




BMJ Open Challenges and facilitators of implementation of an information communication and technology (ICT)-based human resources management tool in the government health sector in Bangladesh: protocol for an exploratory qualitative research study

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ABSTRACT

Introduction To improve human resources for health (HRH) management in Bangladesh, the directorate general of health services (DGHS) introduced a new information and communications technology (ICT) tool, named 'human resources information system (HRIS)', to process real-time HRH data of all facilities under the DGHS. However, synchronisation is a major concern since multiple authorities are involved in the implementation of the tool at different tiers of the health system. Introducing ICT tools in healthcare organisations has always proved challenging as evidence from low-income and middle-income countries suggests. The knowledge gap in terms of factors that support or constrain the successful implementation of the HRIS in Bangladesh will be investigated in this exploratory study to identify ways of engaging the key stakeholders in a better way for an effective use of the tool.

Methods and analysis Desk review and qualitative data collection methods will be used to address the study objectives. Key informant interviews and in-depth interviews will be conducted to explore perspectives of policy-makers, programme managers, service providers and other stakeholders to understand the barriers to implementing HRIS in the context of Bangladesh. We plan to organise stakeholder consultation workshops to validate the qualitative study findings and to seek suggestions for ensuring a successful implementation of the HRIS. Framework analysis will be applied to analyse qualitative data, and an outline with the definitions of a priori codes guided by the policy engagement framework will be prepared. Besides, emerging themes will also be identified. A data display matrix will be prepared to summarise and interpret the findings for policy review.

Ethics and dissemination The research review committee and the ethical review committee of icddr,b have approved the research protocol. Findings from the study will be communicated through national and international forums, conferences, policy briefs and peer-reviewed journal publications.

Strengths and limitations of this study

- To the best of our knowledge, this exploratory study is among the first few designed to inform policy-makers about the challenges and the ease in implementing an information and communications technology (ICT)-based tool for human resources for health (HRH) management in the government health system of Bangladesh.
- The qualitative methods used for data collection will provide a greater understanding of the factors that shape the integration of ICTs in HRH management.
- Triangulation of data will help synthesise policy-level and user-level issues to create a strong evidence base for health services researchers and practitioners.
- Since the study does not include quantitative methods and explores factors related only to the Bangladesh health system, its findings may not be generalisable to other low-income and middle-income countries, where the use of ICT for HRH is not common.

INTRODUCTION

To achieve health-related targets of the Sustainable Development Goals (SDGs), strengthening health systems is of paramount importance in low-income and middle-income countries (LMICs).^{1 2} Evidence suggests that human resources for health (HRH) management requires priority policy attention since the overall performance of health systems is largely dependent on how HRH is planned, maintained and managed.^{3 4} In the context of LMICs, many health systems initiatives have been known to fail owing to the challenges in

HRH management,⁵ which include acute shortage, lack of proper skill mix, unequal distribution, as well as poor quality and performance of HRH.^{6–8}

Bangladesh has been identified as a country with an ‘acute shortage’ of HRH.^{9–10} In the ‘Dhaka Declaration’, during the 24th meeting of the health ministers of WHO South-East Asia region in 2006, Bangladesh was recognised as a country with critical HRH issues in terms of shortage, migration and work environment.¹¹ Further, the country is burdened by the challenges of an inappropriate skill mix, inequitable distribution, poor monitoring mechanism and lack of comprehensive data on HRH.¹² Recent studies have identified that effective HRH management is one of the priority issues that Bangladesh needs to address to achieve universal health coverage and the other targets set by the SDG3.^{13–14}

A crucial first step in addressing the challenges of managing HRH is to develop and maintain a comprehensive and functional human resources information system (HRIS).^{13–14} During the first global forum on HRH in Kampala in 2008, much emphasis was laid on establishing HRH information systems to improve health systems performance.¹⁵ Since then, there have been several international and regional calls for strengthening information systems that could support a coordinated, harmonised and standardised approach to health workforce information and a monitoring mechanism for improved HRH policy and planning.^{16–21}

Nonetheless, it is worth mentioning that the health systems in Bangladesh have achieved remarkable milestones in improving health management information systems (HMIS) with the incorporation of information and communications technology (ICT) based innovations into the health systems. The countrywide deployment of the open-source District Health Information Software 2 has enabled capturing real-time performance data, which in turn has facilitated evidence-based decision making in the planning process. The online HMIS now connects all government health facilities from the central level to most peripheral level of the rural community clinics.²² However, among all the components of the HMIS, the HRIS was found to be one of the weakest.

To address the challenges in HRH management, the ongoing strategic plan of the Health Sector Development Programme of the Ministry of Health and Family Welfare (MOHFW) has prioritised it as one of the important action areas.²³ The strategic plan emphasises establishing and rolling out a comprehensive HRH information system in the country. In line with this, the Directorate General of Health Services (DGHS), introduced an ICT tool named the ‘personal data sheet (PDS)’. However, owing to system inefficiency, it was discontinued in 2017. In early 2018, to improve HRH management in public sector, the DGHS introduced another new ICT-based tool, known as the ‘HRIS’. This tool was aimed at creating a dynamic online central platform that could incorporate and process data on the human resources management of all HRH working under the DGHS.²⁴ With the technical

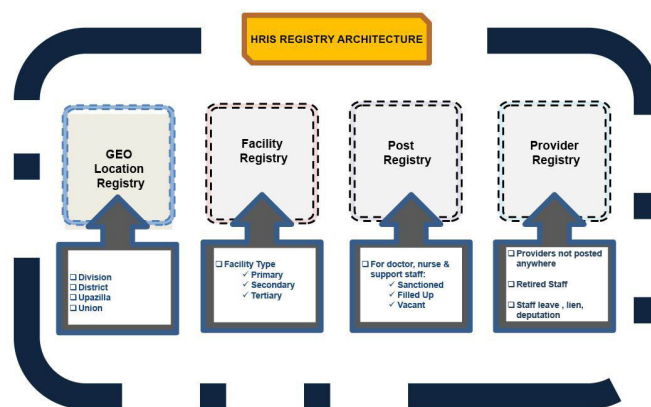


Figure 1 Architecture of the HRIS tool. HRIS, human resources information system.

support of the MIS of the DGHS, this tool is currently used for administrative purposes by health managers working at different levels of the health systems.

The HRIS system comprises four main databases, each known as a ‘registry’: Geo-location Registry, Facility Registry, Posts Registry, and Provider Registry (figure 1). The Geo-location Registry captures the actual geographical location of the health facilities; the Facility Registry contains information on type, functionalities, ownership and service details; information on all sanctioned posts in the health facility is captured in the Posts Registry; and details of each service providers are listed in the Provider Registry. In the HRIS system, there are two types of users: ‘provider user’ and ‘facility user’. Logging-in with a unique username and password, any user can navigate each application of the system according to his or her user role and view the required information in both English and Bangla. The file management architecture in the HRIS facilitates storage and easy retrieval of user documents and allows users to access and download administrative orders such as transfer notices, deputations, leaves and so on through the HRIS profile.

The central idea of establishing the HRIS was to ensure accurate and updated HRH information for policy-makers, health managers and other stakeholders so that the existing gaps in shortage, skill mix and unequal distribution of HRH can be monitored and addressed in a timely manner. This continuous data flow from each tier of the health system further helps in evidence-based planning and action for HRH management. However, introducing ICT tools in healthcare organisations of developing countries comes with its own set of challenges both at the individual level and at the level of health systems and policy.^{25–28} Especially in building ICT-based tools for HRH, the process is more complex since it involves a series of actions from different tiers of the national health systems. In Bangladesh, the public sector HRH management, for example, posting and transfer, involves multiple authorities in different tiers of the government health system. The existing transfer and posting rules involve all the health system actors, ranging from the central-level MOHFW and the DGHS to the peripheral-level divisional

and district health offices.^{29 30} Since multiple authorities are simultaneously engaged in the implementation of the HRIS tool, gaps in the overall synchronisation of HRH management are bound to occur, which may ultimately affect the health sector governance and management.

Therefore, the tool design must be based on an accurate understanding of the needs and expectations of operational-level users, rather than from the perspective of the central-level ministry alone.²⁷ Investigating the major implementation barriers and facilitators of the new ICT tool and keeping the key stakeholders informed about the implementation process are crucial to avoid failure and resource wastage.^{27 28} Understanding the implementation bottlenecks of the newly introduced HRIS and the perspectives of users towards it is therefore fundamental to facilitate data-driven decision making.

Study aims

The proposed research aims to explore the factors that aid and constrain implementation and use of the HRIS tool in the government health sector in Bangladesh. The specific objectives are to (1) review current policies and strategies regarding recruitment, deployment and retention of HRH, (2) explore the barriers and facilitating factors in adopting an ICT-based tool for HRH management and (3) document suggestions of key stakeholders on how to strengthen implementation of HRIS in keeping with the needs.

METHODS

Study design and participants

A qualitative study design is proposed with desk review and qualitative data collection methods to meet the study objectives. An exploratory design is chosen as it allows for investigating a wide range of complex patterns of experiences of individuals and groups involved in the implementation of health technologies.³¹ Besides, the qualitative data collection method will help to develop a deeper understanding of the factors that challenge and facilitate introducing the tool as well as formulate context-specific recommendations for further improvement. To understand the experiences, perspectives and suggestions on implementing the HRIS, related policy-makers at the national level and key implementers and users at the periphery level will be interviewed.

Study sites

The study is proposed to be conducted in Dhaka, the capital and in two divisions in Bangladesh: Khulna and Sylhet. Dhaka is chosen since it is the seat of the central government health institutions and access to senior government officials would become easy. Khulna and Sylhet are chosen because evidence from previous studies indicates that these two divisions are, respectively, the highest and the lowest performers in terms of health workforce and health indicators.¹² For collecting divisional level data, Health System Strengthening (HSS)

database will be reviewed. In 2014, the Government of Bangladesh, with technical assistance from the WHO, icddr,b (formerly known as International Centre for Diarrheal Disease Research, Bangladesh) and UNICEF launched an online system for measuring and scoring performances of health facilities performances, based on which the Health Minister National Awards are presented to the best performing facilities.³² To choose the best performing facility, the database is examined based on two indicators: (1) completeness of personnel level data and (2) completeness of facility-level data. For the latter, the number of sanctioned posts, number of post filled and the actual workforce count of the facility will be extracted. Availability of this information in the HRIS profile will determine to what extent the HRIS tool is being used by the facilities. Similarly, for personnel-level information, such as the number and details of the training/courses, educational attainment and length of service of each provider are to be incorporated in the HRIS profile of the facility. Scoring personnel-level data will also allow determining the extent of use of HRIS by a particular facility. The best-performing and the least-performing facilities in the two divisions will be selected based on the analysis of the two indicators from the HSS databases.

Sample size

Study participants will be selected purposively for in-depth interviews (IDIs) and key informant interviews (KIIs) from the organisations or departments that influence or are influenced by the implementation of the HRIS tool. Patton claims that purposive sampling can be used to select participants as per set criteria to attain a particular research objective.³³ To determine the sample size for a qualitative research, Guest *et al* suggest at least 12 interviews from a homogenous group of respondents for attaining data saturation.³⁴ Crouch and McKenzie recommend a sample size of around 20 respondents to provide qualitative researchers adequate opportunity to develop and maintain a meaningful relationship with the study participants, which also enhances the validity of the research.³⁵ Therefore, we plan to have a sample of 20 respondents for the interviews. Sampling strategy for each study activity is as provided in table 1.

Data collection

A group of researchers skilled in qualitative data collection methods and with relevant work experience in country health systems will conduct the KIIs and IDIs. Open-ended guidelines will be developed both for KII and IDI. All interview guidelines will be piloted before the actual interviews and adapted accordingly. The field data collection team will be continuously guided by senior health system researchers who have extensive experience in health policy and systems research in Bangladesh. Since the success of health systems research largely depends on rapport building with key government health system actors, a core committee member of the HRIS implementation team from the government will be included as a

Table 1 Sampling strategy and sample type for each activity of the study

Activity and focus	Sampling strategy	Type of respondent	Sample size
Key informant interviews	Purposive sampling	High-level policy-makers, authorities and decision-makers at DGHS, MOHFW and other relevant stakeholders	20
In-depth interviews	Purposive sampling	District and upazila level health managers, Upazila Health and Family Planning Officer, civil surgeons; statisticians.	20
Stakeholder consultation workshop	Purposive sampling	High-level policy-makers, district and upazila health managers and providers, and researchers	2 (with 15–20 participants per workshop)

DGHS, directorate general of health services; MOHFW, Ministry of Health and Family Welfare.

coinvestigator in this study. A multidisciplinary team will facilitate the data-collection process, especially in terms of access to high-level government officials. However, to avoid the chances of biases while collecting data from health system actors, the core committee members of the HRIS implementation team will not be engaged during the interview process.

Data collection methods for objective 1

To address objective 1, a comprehensive desk review of relevant policy documents will be undertaken, which will encompass peer-reviewed publications as well as grey literature and policy documents of the government and other relevant organisations such as the WHO, UNICEF, WB, DFID and USAID. To retrieve peer-reviewed publications on HRH management issues in Bangladesh, a search will be conducted on the PubMed database using a combination of keywords such as ‘Human resource for health’, ‘posting’, ‘transfer’, ‘recruitment’, ‘retention’, ‘policy’, ‘promotion’, ‘ICT’. Before finalising the search strategy, a thorough discussion with relevant HRH experts will be organised so that the focus of the review remains aligned with the objective of understanding the barriers to the implementation, and the facilitators, of the HRIS tool. Government documents will be accessed by searching the MOHFW and DGHS websites to extract existing HRH policies and strategies. A hand search of relevant policy documents related to HRH will also be conducted. In this regard, we plan to do preliminary groundwork and prepare a list of documents, which includes the (1) Bangladesh Civil Service recruitment policy 1981, (2) Bangladesh Health Workforce strategy 2015, (3) Human Resource Management Operational Plan, Health Population and Nutrition Sector Development Programme (HPNSDP) 2017–2022, (4) Health information systems and e-health Operational Plan, HPNSDP 2017–2022 and the (5) Health Manpower Development Operational Plan, HPNSDP 2017–2022. Additions can be made to the preliminary list based on the recommendation of the stakeholders. On Google Scholar, an additional search will be conducted to retrieve grey literature like reports, government documents, and conference and workshop

proceedings. In addition to this, the snowballing technique, which involves searching the reference list of eligible studies, will also be applied.

This review exercise will help understand government policy provisions on the current posting, transfer and recruitment practices in Bangladesh. Since the HRIS is an ICT-based tool that facilitates implementing upstream policy decisions, a clear understanding of the policies will help in identifying the critical facilitating and constraining factors for the implementation of the HRIS tool.

Data collection methods for objective 2

To address objective 2, 20 KIIs will be conducted with policy level actors from different related government authorities, such as the MOHFW and DGHS, to examine the methods by which the current HRH planning and decisions regarding posting and transfers are undertaken and the policies that are being followed besides identifying barriers and facilitators of adopting and implementing the HRIS. These KIIs will help examine the future sustainability of the HRIS in terms of its technical and financial features. We also plan to explore how the HRIS data are linked with the broader health information, such as disease burden, health services utilisation and patient outcomes, and the key functionalities of the previously used ‘PDS’ tool and the reasons for its discontinuation.

Further, a total of 20 IDIs will be conducted among HRIS users at the district and subdistrict level, such as with civil surgeons, upazila health and family planning officers, medical officers and statisticians, to obtain their perspectives about the existing tool, the areas that need to be modified, and ways to improve the HRIS tool to suit their needs. Information regarding any barrier or facilitator of providing real-time, accurate, timely and comprehensive profiles of workforce size through the HRIS system will be explored through the IDIs, which will also capture information regarding any discrepancies in accessing the tool in terms of geographical location (eg, remote area vs urban area). Apart from their perception about the gender and ethical dimension of the tool, their

views on sharing their personal information in a national-level database will also be gathered from the IDIs.

Data collection methods for objective 3

To address objective 3, a consultation workshop for stakeholders is proposed to share and validate the findings from the desk review and qualitative interviews. These stakeholder consultations will document suggestions and help advocating for actions to enhance the efficiency and effectiveness of the HRIS tool for improving HRH management in Bangladesh. Target participants of the workshops will include government officials, healthcare professionals, non-clinician healthcare providers, researchers, academicians and development partners. We will begin by undertaking a stakeholder mapping, which will include the identification and listing of the stakeholder groups involved in human resource management to understand their role and influence in policy-making and in the implementation processes.³⁶ Given the importance of stakeholder satisfaction and support for the success of any programme,³⁷ incorporating stakeholders' perspectives is a critical step in ensuring sustainability. The aim is to (1) create responsiveness regarding the challenges and ease in adopting the ICT tool and (2) identify strategies and review plans to strengthen the system. For policy-makers to become committed and responsive towards using this tool, the result from the desk review of the policies and strategies as well as published articles will be shared during the workshop to explain how HRH management and the HRIS tool intersect. Findings from the KIIs and IDIs on key challenges of the HRH will also be presented in the workshops. Thus, the stakeholders' consultation will work as an interactive knowledge-sharing mechanism that will allow the research evidence to be considered in the health policy process.

Process documentation will then be carried out to systematically document study implementation including the desk review, qualitative study and stakeholder consultation workshops. This continuous information gathering and documentation will generate supporting knowledge required for the next phase of recommendations for policy formulation.

Data analysis

To analyse the various aspects of HRIS implementation and its integration into the current health system in Bangladesh, the health policy triangle will be used as a conceptual framework, since it provides a useful guide for understanding interactions among context, content, structure and actors.³⁸ Besides, the strength of this framework (figure 2) lies not only in its simplicity in interrelating complex relations but also in facilitating 'analysis of policy' rather than 'analysis for policy'.^{39–41}

The political, social and cultural contexts that may have an influence on shaping and implementing the HRH policies will be explored to understand the national context. Global attributes and commitments will also be regarded useful for the context. For the

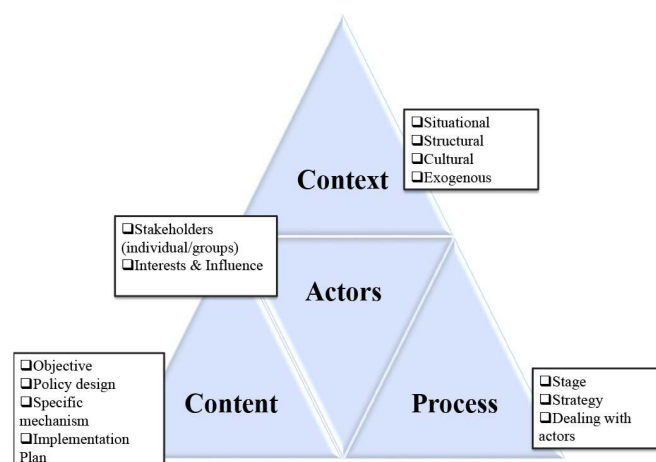


Figure 2 Health policy triangle³⁶.

content, we plan to investigate the main theme, objectives, and specific mechanism and implementation plan of the policies. Under actors, first, the persons or organisations in the policy process will be identified; then, their relative power and position in terms of influence, ownership over financial and infrastructural issues and nature and degree of supporting and opposing factors in relation to the implementation will be explored. For the process, implementation-related challenges and facilitators of each policy will be discussed.

The policy engagement framework³⁸ will provide a guide to prospectively analyse how context, content, structure and actors interact and the strategies necessary to ensure sustainability of the ICT tool in the HRH management in the government sector. To analyse the data from KII and IDIs, framework analysis⁴² will be used, by which large quantities of data can be summarised while the context of, and the connection between, each case/interviewee can be facilitated through data displays.⁴³ Framework analysis will be conducted as per the five steps of data familiarisation; identifying a thematic framework; indexing; charting and mapping and interpretation.⁴² An outline of the data analysis plan as well as the definition of a priori codes will be prepared in advance of the research. However, analysis will be open to emerging themes as well. Data transcription will follow immediately after each interview. For data familiarisation, team members will have to read the transcripts many times for a literal and reflexive interpretation of data. This will also allow for assessing data quality and strengths and weaknesses of the interview techniques and help identify any gaps, which can then be followed up. Summaries will also be developed for each transcript to preserve the data in context. Atlas-ti software will be used to apply the codes through a team approach to minimise researcher bias. Intracoder and intercoder reliability will be checked by having multiple analysts code and compare the same sections of text. Codes and emerging concepts will be displayed in data matrices

to identify patterns and allow comparing the characteristics, perceptions and experiences of respondents. For reviewing the policies and the literature, a document analysis matrix will be developed, wherein the columns will represent the themes to be used in the analysis and the rows of the matrix will reflect the policy name and the text responses to be analysed.

Considering the importance of stakeholders' views and perception in the continuum of research to policy translation,⁴⁴ stakeholder analysis and engagement will help facilitate mutual trust, continued dialogue among researchers, implementers and policy-makers for further modification, and improvisations in the HRIS tool. Stakeholder assessment will be done according to the resources they possess, their influence over decisions to be made, and the likely impact of the decisions taken on them. Based on this analysis, a two-dimensional grid will be developed to plot and identify the relative position of the stakeholders.

Patient and public involvement

Patients will not be included in this study as participants. This qualitative study will mainly engage policy makers and relevant stakeholders currently involved in the implementation of the HRIS tool. Although there will be no public involvement in this qualitative research, stakeholder consultations and meetings will be arranged with representatives from government, development partners, academicians and senior researchers.

Ethics and dissemination

This study will involve relevant health systems actors and poses no more than minimal risk to subjects. Subjects will be asked for written consent prior to the interviews. Participation in the interview is completely voluntary, and participants can stop participation without any obligation at any time during the discussion or interview if they feel uncomfortable. Refusal to take part in or withdrawal from the discussion or interview will involve no negative consequences. Arrangements for the place of interview or discussion will be as per the participants' preferences for an environment where they can sit and talk freely in privacy. The interviewer will try to schedule/reschedule the interview as per the time convenient for the participants. With prior permission from participants, recorders will be used for recording the discussions to collect full and intact thoughts.

This study has already been approved by the institutional review board of icddr,b (www.icddr.org). The process includes approval from the research review committee for a critical examination of technical competencies and approval from the ethical review committee (ERC) for an in-depth investigation of ethical issues related to the local context. Data confidentiality will be maintained and all data forms will be kept in locked storage, or controlled

access folders, allowing access only to study investigators and members of the ERC of icddr,b. In the case of qualitative data, quotes will not be associated with individuals, nor will any identifiers that might reveal their source. Interviewers will be trained on the importance of confidentiality and participants will be informed that their names will not be published during dissemination.

Study findings will be communicated at various levels to strengthen the implementation process of an ICT tool in Bangladesh and elsewhere in LMICs. Findings will be presented to relevant government authorities and development partners as well as other relevant stakeholders and researchers. During these dissemination events, visually engaging formats, for example, project brochures or policy briefs will be used to effectively reach a wide range of stakeholders. Peer-reviewed journal articles will be published based on the results of the study. In addition, results will be shared in scientific forums and in international conferences related to health systems and human resources issues to add the evidence to the current global knowledge repository. This is a qualitative study and will be conducted with a small sample size and study area. Thus, the limitation of the study will be the findings of the study may not be generalisable beyond the study areas. Findings from this study will be interpreted based on whether the processes around building a comprehensive HRH information system are being implemented as intended. This research is expected to support policy through generating a unique understanding about the bottlenecks of implementation and propose methods to overcome them for better implementation. The research finding will thus be important to modify and customise the existing tool based on the needs of the stakeholders. Moreover, the evidence generated from this study may be helpful for other similar countries to facilitate the policy action around building a strong HRIS.

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Contributors DSB and IA conceptualised the study and finalised the design. DSB prepared the first draft of the manuscript. IA, SS, SA and AR revised the manuscript to incorporate the intellectual content; MZI and NR contributed in writing the detail features of HRIS tool, DSB revised the version submitted with inputs from all other coauthors.

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REFERENCES

- Evans T, Nishtar S, Atun R, *et al*. Scaling up research and learning for health systems: time to act. *The Lancet* 2008;372:1529–31.
- Hafner T, Shiffman J. The emergence of global attention to health systems strengthening. *Health Policy Plan* 2013;28:41–50.
- Chen L, Evans T, Anand S, *et al*. Human resources for health: overcoming the crisis. *Lancet* 2004;364:1984–90.
- World Health Organization. *Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies*. World Health Organization, 2010.
- Liu JX, Goryakin Y, Maeda A, *et al*. *Global health workforce labor market projections for 2030*. The World Bank, 2016.
- Scheil-Adlung X. Health workforce benchmarks for universal health coverage and sustainable development. *Bull World Health Organ* 2013;91:888–9.
- Truth AU. *No health without a workforce*. World Health Organisation (WHO) report, 2013: 1–4.
- McPake B, Maeda A, Araújo EC, *et al*. Why do health labour market forces matter? *Bull World Health Organ* 2013;91:841–6.
- El-Saharty S, Sparkes SP, Barroy H, *et al*. *The path to universal health coverage in Bangladesh: bridging the gap of human resources for health*. The World Bank, 2015.
- World Health Organization. *The world health report 2006: working together for health*. World Health Organization, 2006.
- World Health Organisation. Dhaka declaration: Dhaka declaration on strengthening health workforce in the countries of south-east Asia region. Available: http://www.searo.who.int/about/governing_bodies/regional_committee/rc59-r6.pdf?ua=1
- Ahmed SM, Hossain MA, Rajachowdhury AM, *et al*. The health workforce crisis in Bangladesh: shortage, inappropriate skill-mix and inequitable distribution. *Hum Resour Health* 2011;9:3.
- More health workers needed for universal health coverage. *Bull World Health Organ* 2018;96:734–5.
- Adams AM, Ahmed T, El Arifeen S, *et al*. Innovation for universal health coverage in Bangladesh: a call to action. *Lancet* 2013;382:2104–11.
- World Health Organization. The Kampala declaration and agenda for global action, 2008. Available: https://apps.who.int/iris/bitstream/handle/10665/43898/9789241596725_eng.pdf
- World Health Organization. *Global strategy on human resources for health: workforce 2030*, 2016.
- World Health Organization. Seventy Second World Health Assembly Provisional Agenda Item 12.3. In: *Human resources for health, global strategy on human resources for health: workforce 2030, report by director General*, 2019.
- World Health Organization. *Dublin Declaration on human resources for health: building the health workforce of the future*. In *Fourth global forum on human resources for health*. Dublin: WHO, 2017. https://www.who.int/hrh/events/Dublin_Declaration-on-HumanResources-for-Health.pdf?ua=1
- Prince Mahidol Award Conference, Global Health Workforce Alliance, World Health Organization. Outcome statement of the second global forum on human resources for health. adopted at the second global forum on human resources for health, Bangkok. Available: https://www.who.int/workforcealliance/knowledge/resources/SecondHRHForum_report_en.pdf?ua=1
- World Health Organization. *World health assembly resolution 63.16: global code of practice on the International recruitment of health personnel*. Geneva, 2010. http://apps.who.int/gb/ebwha/pdf_files/WHA63/A63_R16-en.pdf
- World Health Organization., Global Health Workforce Alliance. The Kampala Declaration and agenda for global action. adopted at the first global forum on human resources for health, Kampala, 2008. Available: https://apps.who.int/iris/bitstream/handle/10665/43898/9789241596725_eng.pdf
- Khan MAH, Cruz VdeO, Azad AK. Bangladesh's digital health journey: reflections on a decade of quiet revolution. *WHO South East Asia J Public Health* 2019;8:71 <http://www.thinkmd.org/>
- Ministry of Health and Family Welfare. *Health, population and nutrition development program 2011–16: program implementation plan*. 1. Dhaka, 2011. http://www.mohfw.gov.bd/index.php?option=com_content&view=article&id=166&Itemid=150&lang=en
- MOHFW D, 2019. Available: <http://www.dghs.gov.bd/index.php/bd/home/4792-2017-12-31-12-15-57> [Accessed 17 Mar 2019].
- Gagnon M-P, Desmaris M, Labrecque M, *et al*. Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals. *J Med Syst* 2012;36:241–77.
- Anwar F, Shamim A, Khan S. Barriers in adoption of health information technology in developing societies. *IJACSA* 2011;2:40–5.
- Ishijima H, Mapunda M, Mndeme M, *et al*. Challenges and opportunities for effective adoption of HRH information systems in developing countries: national rollout of HRHIS and TIIS in Tanzania. *Hum Resour Health* 2015;13:48.
- Bloom G, Berdou E, Standing H, *et al*. ICTs and the challenge of health system transition in low and middle-income countries. *Global Health* 2017;13:56.
- Ministry of Health and Family Welfare. *Inter-departmental transfer policy for 9-7th grade and non-cadre officer of BCS (health)*. Government of the People's Republic of Bangladesh, 2017.
- Government of the People's Republic of Bangladesh. *Transfer policy for the 3rd and 4th class employees to transfer them from one place to another*, 1986.
- Murphy E, Dingwall R, Greatbatch D, *et al*. Qualitative research methods in health technology assessment: a review of the literature. Management Information System, Health Systems Strengthening Initiative. *Health Minister National Award*. Dhaka: Directorate General of Health Services, 2017. http://dashboard.dghs.gov.bd/webportal/files/HSSHealthMinisterNationalAward_2017.pdf
- Patton MQ. *Qualitative research and evaluation methods*. Thousand Oaks, Cal: Sage Publications, 2002.
- Guest G, Bunce A, Johnson L. How many interviews are enough? an experiment with data saturation and variability. *Field Methods* 2006;18:59–82.
- Crouch M, McKenzie H. The logic of small samples in Interview-Based qualitative research. *Social Science Information* 2006;45:483–99.
- Bryson JM. *Strategic planning for public and nonprofit organizations: a guide to strengthening and sustaining organizational achievement*. John Wiley & Sons, 2018.
- Goodman MS, Sanders Thompson VL. The science of stakeholder engagement in research: classification, implementation, and evaluation. *Transl Behav Med* 2017;7:486–91.
- Walt G, Gilson L. Reforming the health sector in developing countries: the central role of policy analysis. *Health Policy Plan* 1994;9:353–70.
- Walt G, Shiffman J, Schneider H, *et al*. 'Doing' health policy analysis: methodological and conceptual reflections and challenges. *Health Policy Plan* 2008;23:308–17.
- Buse K, Mays N, Walt G. *Making health policy*. UK: McGraw-Hill Education, 2012.
- Joarder T, Rawal LB, Ahmed SM, *et al*. Retaining doctors in rural Bangladesh: a policy analysis. *Int J Health Policy Manag* 2018;7:847–58.
- Srivastava A, Thomson SB. Framework analysis: a qualitative methodology for applied policy research. *J Admin Gov* 2009;72.
- Gale NK, Heath G, Cameron E, *et al*. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Med Res Methodol* 2013;13:117.
- Namazzi G, N KS, Peter W, *et al*. Stakeholder analysis for a maternal and newborn health project in eastern Uganda. *BMC Pregnancy Childbirth* 2013;13:58.