustainability

Following the containment of an outbreak, the emergency CBS system will be transitioned back to preparedness CBS. This transition will include revising the frequency of zero reports (from daily to weekly), expanding the range of priority diseases, and re-integrating volunteers into standard community surveillance routines.

A quarterly monitoring system led by IEDCR and implementing partners will assess CBS performance and identify areas for improvement. Sustainability planning will be pursued through consultations with national and local authorities, ensuring alignment with long-term health system needs. The potential for CBS to fill gaps in national surveillance will be explored, and resource requirements will be defined for maintaining CBS functionality post-outbreak.

2.20. Collaboration with Stakeholders and Government Systems

The CBS initiative will be implemented in close collaboration with the Government of Bangladesh, particularly through a formal Memorandum of Understanding (MoU) with the Institute of Epidemiology, Disease Control and Research (IEDCR). A National Technical Working Group will be established, comprising representatives from IEDCR, Movement partners, the World Health Organization (WHO), and the Risk Communication and Community Engagement (RCCE) platform.

The BDRCS will participate in Health Cluster coordination mechanisms at both national and sub-national levels, including coordination committee meetings within City Corporations. Engagement with government counterparts will be tailored to the contextual needs—differentiating between emergency outbreak responses and passive preparedness phases without active outbreaks.

2.21. Community Engagement, Communication, and Accountability

Community engagement and accountability (CEA) activities will be integrated into all phases of CBS implementation. CBS volunteers and community members will be engaged through participatory planning meetings to ensure that CBS design and implementation are both relevant and accepted by the

communities. Community orientation meetings will be conducted to clarify the roles of volunteers, reporting pathways, and limitations of CBS (e.g., volunteers are not health professionals).

Community participation will be encouraged at every level, and efforts will be made to foster a culture of openness and shared decision-making. These engagements will help build trust, promote accountability, and ensure transparency of CBS activities. A key performance measure will be the degree to which the community influences the purpose, scope, and outcomes of CBS operations.

2.22. Planning, Monitoring, Evaluation, and Reporting (PMER)

CBS implementation will be guided by a comprehensive work plan developed by the BDRCS Health Department, in coordination with relevant internal departments and external partners. This plan will be supported technically by IEDCR and the National Technical Working Group, with biannual data assessments conducted under the PPP framework.

Joint monitoring visits will be conducted with Movement partners and government stakeholders, including IEDCR and City Corporation (CC) health teams, to ensure consistent progress tracking, early problem identification, and timely corrective actions. Mid-term and final evaluations of CBS activities will be conducted as part of the overall PPP evaluation framework.

2.23. Reporting Framework

The reporting system will include:

· **Daily Reports:** Volunteers will submit data automatically via mobile applications. Zero reporting and alert generation will be transmitted in real-time to Field Health Officers (FHOs).

· **Weekly Reports:** Volunteer team leaders will submit weekly activity summaries and workplans to FHOs.

· **Monthly Reports:** FHOs will compile field data and submit monthly summaries to the CHO and the Epidemic Preparedness and Pandemic Response (EPPR Officer), who will coordinate with the Health Department and IEDCR.

· **Annual Reports:** Aggregated annual data and outcomes will be shared with key stakeholders and partners.

2.24. Outbreak Response Protocol

In the event of a suspected outbreak, the PHEOC serves as the central hub for receiving and verifying alerts of suspected outbreaks reported by community volunteers through supervisors or focal persons. After receiving a signal, the PHEOC verifies the information with local health authorities or health facilities, collects basic epidemiological details, and, if validated, coordinates activation of the Upazila

Rapid Response Team (URRT), District Rapid Response Team (DRRT), or National Rapid Response Team (NRRT) depending on the severity, location, and scale of the event for further investigation and public health response.

2.25. Integration with National and Multisectoral Systems

· **Anticipatory Action for Health:** CBS will provide real-time community-level indicators to support early action, such as targeted health interventions prior to outbreak escalation.

· **One Health Approach:** CBS volunteers will report events across human, animal, and environmental sectors, enhancing intersectoral coordination for early detection of zoonotic diseases.

· **Public Health Emergency Operations Centre (PHEOC):** CBS data will be shared with the PHEOC to support national-level decision-making during public health emergencies.

· **Early Warning, Alert and Response System (EWARS):** CBS-generated alerts will be integrated with EWARS, enhancing the scope and sensitivity of national surveillance systems.

· **Disaster Response Coordination:** CBS will contribute to real-time situational awareness during disasters, providing critical health data to national emergency management agencies.

· **Climate Health Initiative:** CBS will be expanded to include indicators of climate-sensitive diseases, promoting adaptive responses to environmental health risks.

3. Discussion

This protocol outlines the strategic implementation plan for CBS in Bangladesh, designed to strengthen early warning and public health response mechanisms by leveraging community networks. CBS will serve as a critical interface between communities and the national facility-based surveillance system, particularly in contexts where health infrastructure is limited or under strain. By engaging trained community volunteers and aligning with national health authorities such as the Institute of Epidemiology, Disease Control and Research (IEDCR), the initiative is expected to enhance the timeliness, sensitivity, and reach of outbreak detection and response efforts.

A core strength of this CBS protocol lies in its alignment with the government's health system, including coordination through the National Technical Working Group, and reporting channels that link directly to Public Health Emergency Operations Centers (PHEOCs). Through these institutional linkages, CBS will contribute to a more cohesive and responsive health surveillance ecosystem, capable of both routine risk detection and emergency response.

The protocol also places a strong emphasis on community engagement and accountability. Building trust, ensuring community ownership, and maintaining transparent communication will be foundational

to CBS success. These elements are particularly important given the preventive nature of CBS, which relies on early signal detection before visible health crises emerge. Empowering volunteers with the necessary training, feedback mechanisms, and motivation will be critical to sustaining high-quality surveillance over time.

In addition, the protocol has been designed to be adaptive to different scenarios, including emergencies, climate-related health risks, and One Health threats. By equipping CBS volunteers to monitor not just human health events but also animal signals, the system will provide early warning for complex, interlinked threats such as zoonotic outbreaks. The inclusion of climate-sensitive indicators is also expected to contribute to Bangladesh's broader climate health preparedness and resilience agenda.

However, several potential challenges may emerge during implementation. These may include variability in volunteer performance, reporting fatigue, data quality concerns, and coordination difficulties across sectors. To address these issues, robust monitoring and supervision systems will be put in place, along with regular joint reviews and capacity-building activities.

Another anticipated challenge is the sustainability of CBS beyond the project cycle. While the protocol emphasizes integration with national systems and institutional coordination, additional efforts may be needed to secure long-term financing, policy endorsement, and institutionalization within the national disease surveillance framework. Advocacy and evidence generation will therefore be prioritized to demonstrate the added value of CBS for early detection, cost-effectiveness, and community resilience.

4. Conclusion

the CBS protocol presented here aims to operationalize a structured, participatory surveillance approach that enhances Bangladesh's epidemic preparedness and response capacity. By leveraging community involvement, multisectoral coordination, and digital reporting tools, CBS is expected to strengthen both vertical and horizontal integration of surveillance efforts. As implementation progresses, lessons learned will inform future scale-up and contribute to global knowledge on participatory surveillance in low-resource settings.

Abbreviations

AJS
Acute Jaundice Syndrome
AWD
Acute Watery Diarrhea
BDRCS
Bangladesh Red Crescent Society
CBHFA
Community-Based Health and First Aid
CBS

Community-Based Surveillance
CDC
Communicable Disease Control
CHO
Community Health Officer
CS
Civil Surgeon
DHIS2
District Health Information Software 2
DG ECHO
Directorate-General for European Civil Protection and Humanitarian Aid Operations
DGHS
Directorate General of Health Services
ECV
Epidemic Control for Volunteers
EOC
Emergency Operations Centre
EPPR
Epidemic Preparedness and Pandemic Response
EWARS
Early Warning, Alert and Response System
FGD
Focus Group Discussion
FHO
Field Health Officer
HBRIS
Hospital-Based Rotavirus and Intussusception Surveillance
IEDCR
Institute of Epidemiology, Disease Control and Research
ILI
Influenza-like Illness
IRB
Institutional Review Board
KII
Key Informant Interview
MIS
Management Information System
MoHFW
Ministry of Health and Family Welfare
MoU

Memorandum of Understanding
NDRT
National Disaster Response Team
NGO
Non-Governmental Organization
PFA
Psychological First Aid
PIC
Project Implementation Committee
PPP
Pilot Programmatic Partnership
PHEOC
Public Health Emergency Operations Centre
RCCE
Risk Communication and Community Engagement
RCY
Red Cross Youth
RRT
Rapid Response Team
SOP
Standard Operating Procedure
ToT
Training of Trainers
UDRT
Unit Disaster Response Team
UPHCSDP
Urban Primary Health Care Services Delivery Project
WASH
Water, Sanitation and Hygiene
WB-DSS
Web-Based Disease Surveillance System
WHO
World Health Organization

Declarations

Ethics approval and consent to participate

The CBS protocol was reviewed and approved by the ethical review committee of IEDCR. All volunteers will provide written consent to participate as surveillance workers. Household members will be informed about the purpose of data collection at each visit and will give verbal consent for the volunteer to record

non-identifiable health information. The surveillance activity poses minimal risk to participants; confidentiality is maintained by anonymizing individual data and securely storing reports. No identifying personal data will be published. Consent for publication of this protocol is not applicable.

Consent for publication

Not applicable

Availability of data and materials

Not applicable (For the purposes of this article, data sharing does not apply as no datasets have been produced or analyzed)

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

The study was designed by Md. Omar Qayum, Arifa Hasnat Ali, Immamul Muntasir, Nazmus Sakib, Mohammad Rashedul Hassan, Mahbubur Rahman, and Tahmina Shirin. The original protocol was written by Md. Omar Qayum and Arifa Hasnat Ali. Md. Omar Qayum, Arifa Hasnat Ali, and Nazmus Sakib responded to external reviewer comments. Md. Omar Qayum, Arifa Hasnat Ali, Immamul Muntasir, Nazmus Sakib, and Mahbubur Rahman developed the data collection tools. Md. Omar Qayum, Immamul Muntasir and Arifa Hasnat Ali drafted the manuscript. All authors reviewed the manuscript and approved the final version for submission.

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