Development and Implementation of National External Quality Assessment (NEQA) Schemes for Antimicrobial Resistance Testing: Lessons from Pilot Activities in Bangladesh and Nepal under the EQAsia Programme

Table of Contents


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Abstract

High-quality diagnostic laboratory performance is fundamental to antimicrobial resistance (AMR) surveillance and public health decision-making. In low- and middle-income countries, participation in international External Quality Assessment (EQA) schemes is often constrained by high costs, logistics, and limited national coordination capacity. To address these gaps, the Fleming Fund's EQAsia programme supported the establishment of *National External Quality Assessment (NEQA)* schemes for AMR diagnostics in Bangladesh and Nepal led by the Technical University of Denmark (DTU Food) and the International Vaccine Institute (IVI).

This report documents the design, implementation, and outcomes of NEQA activities conducted between 2023 and 2025, highlighting capacity-building activities, pilot trials, digital innovation, and lessons learned. The results show that establishing nationally led and digitally supported EQA systems is feasible, potentially sustainable, and impactful in strengthening AMR surveillance across sectors.

1. Introduction

Reliable laboratory testing is essential for the early detection, control, and monitoring of infectious diseases and AMR. External Quality Assessment (EQA) is a cornerstone of laboratory quality management, enabling laboratories to evaluate their analytical performance, identify weaknesses, and implement corrective actions in line with ISO 15189 and ISO/IEC 17043 standards.

Participation in the EQAsia regional EQA programme, designed around WHO and FAO priority AMR pathogens and provided free of cost, has significantly strengthened laboratory benchmarking, harmonization, and capacity across South and Southeast Asia. Nevertheless, regional schemes alone cannot fully address country-specific operational needs, long-term sustainability considerations, or the requirement for nationally led coordination structures. The establishment of National External Quality Assessment (NEQA) systems, which allow countries to test the performance of their national, regional or local laboratories, is a critical complementary step, therefore represents a critical complementary step, enabling countries to develop local capacity for panel preparation, distribution, data analysis, and continuous quality improvement within their own laboratory networks.

Within this context, the Fleming Fund's EQAsia programme, led by The Technical University of Denmark (DTU) National Food Institute (DTU Food), and supported by the International Vaccine Institute (IVI) in Seoul, initiated efforts to support the development of NEQA schemes in selected Fleming Fund countries. Bangladesh and Nepal were chosen as human health pilot sites based on their strong and consistent engagement in EQAsia, the presence of established national reference laboratories with AMR surveillance mandates, the Institute of Epidemiology, Disease Control and Research (IEDCR) and the National Public Health Laboratory (NPHL), and their demonstrated readiness to advance toward national EQA provision. The initiative was implemented through close collaboration between DTU Food, IVI,

and the national laboratories, providing the foundation for piloting and evaluating NEQA feasibility and operationalization under the EQAsia framework.

2. Approach and Implementation Framework

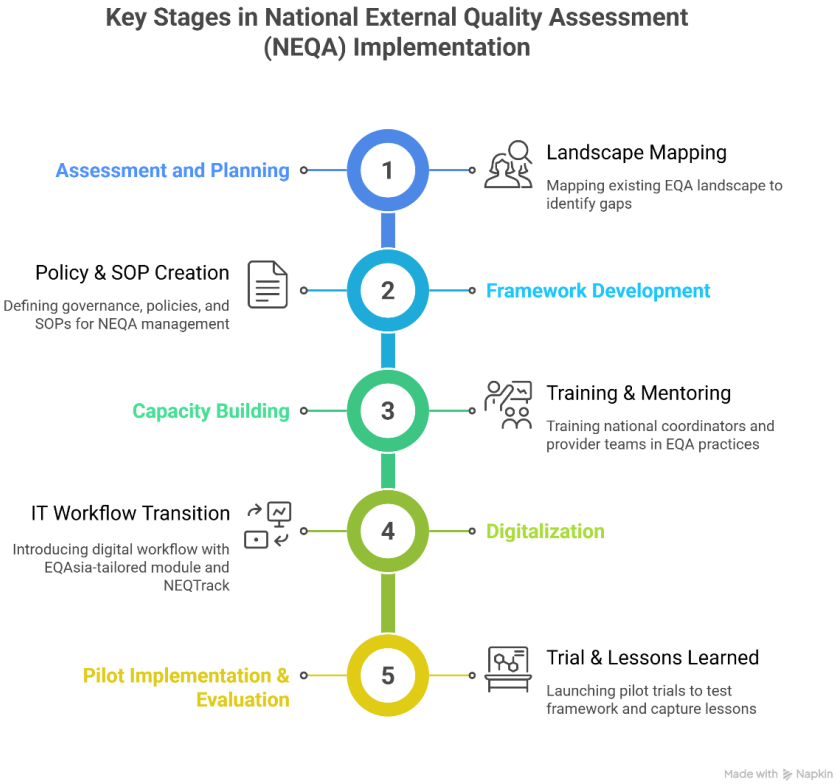
2.1 Overall Strategy

The development of the NEQA schemes followed a phased and stepwise approach aligned with the *WHO Manual for Organizing a National EQA Programme for Health Laboratories and Other Testing Sites* (2016) and the EURL-AR guidance, while adopting the technical and operational architecture of the EQAsia EQA programme.

The implementation strategy was designed to progressively build national ownership and sustainability through five key stages:

1. Assessment and Planning: mapping the existing EQA landscape to identify ongoing national participation, laboratory infrastructure, and capacity gaps in coordination, logistics, and data management.
2. Framework Development: defining the governance structure, operational policies, and standard operating procedures (SOPs) for NEQA management, ensuring alignment with ISO 15189 and ISO/IEC 17043 principles.
3. Capacity Building: training national coordinators, technical focal points, and provider teams in EQA provision, quality assurance practices, and data evaluation, with mentoring support from EQAsia experts.
4. Digitalization: introducing a digital workflow through the EQAsia-tailored NEQA IT module during the initial trials, followed by the transition to the NEQTrack platform for optimized online coordination, data submission, scoring, and reporting.

5. Pilot Implementation and Evaluation: launching pilot NEQA trials to test the established framework, evaluate technical readiness, and capture lessons learned for scale-up and national institutionalization.



2.2 Stakeholder Engagement and Governance

During the pilot phase, stakeholder coordination focused primarily on technical collaboration between international and national partners rather than on establishing a formal governance structure. The aim was to test feasibility, build technical capacity, and develop operational tools that could later support a nationally led EQA framework.

The EQAsia programme led the overall design, implementation, and supervision of the NEQA trials. DTU provided technical mentorship, logistical oversight, and harmonization with EQAsia's regional EQA architecture.

The University of Melbourne played a key material-support role. Material Transfer Agreements (MTAs) were established to facilitate the safe provision of bacterial strains for the NEQA trials. Several isolates used in the pilot panels originated from EQAsia's strain collection, for which the University of Melbourne serves as a member of the Scientific Advisory Board and a source of external and reference strains for validation and cross-comparison.

The International Vaccine Institute (IVI) contributed to two core components of the NEQA initiative:

1. Quality Management Systems (QMS): provided support in establishing quality management systems for diagnostic microbiology and proficiency testing in alignment with ISO 15189:2022 and ISO 17043:2023 standards. ; and

2. Digitalization: co-development of the NEQTrack web platform with DTU Food under the *CAPTURA* (Capturing data on Antimicrobial Resistance Patterns and Trends in Use in Regions of Asia) project, enabling online coordination, data submission, automated scoring, and feedback for the NEQA trials.

At the country level, IEDCR in Bangladesh and NPHL in Nepal were trained and mentored to act as national NEQA providers. They were responsible for receiving and testing candidate strains, selecting isolates for inclusion in the NEQA panels, preparing and distributing panels to participating laboratories, coordinating data submission through the IT systems, analyzing results, and disseminating performance feedback.

Alongside the pilot sites, several additional institutions from the animal health and aquaculture sectors from several FF countries were invited to participate as observers. These observer laboratories attended training sessions, participated in selected coordination meetings, and gained exposure to the NEQA process, but did not receive tailored or extensive technical support or materials from the DTU or IVI teams.

Observer institutions included:

- Nepal: Patan Academy of Health Sciences (Patan), Tribhuvan University Teaching Hospital (Maharajgunj), Central Veterinary Laboratory (CVL)
- Bangladesh: Central Disease Investigation Laboratory (CDIL), Bangladesh Livestock Research Institute (BLRI)
- Bhutan: Enteric Zoonotic and Vector-borne Disease Laboratory (EZVBDL), Royal Centre for Disease Control (RCDC)
- Indonesia: BB Binomika, BPKIL, BBLK Surabaya, BPMPSPH

The inclusion of these observer sites broadened regional engagement and promoted early awareness of NEQA concepts within the One Health community across FF countries.

In addition to the designated pilot laboratories and observers, Fleming Fund Country Grant (FF-CG) teams in Bangladesh, Nepal, Bhutan and Indonesia played an important supporting role. These national teams helped facilitate communication with participating laboratories, especially for coordination with observer sites, and assisted with logistical arrangements where relevant. Their engagement strengthened local awareness of NEQA activities and ensured alignment with ongoing national AMR initiatives supported through FF-CGs.

While a formal national governance structure for NEQA had not yet been established, this collaborative network of national reference laboratories, FF-CG teams, observer institutions, and international partners provided a pragmatic and functional model for coordination. The approach ensured that pilot NEQA activities were consistent with WHO GLASS, EURL-AR, and FAO/WHO priority pathogen frameworks, creating a strong foundation for the future institutionalization of nationally led EQA systems.

2.4 Capacity Building and Training

Capacity building was a central component of the NEQA development process, aiming to equip the designated national laboratories, IEDCR in Bangladesh and NPHL in Nepal, with the technical and managerial competencies required to function as independent EQA providers. Training activities were designed and delivered under the EQAsia framework. The approach combined structured training modules, practical mentorship, and progressive implementation to ensure learning was immediately applied in the pilot trials. Activities spanned from mid-2024 to late-2025 and covered the following key areas:

- **Foundational Knowledge and QMS Alignment:**
  A series of five virtual training modules were delivered between March and September 2024, introducing principles of EQA design and management, development of SOPs, documentation control, internal audits, and corrective-action planning. These sessions emphasized the integration of NEQA activities within the broader QMS and their alignment with ISO 17043 and ISO 15189 requirements.

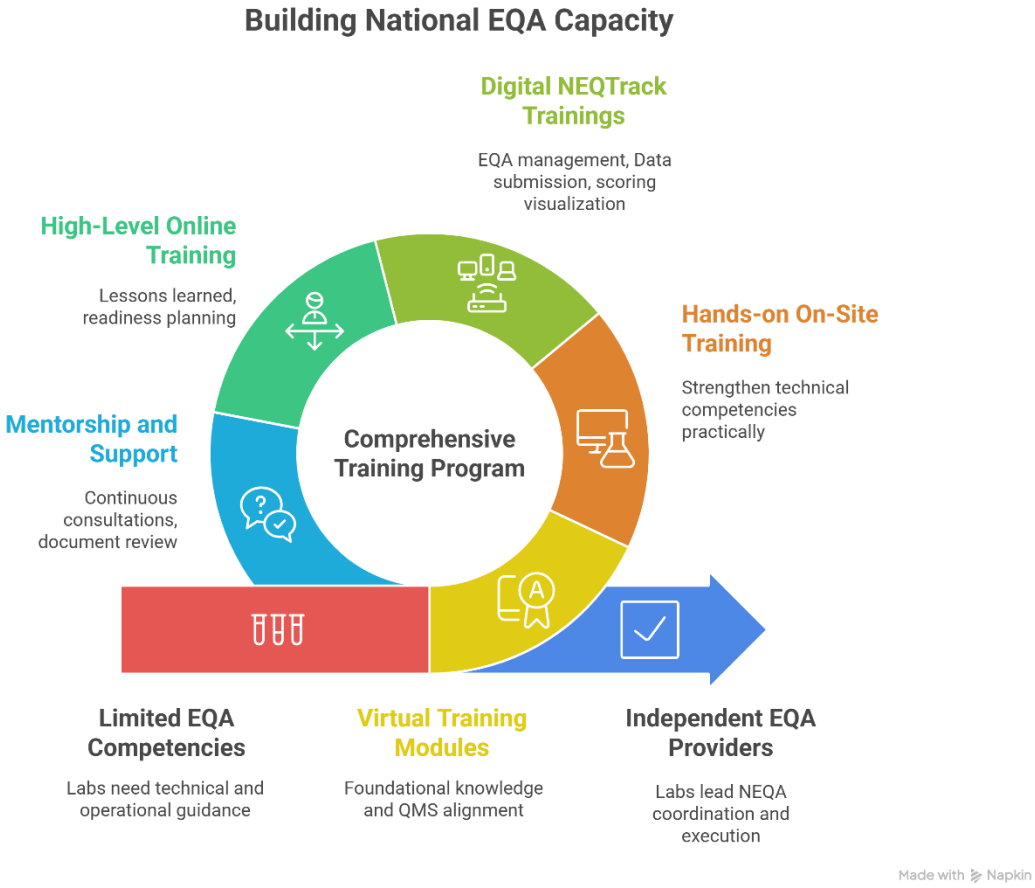
- **Hands-on On-Site Training:**
  In October 2024, hands-on training sessions were conducted in both countries to strengthen technical competencies in panel preparation and logistics coordination. During these sessions, staff from IEDCR and NPHL gained practical experience in testing trial batches, assessing sample performance, and managing panel distribution and data submission workflows. The sessions were facilitated and mentored by experts from DTU and IVI.

- **Digital NEQTrack Trainings:**
  Dedicated online sessions introduced national focal points and participants to the **NEQTrack** digital platform, covering data submission, scoring visualization, and certificate download functionalities. These trainings ensured users' readiness for the digital transition planned for the second NEQA trial and enhanced familiarity with automated data management and reporting processes.

- **High-Level Online Training (HLT):**
  The NEQA High-Level Training was held on 23–24 September 2025 via Microsoft Teams. It brought together 26 participants, including NEQA providers, facilitators, and observers from partner institutions. The training focused on lessons learned from the first NEQA trial, identification of technical and logistical challenges, and readiness planning for the second trial. Topics included risk assessment, freeze-drying processes, internal audits, and digital readiness through the NEQTrack platform.

- **Mentorship and Continuous Support:**
  Throughout the implementation period, DTU and IVI maintained regular consultations with the national provider teams, supporting document review, data analysis, and troubleshooting of quality-control issues. Feedback from each stage was incorporated into readiness plans for the following trial.

The combined capacity-building efforts enabled IEDCR and NPHL to progress from receiving technical guidance to leading the coordination of their own NEQA trials, from strain selection and panel preparation to data analysis and dissemination of results. This progressive, hands-on model proved effective in translating training outcomes into operational capability and establishing the foundation for sustainable national EQA provision.



2.5 Development of the EQAsia NEQA module and NEQTrack Platform

The digitalization of NEQA implementation progressed through two main phases, reflecting the continuous evolution of data management needs within the EQAsia framework.

During the first NEQA trial, a dedicated EQAsia NEQA tool was developed and deployed to support national-level data entry, scoring, and result dissemination. This tool was derived from the regional EQAsia EQA platform, which had successfully supported 11 EQA rounds between 2021 and 2025. While effective for regional coordination, the system operated on a separate Customer Relationship Management (CRM) structure, where laboratory registration and user management were handled outside the main data-entry environment. This setup required extensive testing, frequent updates, and reliance on third-party technical support.

Although the platform performed well for centrally managed regional schemes, it presented limitations for national EQA providers, who required more autonomy, flexibility, and integrated functionalities for trial creation, participant management, and real-time reporting.

To address these needs and streamline operations, an enhanced and independent digital system, NEQTrack (*National External Quality Assessment Tracker*), was developed. NEQTrack was created under the EQAsia programme and embedded within QAAPT (*Quick Analysis of Antimicrobial Patterns and Trends*), a free, web-based AMR data analysis tool developed by the CAPTURA project, led by the International Vaccine Institute (IVI).

NEQTrack serves as its dedicated operational module for managing EQA activities. The platform enables national NEQA providers to:

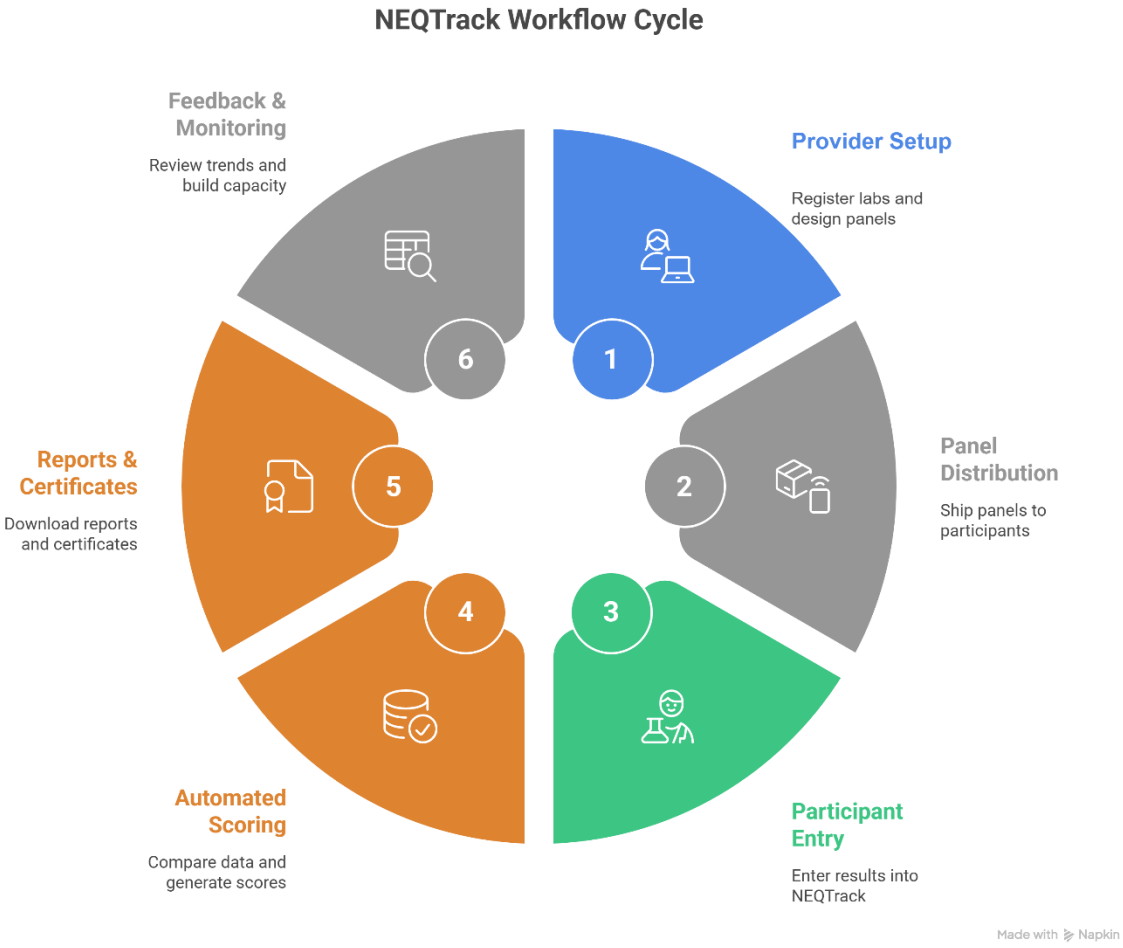
- Register microbiology laboratories and create user accounts directly within the system;
- Manage participant access and roles across different sectors;
- Design and manage EQA panels, including bacterial strains, antimicrobial-susceptibility combinations and Quality Control (QC) testing;
- Upload expected results and interpretive criteria;
- Collect, validate, and automatically score participant submissions;
- Generate performance reports and participation certificates

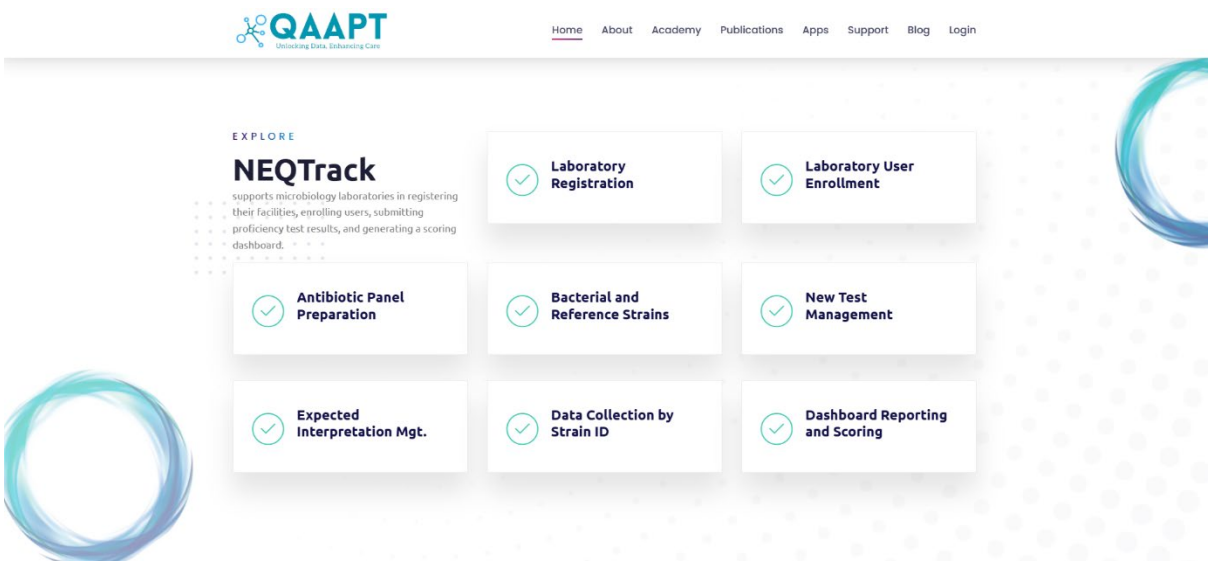
A key feature of NEQTrack is its role-based interface, which ensures that what participants see is distinct from what providers see:

- Providers access administrative dashboards to create trials, manage laboratory accounts, configure expected results, monitor submissions in real time, and generate summary reports.
- Participants access a simplified interface limited to their enrolled trials, where they can enter and edit results, monitor submission status, and download their reports and certificates once released.

This differentiation ensures data integrity, confidentiality, and efficient oversight while maintaining user-friendliness and transparency.

The name NEQTrack reflects its primary purpose, *tracking and managing national EQA programmes efficiently and transparently*. By integrating registration, administrative, analytical, and reporting functionalities within a single secure environment and leveraging QAAPT's modular architecture, NEQTrack provides a scalable and sustainable digital solution tailored to the operational realities of national EQA providers.





2.6 Pilot NEQA Trial Implementation

The implementation of the NEQA pilot trials served as the first practical application of the developed frameworks, procedures, and digital tools in Bangladesh and Nepal. The process aimed to assess the

feasibility of national EQA coordination and the readiness of the designated laboratories to function as national providers under technical mentorship.

Following the preparatory trainings and readiness reviews, the first NEQA trials were conducted between March and May 2025. Both IEDCR in Bangladesh and NPHL in Nepal coordinated the trials under the close technical guidance and support of DTU Food and IVI. At this stage, neither institution operated independently; the focus remained on capacity building and procedural validation.

- Trial design: Each pilot included a bacterial pathogens panel comprising four to five isolates relevant to national AMR surveillance priorities (*E. coli, K. pneumoniae, S. aureus, P. aeruginosa*, etc.). Candidate strains were selected, tested, and validated for inclusion in the panels.
- Participation: The trials engaged six sentinel sites in Bangladesh and five in Nepal, all from the human health sector.
- Panel preparation and distribution: As freeze-drying processes were not yet validated, swab-based delivery was used to ensure the stability and viability of the distributed strains. Each provider managed packaging, shipment, and communication with participating laboratories, with supervision and support from DTU and IVI.
- Digital environment: The first trials were conducted using the EQAsia NEQA tool, adapted from the regional EQAsia platform. The system allowed participants to enter identification and AST results online, while data management and scoring were performed by the project team in collaboration with the national providers.
- Data return: All participating laboratories successfully submitted results, achieving a 100% response rate, confirming the functionality of the workflow and the strong engagement of laboratories during the pilot phase.

The pilot implementation provided critical insights into technical performance, logistical constraints, and digital functionality. These lessons informed the development of the second NEQA trial, planned for late 2025, which included improvements in panel preparation procedures and the introduction of the NEQTrack platform to streamline coordination and data management.

2.7 Scoring and Evaluation

Evaluation of laboratory performance during the NEQA trials followed standardized principles consistent with the EQAsia regional scoring framework and aligned with ISO 17043 requirements. The scoring aimed to objectively assess both technical accuracy and adherence to quality control procedures.

Each participating laboratory's submission was evaluated across the following modules:

1. Species identification accuracy – correct identification of bacterial isolates to genus and species level.
2. Antimicrobial susceptibility testing (AST) accuracy – concordance of reported interpretations (S, I, R) with reference results based on standardized criteria.

3. QC and ATCC strain performance – verification that the QC reference strains used by participants produced inhibition zone diameters or MIC results within accepted CLSI or EUCAST reference ranges.

SCORES		Obtained Interpretation		
		Susceptible	Intermediate	Resistant
Expected Interpretation	Susceptible	4	3	1
	Intermediate	3	4	3
	Resistant	0	3	4

0	Incorrect: very major
1	Incorrect: major
3	Incorrect: minor
4	Correct

Performance classification thresholds were as follows:

- Satisfactory: ≥ 95 % correct results;
- Questionable: 80–94 %;
- Unsatisfactory: < 80 %.

Individual laboratory results were reviewed and analyzed by the NEQA provider teams together with DTU and IVI mentors. Summary reports and certificates were generated to present overall findings, highlight common discrepancies, and identify key technical areas requiring improvement.

The evaluation results from the first trial provided essential baseline data on laboratory diagnostic capacity and formed the foundation for refining subsequent NEQA activities, including targeted training, protocol adjustments, and process standardization for the second trial.

3. Results

3.1 Establishment of National NEQA Systems

By mid-2025, both Bangladesh and Nepal had completed foundational steps toward establishing operational NEQA systems under the EQAsia framework. Dedicated provider teams were trained, SOPs were developed, and trial logistics, including strain validation, packaging, and data coordination, were successfully implemented under mentorship.

IEDCR and NPHL demonstrated the capacity to organize and coordinate national-level EQA trials, supported by EQAsia mentors and technical partners. Although full independence was not yet achieved during the first trials, both laboratories progressively gained the operational experience necessary for eventual self-management of future NEQA activities.

3.2 Participation and Performance

The first NEQA pilot trials included six sentinel laboratories in Bangladesh and five in Nepal, all representing the human health sector. Each participating site completed testing and submitted results through the EQAsia NEQA tool, achieving a 100% data submission rate.

Performance outcomes varied across laboratories, with generally strong species identification results but variable accuracy in AST. Common discrepancies were observed in interpretation of inhibition zones and use of QC strains, highlighting areas for further training and harmonization.

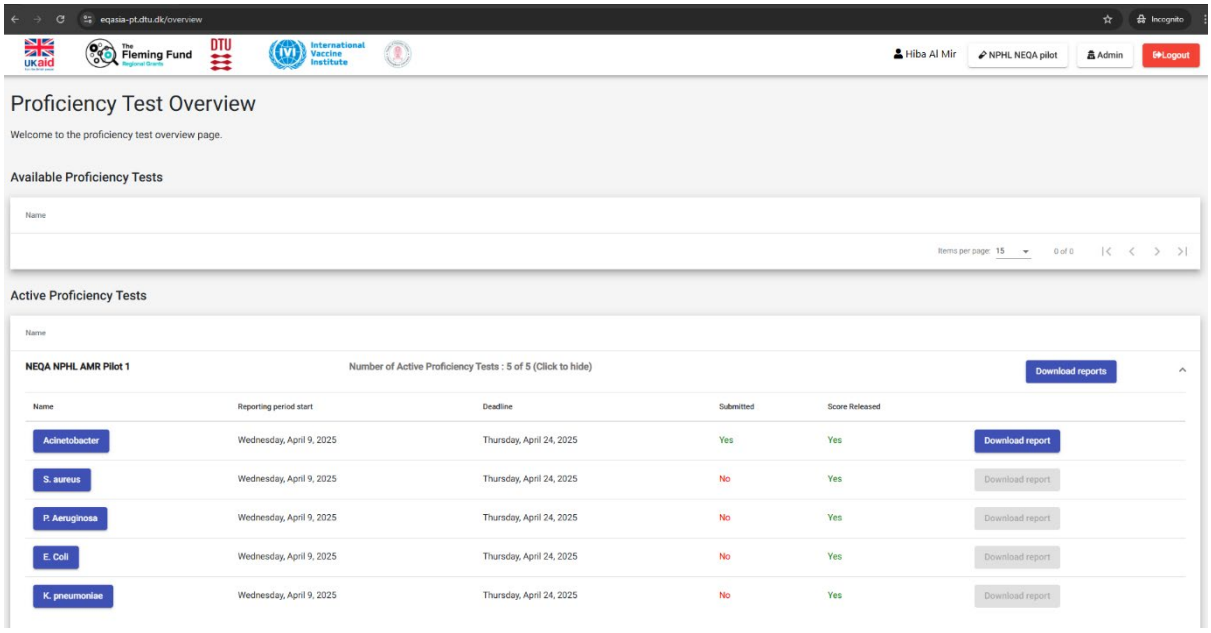
Country	Year	Trial Type	No. of Participants	Sector	Submission Rate
Bangladesh	2024-2025	Bacterial pathogens (ID, AST and QC)	6	Human Health	100%
Nepal	2024-2025	Bacterial pathogens (ID, AST and QC)	5	Human Health	100%

All laboratories successfully submitted results via the EQAsia NEQA module, marking the first complete digital EQA submission cycle in both countries.

3.3 Digitalization Outcomes

The deployment of the EQAsia NEQA tool for data entry and scoring marked the first use of a digital environment for national EQA coordination in both countries.

The tool enabled standardized result submission, automated data validation, and centralized performance analysis. Despite relying on external account registration and CRM-based user management, the system demonstrated the feasibility of digital EQA coordination at national level. The pilot results directly informed the development of the NEQTrack platform, which addressed the need for integrated registration, account management, and autonomous provider operation within a single environment. The NEQTrack tool allows for 100% of data to be collected electronically with automatic scoring. It also provides users with immediate feedback via an individual report generated by the system. The tool also allows the NEQA provider to easily produce certificates for participants and to archive the data collected in the trial. Users in the first trial of the system reported high satisfaction with the tool.



3.4 Performance Trends and Observations

Performance patterns across both pilot countries revealed encouraging diagnostic capability, particularly in bacterial species identification, with most laboratories achieving satisfactory (≥95%) identification scores for the majority of strains. In Nepal, NPHL compiled all site-level results into a consolidated summary report, showing consistently high identification accuracy and generally strong AST interpretation across participating laboratories, with only a limited number of discrepancies observed for specific antibiotic–pathogen combinations.

In Bangladesh, overall performance also demonstrated good agreement with expected results. Four laboratories achieved 100% identification accuracy, and their AST performance ranged from 93.18% to 97.67%, indicating strong technical consistency. One laboratory (*IEDCR-NEQA-006*) showed lower identification performance (75%) while still achieving satisfactory AST accuracy (91.67%), suggesting targeted support may be needed in identification workflows. One site (*IEDCR-NEQA-005*) was unable to complete testing and therefore did not receive a performance classification for this pilot round. Despite staffing constraints and unforeseen operational challenges, IEDCR reviewed all submitted data and provided timely performance feedback to participating laboratories.

	Performance	
Lab ID	**Strain ID**	**AST Overall Score**
IEDCR-NEQA-001	Satisfactory (100%)	Satisfactory (97.67%)
IEDCR-NEQA-002	Satisfactory (100%)	Satisfactory (93.18%)
IEDCR-NEQA-003	Satisfactory (100%)	Satisfactory (93.47%)
IEDCR-NEQA-004	Satisfactory (100%)	Satisfactory (93.75%)
IEDCR-NEQA-005	NA*	NA*
IEDCR-NEQA-006	Not acceptable (75%)	Satisfactory (91.67%)

* Identification and AST for most antibiotics were performed using an automated system, differing from the NEQA Pilot 1 protocol; therefore, performance scoring was not applicable for this laboratory.

Across both countries, the most frequent sources of variation included AST interpretation differences, occasional misclassification of specific species, and inconsistent QC/ATCC results in a subset of laboratories. These findings highlight the need for continued emphasis on interpretive standards, QC verification, and harmonized workflows in future NEQA rounds. Overall, the pilot results demonstrated strong engagement and readiness among participating laboratories, providing a clear baseline for targeted capacity strengthening in subsequent implementation phases.

4. Discussion

The EQAsia-supported NEQA initiative demonstrated that the stepwise development of national EQA systems in LMIC settings is feasible when built on structured mentorship, established international standards, and collaborative learning.
Although the first NEQA trials were conducted under direct technical supervision, both IEDCR and NPHL successfully managed critical operational components, panel preparation, data coordination, and feedback dissemination.

The digital integration of EQA processes through the EQAsia NEQA tool represented a major advancement, paving the way for more autonomous implementation through NEQTrack.

The results highlight the effectiveness of a phased, mentorship-based approach to capacity building and the necessity of integrating digital tools early in the development process. Moreover, the focus on One Health coordination, even at a limited pilot scale, created a foundation for future cross-sectoral expansion.

5. Challenges and Lessons Learned

Implementation of the pilot NEQA trials revealed several technical, operational, and structural challenges, many of which are common in early-stage national EQA development. These challenges provided important insights that informed subsequent improvements and will guide future scale-up efforts.

Technical Challenges

- Freeze-dryer readiness: Both IEDCR and NPHL faced limitations in validating freeze-drying processes, resulting in reliance on swab-based panels for the first trial. This highlighted the need for early equipment testing, calibration, and contingency planning.
- Variability in AST interpretation: Although overall AST concordance was strong, inconsistencies in zone-reading techniques, interpretive criteria, and antibiotic disk quality resulted in performance variations. Continued training and standardization remain essential.
- QC/ATCC discrepancies: A subset of laboratories reported QC results outside expected CLSI/EUCAST ranges, underscoring the importance of routine QC verification and reinforcement of QC troubleshooting practices.

Operational Challenges

- Staffing constraints and competing priorities: Both countries experienced workload pressures and staff shortages, which affected timelines for panel preparation, data analysis, and summary report completion. This emphasized the importance of cross-training and institutional backup planning.
- Logistics and procurement delays: Delays in receiving consumables, reagents, and equipment, which is very common in low and middle income (LMIC) settings, impacted preparation timelines. Early procurement planning and coordination with country teams proved critical.
- Limited sectoral engagement in the pilot phase: While observer sites from animal health and aquaculture sectors participated in trainings, only human health laboratories were involved in testing during the first trial. Future rounds should include more diverse sectors to fully advance the One Health mandate, if applicable.

Digital and System Challenges

- Limitations of the EQAsia NEQA tool: The initial digital platform required external registration and relied on CRM-based account management, creating technical dependencies and added complexity for national providers. This experience directly informed the design of NEQTrack,

which integrates registration, trial creation, data submission, and performance analysis into a single platform.

- Varying levels of digital readiness among users: Some participating laboratories required additional support to navigate online submission processes. Dedicated NEQTrack trainings improved user confidence and highlighted the need for early and recurring digital orientation.

Coordination and Communication Challenges

- Dependence on external mentorship: During the first pilot, both IEDCR and NPHL required close support from DTU and IVI in strain validation, panel preparation, and result interpretation, which was expected at this stage but reinforced the need for gradual transition planning.
- Observer site communication: Coordination with observer laboratories across Bangladesh, Nepal, Bhutan, and Indonesia required additional facilitation by Fleming Fund Country Grant teams to ensure consistent information flow and engagement.

Key Lessons Learned

- Early planning and phased readiness assessments are essential for anticipating operational constraints and aligning timelines with national laboratory workloads.
- Progressive transfer of responsibilities, coupled with targeted mentorship, builds confidence and ensures long-term sustainability.
- Digital platforms must be tailored to national needs, minimizing reliance on external systems and allowing providers full autonomy.
- Continuous QC reinforcement and AST harmonization remain foundational to improving national diagnostic performance.
- Engaging multiple sectors early, even as observers, strengthens One Health awareness and creates pathways for broader inclusion in future NEQA rounds.

Together, these lessons provide a valuable roadmap for guiding future national EQA implementation and strengthening AMR diagnostic quality across the region.

6. Sustainability and Future Directions

The NEQA pilot activities in Bangladesh and Nepal have established a solid foundation upon which sustainable, nationally led EQA systems can be built. While both IEDCR and NPHL required close technical support during the initial phases, each institution demonstrated progressive ownership of core NEQA functions, including strain selection, panel preparation, coordination of participating sites, and performance evaluation. The following priorities will guide the continued development and institutionalization of NEQA systems in both countries.

6.1. Consolidation of National Provider Capacity

Strengthening and maintaining national provider teams will be essential to sustain NEQA activities beyond the pilot phase. This includes:

- Ensuring cross-training to mitigate the impact of staff turnover;

- Embedding NEQA tasks within routine institutional mandates and job descriptions; and
- Continuing the refinement of SOPs, documentation, and internal audit processes.

6.2. Transition to Full Digital Management through NEQTrack

The development of NEQTrack marks a major milestone toward sustainable and autonomous national EQA coordination. Future priorities include:

- Full transition from the EQAsia NEQA tool to NEQTrack for registration, trial creation, result submission, and performance scoring;
- Training of additional staff to ensure digital continuity; and
- Integration of NEQTrack-generated insights into national AMR data systems and routine quality review mechanisms.

6.3. Expansion to a One Health National EQA Model

Although the first pilot trial involved only human health laboratories, both Bangladesh and Nepal engaged observer sites from the animal health and aquaculture sectors. Building on this initial engagement, future NEQA cycles should aim to:

- Gradually include veterinary and aquaculture laboratories as full participants;
- Expand and align pathogen panels with national One Health surveillance needs; and
- Foster multisectoral collaboration and harmonized laboratory standards.

6.4. Strengthening QC Systems and Standardization

Sustained improvement in AST and QC accuracy will require ongoing emphasis on:

- Routine internal QC verification and troubleshooting;
- Adoption of up-to-date interpretive guidelines (CLSI/EUCAST); and
- Access to validated ATCC reference strains and consistent supply chains for critical consumables.

6.5. Institutional Integration and Policy Alignment

For long-term sustainability, NEQA should be incorporated into national AMR and laboratory quality frameworks. This includes:

- Inclusion of NEQA under national AMR action plans and surveillance strategies;
- Coordination with accreditation bodies and quality programmes wherever applicable; and
- Establishing mechanisms for routine national reporting and review of NEQA findings.

6.6. Financial Sustainability and Resource Planning

Ensuring long-term continuity will require clear strategies for resource mobilization. Potential avenues include:

- National budget allocation for routine NEQA implementation;
- Integration of NEQA costs within AMR surveillance budgets; and
- Leveraging partner support during transition phases, while planning for eventual full national ownership.

The progress demonstrated during the pilot period provides a strong platform for moving toward fully autonomous, nationally institutionalized EQA systems. With continued investment in capacity building, digitalization, cross-sectoral engagement, and policy integration, Bangladesh and Nepal are well positioned to sustain and expand NEQA as part of their broader efforts to strengthen AMR laboratory quality and surveillance.

7. Conclusion

The pilot implementation of NEQA schemes in Bangladesh and Nepal under the EQAsia programme marks an important milestone in strengthening national laboratory quality systems for AMR surveillance. Through a structured, phased approach combining hands-on capacity building, technical mentorship, digital development, and collaborative problem-solving, both IEDCR and NPHL successfully coordinated their first NEQA trial and demonstrated measurable progress toward becoming autonomous national EQA providers.

The results showed strong engagement, complete data submission, and encouraging performance in species identification and AST accuracy, while also revealing areas needing continued attention, particularly QC verification, interpretive standardization, and harmonization of workflows. The lessons learned from the initial use of the EQAsia NEQA tool directly informed the development of NEQTrack, providing a more sustainable and provider-oriented digital solution for future trials.

Importantly, this progress comes at a time when the EQAsia programme and the Fleming Fund are approaching their closure, which introduces uncertainty for the continuation of regional coordination, technical mentorship, and subsidized EQA participation. The conclusion of these programmes may affect countries' access to free, high-quality regional EQA schemes and reduce external technical support that has been instrumental in building national capacity to date. This reality underscores the urgency of institutionalizing NEQA within national systems, securing sustainable resource allocation, and ensuring that the capacities developed during the EQAsia period are preserved and strengthened.

Although full independence was not yet achieved during the pilot phase, the foundational structures, trained personnel, and digital tools now in place position Bangladesh and Nepal to advance toward sustaining their NEQA systems beyond external funding cycles. The involvement of observer laboratories across human, animal, and aquaculture sectors further broadened national and regional awareness, setting the stage for future One Health integration.

Overall, the NEQA pilots demonstrate the feasibility and value of transitioning from regionally supported to nationally led EQA systems in LMIC settings. With committed national leadership, continued investment in quality management, and adoption of digital solutions such as NEQTrack, both countries are well placed to maintain and expand NEQA activities, ensuring that the end of EQAsia and the Fleming Fund does not interrupt the progress made toward stronger, more resilient AMR surveillance systems.

Acknowledgments

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Summary of participating laboratories and overall performance results – NEQA Pilot 1 (2025)

Country	Participating Laboratories (n)	Sector(s)	Pathogens Included in Panel	Identification Accuracy (% Correct)	AST Accuracy (% Correct, R/I/S agreement)	QC/ATCC Concordance (% Within Expected Range)	Comments / Key Observations
Nepal (NPHL)	5	Human health	E. coli, K. pneumoniae, P. aeruginosa, Acinetobacter spp., S. aureus	100% across all panels except Acinetobacter spp. (4/5 correct for one strain)	87.8–100% (average ≈93%) depending on pathogen and antimicrobial	Generally, within CLSI reference ranges; minor deviations in E. coli ATCC 25922 and P. aeruginosa ATCC 27853	All five labs submitted complete results using the EQAsia NEQA tool; strongest performance for Enterobacterales; variability in AST for carbapenems and TMP-SMX.
Bangladesh (IEDCR)	6	Human health	E. coli, K. pneumoniae, P. aeruginosa, Acinetobacter spp., S. aureus	100% in four labs; one lab at 75%; one site did not report (NA)	91.67–97.67% among reporting labs	Generally, within expected ranges; minor deviations observed in a subset of QC results	Data submission 100%; similar pattern of variability in AST interpretation; corrective feedback to be addressed in second trial.

Notes:

- Identification accuracy calculated based on correct species assignment of two target and one non-target strains per panel.
- AST accuracy represents concordance of reported R/I/S interpretations with expected results according to CLSI M100 (34th Ed.).
- QC/ATCC concordance refers to percentage of QC results falling within accepted CLSI reference ranges.