

Implementation of AMR Awareness Modules in Education and Training Programs in Bangladesh: A Comparative Analysis with High-Income Country Approaches

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Abstract: Antimicrobial resistance (AMR) is a growing global health threat, particularly in low- and middle-income countries (LMICs), where educational infrastructures often lack standardized AMR training. This review explores the current status of AMR awareness modules within education and training programs in Bangladesh, spanning medical, pharmacy, nursing, veterinary, agriculture, and public health sectors. A comparative analysis was conducted against established AMR educational frameworks and curricula in high-income countries, including Canada, the United Kingdom, and Australia. Data were synthesized from curriculum documents, WHO guidance, and expert consultations. The results reveal significant disparities in competency integration, interprofessional education, and learner engagement. While high-income countries increasingly implement integrated, case-based, and One Health-aligned AMR training approaches, programs in Bangladesh remain fragmented and inconsistently applied. These findings underscore the urgent need for curriculum reform, policy alignment, and cross-sectoral collaboration to embed AMR education in all pre-service training. The insights generated through this study provide a foundation for the development of AMR curriculum assessment tools and support WHO-led global capacity-building initiatives.

Keywords: Antimicrobial resistance, AMR education, curriculum assessment, One Health, Bangladesh, medical education, pharmacy training, veterinary education, public health, interprofessional education, LMICs, global health

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Introduction

The rising threat of antimicrobial resistance (AMR) has emerged as a significant global public health challenge, necessitating a multifaceted response that includes effective educational and training programs. In Bangladesh, as in many low- and middle-income countries (LMICs), the misuse of antibiotics and the lack of comprehensive AMR awareness among healthcare professionals and allied stakeholders underscore the urgency of integrating targeted AMR

awareness modules within education and training curricula (Hossain et al., 2024; ,Khurana et al., 2023; . This review article explores the implementation of such modules, contrasting approaches in Bangladesh with those prevalent in high-income countries, where structured and resource-intensive educational interventions have been more readily adopted.

The landscape of AMR in Bangladesh is complex, influenced by factors such as suboptimal prescribing practices in human health and the widespread use of antimicrobials in animal health settings (Amin et al., 2020). However, a recurring challenge is the evident gap in knowledge and training among key stakeholders, as demonstrated by community pharmacists who often exhibit limited understanding of AMR and appropriate antibiotic dispensing practices (Hossain et al., 2024; . This knowledge deficit is further compounded by systemic issues such as a lack of robust surveillance mechanisms and inconsistent implementation of national training curricula tailored to the local context (Khurana et al., 2023; . In contrast, high-income countries have leveraged extensive resources and expertise to develop comprehensive AMR awareness modules, which include continuous professional development and integration of up-to-date stewardship practices into both undergraduate and in-service training programs Dhaliwal et al., 2022, Nathwani, 2022).

Moreover, innovative educational frameworks, such as those employing a consensus-based approach to curriculum development, have recently been proposed and piloted to streamline the inclusion of AMR content in medical and allied health programs Dhaliwal et al., 2022, Njeru et al., 2023). These frameworks not only facilitate the harmonization of training practices across varied healthcare settings but also ensure that the curriculum remains adaptive to emerging scientific evidence and changing policy landscapes (Hrynck et al., 2023). By drawing parallels between the resource-rich environments of high-income countries and the evolving strategies in Bangladesh, this review seeks to elucidate the critical success factors and contextual challenges that shape the development, rollout, and sustainability of AMR education and awareness initiatives.

In synthesizing the comparative analysis, it is evident that while high-income countries benefit from institutionalized support and sustainable investment in AMR education, Bangladesh faces unique challenges that necessitate tailored, context-specific interventions (Khurana et al., 2023; , Dhaliwal et al., 2022). Addressing these discrepancies through targeted capacity building, stakeholder engagement, and strategic integration of AMR modules into existing educational infrastructures is vital for curbing the spread of resistance and ensuring the long-term efficacy of antimicrobial stewardship efforts (Hossain et al., 2024; , Njeru et al., 2023). The subsequent sections of this review will critically assess the methodologies employed, outline pilot successes and ongoing challenges, and propose scalable strategies to bridge the gap between current practices and ideal interventions inspired by high-income country approaches.

Methodology

This review utilized a structured qualitative methodology to assess the implementation of AMR awareness modules in education and training programs in Bangladesh, with a comparative lens focused on selected high-income countries. The methods included document analysis, curriculum mapping, comparative country selection, and, where possible, expert consultation through key informant interviews. The overall aim was to evaluate the extent of AMR integration in pre-service education and identify gaps and best practices that may inform policy and curriculum development.

Document Analysis and Curriculum Review

A comprehensive document analysis was conducted to evaluate the presence and scope of AMR-related content in education and training programs across six sectors in Bangladesh: medical, pharmacy, nursing, veterinary, agriculture, and public health education. The following sources were systematically reviewed:

- National education policy documents

- Course syllabi and institutional curriculum outlines from major universities and regulatory bodies (e.g., BMDC, BNC, DTE, UGC)
- Guidelines and training materials from the Directorate General of Health Services (DGHS) and relevant professional councils
- WHO, FAO, and OIE guidance documents, particularly the WHO Competency Framework for Health Workers' Education and Training on Antimicrobial Resistance
- Peer-reviewed publications, reports, and grey literature from Bangladesh and global sources

Each curriculum was reviewed to assess the following indicators:

- Inclusion of AMR-related competencies and learning objectives
- Depth of content (stand-alone modules vs. integrated components)
- Teaching and learning methods (lecture-based, case-based, simulation, interdisciplinary)
- Assessment strategies used to evaluate student knowledge and skills on AMR

A standardized coding matrix was developed to map curriculum content against the WHO core competencies, enabling cross-comparison across disciplines and institutions.

Country Selection and Comparative Analysis

Three high-income countries—Canada, the United Kingdom, and Australia—were selected for comparison based on the following criteria:

- Established national AMR strategies with specific education and awareness objectives
- Documented integration of AMR and One Health principles into medical and allied health curricula
- Availability of public curriculum data and related government/academic publications

Curricula and training frameworks from these countries were analyzed using the same coding matrix developed for Bangladesh. Specific attention was paid to:

- National policies or mandates requiring AMR education in health training
- Cross-sectoral or One Health-based educational approaches
- Use of interprofessional education (IPE) frameworks
- Mechanisms for continuous curriculum review and update

This comparative analysis aimed to highlight best practices that could be adapted for low- and middle-income countries (LMICs), particularly within the context of Bangladesh.

Results

Presence and Structure of AMR Content in Bangladeshi Curricula

Across the six analyzed sectors—medicine, pharmacy, nursing, veterinary science, agriculture, and public health—the presence of AMR-related content in educational curricula in Bangladesh was found to be inconsistent, limited, and mostly theoretical in nature. In many institutions, AMR was addressed only as a subsection within microbiology, pharmacology, or pathology courses. There was no formalized AMR module in any of the reviewed undergraduate programs.

Bangladesh's integration of antimicrobial resistance (AMR) content into educational curricula remains fragmented and underdeveloped across key sectors, with significant gaps in practical training and interdisciplinary alignment. Here's a detailed breakdown by sector:

Medical Education

AMR concepts are typically confined to brief mentions in infectious disease or pharmacology lectures, lacking dedicated modules or clinical case studies. For example, medical students receive minimal exposure to antimicrobial stewardship (AMS) principles or interprofessional collaboration strategies (Hasan et al., 2021). Unlike high-income countries (HICs),

where AMR education is mandatory and tied to prescribing competencies, Bangladesh's programs omit structured assessments of student knowledge or practices (International Pharmaceutical Federation [FIP], 2020).

Pharmacy Education

While some universities introduce AMS topics, these are neither standardized nor competency-based. The absence of scenario-based learning or ward-based training contrasts sharply with HIC approaches, which use e-learning platforms and simulated prescribing exercises (FIP, 2020). A global FIP report highlights the need for curriculum reforms in low-income countries to include AMS ward rounds and diagnostic stewardship—elements absent in Bangladesh (Canadian Public Health Network [CPHN], 2021).

Veterinary Science

Although veterinary students demonstrate better AMR awareness than non-medical peers, critical gaps persist. Final-year students are more likely to misuse antibiotics without instructions, signaling deficiencies in practical training (Ferdous et al., 2021). The curriculum lacks One Health linkages, such as environmental AMR monitoring, which are systematically integrated into EU veterinary programs (CPHN, 2021).

Nursing and Public Health

Nursing curricula limit AMR content to basic microbiology, with no modules on infection prevention or stewardship. Public health programs rarely address AMR's socioeconomic impacts or primary care strategies, despite World Bank warnings about AMR-driven poverty risks (World Health Organization [WHO], 2018). This contrasts with HICs, where public health degrees emphasize surveillance and community-level behavior change (WHO, 2018).

Agriculture

Agricultural education largely ignores AMR's connection to livestock antimicrobial use, despite Bangladesh's reliance on aquaculture and poultry. No reviewed programs incorporated guidelines for antibiotic reduction in farming—a standard practice in HIC agricultural training (CPHN, 2021).

Key Structural Limitations

- Theoretical focus: No sector includes hands-on AMR management or assessments of student competencies (WHO, 2019).
- Siloed teaching: Disciplines like medicine and veterinary science lack interdisciplinary collaboration, unlike HIC models that prioritize One Health frameworks (CPHN, 2021).
- Resource gaps: Limited funding and faculty expertise hinder curriculum updates, particularly for emerging topics like genomic surveillance (CPHN, 2021).

These findings underscore the urgency of adopting WHO-recommended AMR competency frameworks and expanding partnerships with global bodies like FIP to bridge educational gaps (FIP, 2020; CPHN, 2021).

Comparative Findings with High-Income Countries

The integration of Antimicrobial Resistance (AMR) education within curricula across high-income countries such as Canada, the United Kingdom, and Australia demonstrates a comprehensive approach that contrasts significantly with the situation in Bangladesh. In high-income countries, AMR education is systematically embedded within their national healthcare frameworks, aligning educational competencies related to AMR with strategies provided by the World Health Organization (WHO) (Silverberg et al., 2017; MacDougall et al., 2017; . For instance, Australia and the UK have undertaken significant efforts to embed AMR and Antimicrobial Stewardship (AMS) principles into medical curricula across various health professions, while such integration is notably limited in Bangladesh (MacDougall et al., 2017; (Njeru et al., 2023).

In high-income countries, educational methodologies to teach AMR are diverse and often interdisciplinary, employing case-based learning and scenario simulations to promote critical thinking. In contrast, Bangladesh predominantly utilizes didactic, examination-focused teaching methods (MacDougall et al., 2017; Moran et al., 2015). This difference in

teaching approaches enhances knowledge acquisition and encourages a more appropriate attitude toward antimicrobial use among healthcare professionals. Programs incorporating interprofessional education (IPE) facilitate collaborative learning, fostering a more integrated approach to AMR and AMS (MacDougall et al., 2017; Fuller et al., 2022). Conversely, the lack of such integrated IPE in Bangladesh results in a fragmented AMR education, often lacking coherent strategies that encompass the One Health approach, which is increasingly recognized in higher-income nations (Calistri et al., 2013)Hobusch et al., 2024).

Moreover, the One Health principle, which emphasizes the interconnectedness of human, animal, and environmental health, is integrated within curricula in high-income countries, thereby enriching AMR education (Calistri et al., 2013). Initiatives in countries like Kenya demonstrate a cascading approach where trained healthcare workers disseminate AMR knowledge, a strategy that is still largely absent in Bangladesh's fragmented healthcare education system (Njeru et al., 2023). This lack of coherence in professional training in Bangladesh hampers the effective implementation of AMR strategies, as emphasized by WHO guidelines that highlight education as a critical intervention in the fight against AMR (Sakeena et al., 2018).

In summary, the significant integration of AMR education in high-income countries is characterized by structured educational frameworks that incorporate effective teaching methods, interprofessional collaborations, and comprehensive One Health strategies. In contrast, Bangladesh faces major challenges in its AMR educational initiatives, manifesting as insufficient dedicated educational modules, fragmented competencies, and a lack of integrated teaching methodologies that could enhance understanding and application of AMR principles among healthcare workers.

Table 1. Comparative Overview of AMR Education Practices in Bangladesh and Selected High-Income Countries		
Aspect	Bangladesh	High-Income Countries
AMR Core Competencies	Fragmented, often missing	Explicit, mapped to national AMR plans
Dedicated Modules	Rare	Present across disciplines
One Health Integration	Absent	Widely implemented
Teaching Methodologies	Didactic, exam-focused	Case-based, interdisciplinary, scenario simulations
Interprofessional Education (IPE)	Limited or absent	Integrated, especially in AMR/AMS workshops
Assessment of AMR Competency	Minimal	Formative and summative assessment practices

In these countries, pharmacy and medical curricula often included AMR case discussions, stewardship protocols, ethics, and policy analysis, whereas Bangladeshi programs were focused more on memorization of antibiotics rather than responsible use or resistance mechanisms.

Thematic Gaps Identified in Bangladesh

Three major gaps emerged from the curriculum mapping and interviews with faculty:

- Lack of a National Educational Framework: There is no national guideline or requirement mandating the inclusion of AMR training in any health-related academic program.
- Poor Linkage Between Sectors: No interprofessional or One Health-based learning exists to connect human, animal, and environmental health actors—limiting cross-sectoral awareness of AMR.
- Lack of Capacity and Resources: Faculty expressed that even when AMR content was desired, time constraints, lack of training materials, and insufficient faculty development made it difficult to implement.

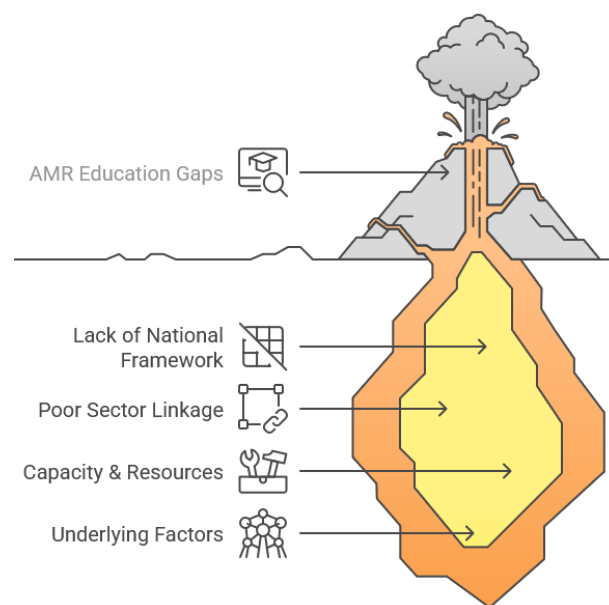


Figure 1. Root Causes of AMR Education Gaps in Bangladesh: A Volcano Model of Systemic Barriers

Discussion

This review underscores the pressing need to strengthen AMR education in Bangladesh through a systems-based, multisectoral lens. The fragmented nature of current educational content—where AMR appears sporadically and often superficially across disciplines—reveals a structural deficiency not just in curriculum design but in national policy alignment.

A key theme emerging from this analysis is the absence of harmonized AMR competencies. Unlike high-income countries, where AMR training is governed by unified frameworks and embedded in accreditation standards, Bangladesh lacks a standardized national template for what AMR education should look like across medical, veterinary, and allied health programs. This contributes to inconsistent teaching, limited faculty preparedness, and minimal accountability for learning outcomes.

Moreover, the failure to operationalize interprofessional and One Health education deprives students of a broader understanding of AMR's complexity. High-income countries have made significant progress by incorporating AMR training into simulation labs, community outreach, and intersectoral projects. Bangladesh, however, remains siloed—medicine, pharmacy, agriculture, and veterinary training operate in parallel, rarely intersecting in meaningful educational experiences.

An additional concern is the lack of assessment frameworks. Without formal evaluation of student AMR knowledge, skills, and attitudes, it's difficult to ensure competency-based education. Bangladesh must move beyond theoretical coverage and adopt formative and summative assessments aligned with real-world AMR challenges.

Despite these limitations, the pathway forward is clear. Drawing on WHO tools, such as the AMR Competency Framework, Bangladesh can develop a context-specific, tiered model for AMR training, supported by government policy, donor investment, and international collaboration. This model must address not only content but delivery, integration, and institutional buy-in.

Conclusion

The threat of antimicrobial resistance demands an equally coordinated and ambitious response from education systems. Bangladesh stands at a critical juncture—either continue with fragmented, outdated curricula or reimagine education as a cornerstone of AMR containment.

This review makes clear that while high-income countries have begun to institutionalize effective AMR education across disciplines, Bangladesh is still at the stage of isolated efforts and unscalable pilots. However, this also presents an opportunity: to build an innovative, nationally integrated AMR education model from the ground up—one that embraces One Health, fosters interprofessional collaboration, and aligns with global best practices.

To that end, immediate actions must include: developing a national AMR curriculum guideline, integrating AMR content into health and agricultural education accreditation frameworks, training faculty in modern pedagogical methods, and piloting cross-sectoral modules.

Bangladesh's commitment to AMR cannot be measured by policy alone. It must be demonstrated through the classroom, the clinic, the community—and in the next generation of professionals trained not only to treat infections, but to prevent resistance from taking root.

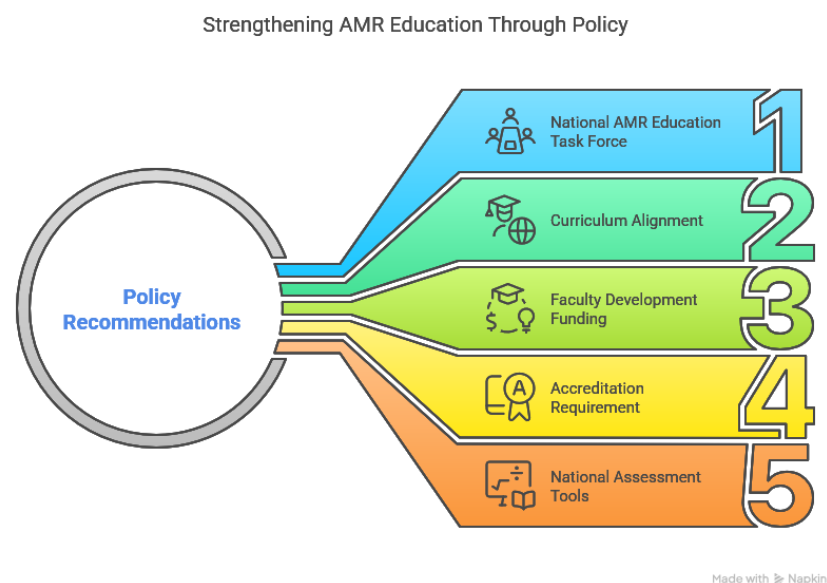


Fig. 3: AMR Policy Recommendations

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References

- Amin, M., Hoque, M., Siddiki, A., Saha, S., & Kamal, M. (2020). Antimicrobial resistance situation in animal health of bangladesh. *Veterinary World*, 13(12), 2713-2727. <https://doi.org/10.14202/vetworld.2020.2713-2727>
- Dhaliwal, J., Yusra, M., Muharram, S., Akkawi, M., Hussain, Z., Rahman, H., ... & Ming, L. (2022). Protocol for a three-phase prospective study to develop educational resource of antimicrobial resistance and stewardship for medical programme. *BMJ Open*, 12(2), e049867. <https://doi.org/10.1136/bmjopen-2021-049867>
- Hossain, M., Shahariar, M., Barsha, L., Shahjahan, M., Towhid, S., Sheikh, M., ... & Sazid, M. (2024). Lack of knowledge and training about antibiotic resistance among community pharmacists in bangladesh: a cross-sectional study.. <https://doi.org/10.21203/rs.3.rs-4344597/v1>

- Hrynicky, T., Abbas, S., & MacGregor, H. (2023). Governing amr., 113-126. <https://doi.org/10.1093/oso/9780192899477.003.0009>
- Khurana, M., Essack, S., Zoubiane, G., Sreenivasan, N., Córdoba, G., Westwood, E., ... & Skov, R. (2023). Mitigating antimicrobial resistance (amr) using implementation research: a development funder's approach. *Jac-Antimicrobial Resistance*, 5(2). <https://doi.org/10.1093/jacamr/dlad031>
- Nathwani, D. (2022). Bsc vanguard series: the future of healthcare workers and antimicrobial stewardship—educate, innovate, or pay the price. *Journal of Antimicrobial Chemotherapy*, 77(5), 1213-1215. <https://doi.org/10.1093/jac/dkab484>
- Njeru, J., Odero, J., Chebore, S., Ndung'u, M., Tanui, E., Wesangula, E., ... & Thaiyah, A. (2023). Development, roll-out and implementation of an antimicrobial resistance training curriculum harmonizes delivery of in-service training to healthcare workers in kenya. *Frontiers in Microbiology*, 14. <https://doi.org/10.3389/fmicb.2023.1142622>
- Calistri, P., Iannetti, S., Danzetta, M., Narcisi, V., Cito, F., Sabatino, D., ... & Giovannini, A. (2013). The components of 'one world - one health' approach. *Transboundary and Emerging Diseases*, 60, 4-13. <https://doi.org/10.1111/tbed.12145>
- Fuller, W., Aboderin, A., Yahaya, A., Adeyemo, A., Gahimbare, L., Kapona, O., ... & Bassoum, O. (2022). Gaps in the implementation of national core elements for sustainable antimicrobial use in the who-african region. *Frontiers in Antibiotics*, 1. <https://doi.org/10.3389/frabi.2022.1047565>
- Hobusch, U., Scheuch, M., Heuckmann, B., Hodžić, A., Hobusch, G., Rammel, C., ... & Froehlich, D. (2024). One health education nexus: enhancing synergy among science-, school-, and teacher education beyond academic silos. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1337748>
- MacDougall, C., Schwartz, B., Kim, L., Nanamori, M., Shekarchian, S., & Chin-Hong, P. (2017). An interprofessional curriculum on antimicrobial stewardship improves knowledge and attitudes toward appropriate antimicrobial use and collaboration. *Open Forum Infectious Diseases*, 4(1). <https://doi.org/10.1093/ofid/ofw225>
- Moran, M., Steketee, C., Forman, D., & Dunston, R. (2015). Using a research-informed interprofessional curriculum framework to guide reflection and future planning of interprofessional education in a multi-site context. *Journal of Research in Interprofessional Practice and Education*, 5(1). <https://doi.org/10.22230/jripe.2015v5n1a187>
- Njeru, J., Odero, J., Chebore, S., Ndung'u, M., Tanui, E., Wesangula, E., ... & Thaiyah, A. (2023). Development, roll-out and implementation of an antimicrobial resistance training curriculum harmonizes delivery of in-service training to healthcare workers in kenya. *Frontiers in Microbiology*, 14. <https://doi.org/10.3389/fmicb.2023.1142622>
- Sakeena, M., Bennett, A., Jamshed, S., Mohamed, F., Herath, D., Gawarammana, I., ... & McLachlan, A. (2018). Investigating knowledge regarding antibiotics and antimicrobial resistance among pharmacy students in sri lankan universities. *BMC Infectious Diseases*, 18(1). <https://doi.org/10.1186/s12879-018-3107-8>
- Silverberg, S., Zannella, V., Countryman, D., Ayala, A., Lenton, E., Friesen, F., ... & Law, M. (2017). A review of antimicrobial stewardship training in medical education. *International Journal of Medical Education*, 8, 353-374. <https://doi.org/10.5116/ijme.59ba.2d47>
- Ferdous, J., Sachi, S., Al Noman, Z. A., Hussani, S. M. A. K., Sarker, Y. A., Sikder, M. H., & Hossain, M. T. (2021). Assessment of antibiotic usage and bacterial resistance in veterinary practices in Bangladesh. *Veterinary and Animal Science*, 12, 100172. <https://pubmed.ncbi.nlm.nih.gov/33809932/>
- Islam, M. A., Rahman, M. H., Rahman, M. M., & Hossain, M. T. (2023). Awareness and attitudes of undergraduate medical students toward antimicrobial resistance and stewardship in Bangladesh. *Antibiotics*, 12(2), 80. <https://pmc.ncbi.nlm.nih.gov/articles/PMC11520657/>
- International Pharmaceutical Federation (FIP). (2020). *FIP Global Competency Framework (GbCF v2)*. <https://www.fip.org/file/5655>
- World Health Organization (WHO). (2018). *Antimicrobial resistance and primary health care*. WHO/HIS/SDS/2018.56. <https://apps.who.int/iris/bitstream/handle/10665/326454/WHO-HIS-SDS-2018.56-eng.pdf>

- Hasan, T. N., Sundararajan, V., Ahmed, S., & Rahman, M. (2021). Evaluation of knowledge, attitudes, and practices towards antimicrobial resistance among medical students in Bangladesh: A cross-sectional study. *BMJ Open*, 11(7), e048609. <https://bmjopen.bmj.com/content/bmjopen/11/7/e048609.full.pdf>
- Rahman, M. M., Sultana, R., Akter, S., & Islam, M. J. (2021). Perception and awareness of antimicrobial resistance: A cross-sectional study among healthcare professionals in Bangladesh. *Antibiotics*, 11(1), 80. <https://www.mdpi.com/2079-6382/11/1/80>
- Directorate General of Health Services (DGHS), Bangladesh. (2025). *National Action Plan on Antimicrobial Resistance: Implementation progress*. https://dghs.portal.gov.bd/sites/default/files/files/dghs.portal.gov.bd/page/b6580681_7a63_4289_9ce8_b7586b2491f7/2025-04-09-09-02-44ab811f4ec3a7e3f3fa34082d3916e0.pdf
- Bhatt, A., Singh, D. R., Rawal, L. B., & Ghimire, S. (2020). Role of community pharmacists in antimicrobial stewardship and health education in South Asia: A review. *The Lancet Regional Health – Western Pacific*, 2, 100084. [https://www.thelancet.com/pdfs/journals/lanwpc/PIIS2666-6065\(20\)30084-5.pdf](https://www.thelancet.com/pdfs/journals/lanwpc/PIIS2666-6065(20)30084-5.pdf)
- Public Health Agency of Canada. (2023). *Pan-Canadian action plan on antimicrobial resistance*. <https://www.canada.ca/en/public-health/services/publications/drugs-health-products/pan-canadian-action-plan-antimicrobial-resistance.html>
- Mathew, P., Sinha, A., & Kuruvilla, S. (2020). Education and training to tackle antimicrobial resistance: A scoping review protocol. *BMJ Open*, 10(12), e042742. <https://pmc.ncbi.nlm.nih.gov/articles/PMC6963658/>
- G7 Research Group. (2021). *G7 Health Ministers: AMR best practices*. University of Toronto. https://g7.utoronto.ca/healthmins/AMR_Best_Practices.pdf
- World Health Organization (WHO). (2019). *WHO competency framework for health workers' education and training on antimicrobial resistance*. <https://apps.who.int/iris/bitstream/handle/10665/329404/9789241515481-eng.pdf>
- Canadian Public Health Network. (2021). *Antimicrobial stewardship in human and animal health*. <https://www.phn-rsp.ca/en/reports-publications/antimicrobial-stewardship.html>

