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## Executive Summary

In 2005, WHO noted eHealth as a tool to strengthen health systems and urged member states to endorse long term strategies and enabling environment to support its development[1, 2]. eHealth is a potential enabler that can improve service delivery and system performance in the SDG (Sustainable Development Goal) era[3]. eHealth applications can improve the quality, availability and use of information, evidences and services; build capacity of the health human resource through better learning options; improve performance monitoring and access to health service and knowledge[4]. Thus, eHealth is a powerful enabler for an “information intensive” sector like health.

Promising as they are, eHealth initiatives’ impact has been questionable [5]. Successful implementation of eHealth solution is challenged by issues like lack of evidence, sustainability, workforce, funding, interoperability, technological infrastructure, legal and ethical limitations [6]. Evidences to support claims like improved patient outcome, cost effectiveness, successful replication are scarce[7]. Pressure for adopting technological solutions often without contextual embedding with suboptimum policy support, scarcity of skilled workforce, lack of adequate infrastructural and logistic support have often hampered the evolving eHealth landscape in many regions of the world [4]. Experience and lessons from established eHealth initiatives are difficult to extract and share due to lack of monitoring and evaluation in many parts of the world including Bangladesh[4, 8].

eHealth services have been tested in Bangladesh since late 90s and have expanded in recent years. But forms of ‘digital’ accountability in relation to issues such as quality and competence have not yet been developed. The government has taken considerable interest in this area by installing basic eHealth infrastructure in different parts of the healthcare system and coming up with eHealth services. Private sector implementers are contributing actively with investment, ideas and innovations. But there is a considerable gap in understanding eHealth’s role in ensuring equitable access to the service and ensuring accountability in service provision.

The purpose of this IDRC (International Development Research Centre) project is to develop conceptual framework for examining the role and potential of eHealth in increasing access to safe, effective and affordable health services, especially for the poor, stimulate evidence-based dialogues about the integration of eHealth into health systems and create pool of trained eHealth researchers with understanding of equity and accountability.

The research activities were undertaken in July 2013 after obtaining activity clearance from icddr,b’s research administration. In the initial phase, literature review for development of the equity and accountability conceptual framework was conducted along with stakeholder mapping and mapping of existing interventions in Bangladesh. Based on a few consultations of key players in the field of ICT for health, a Technical Advisory Group (TAG) was created. The TAG was formed with members from national and international communities, government, non-government organization, academia, researchers and private sector with the aim to help development of the conceptual framework and provide overall direction to the research activities. After extensive literature review a list of themes were generated for incorporation of equity and accountability and system integration considerations within eHealth framework. Based on the first draft of the framework various stakeholders within and outside icddr,b were engaged in consultations and themes from engagements were mapped against the themes obtained from literature review. We had developed sample indicators for each of the 10 concepts and subjected them to review by internal reviewers and stakeholders. We finalized the framework and its indicators through formal consultations with chosen relevant expert panel members and consensus building exercise (Delphi process). The two rounds of Delphi iteration were conducted after obtaining approval of icddr,b’s institutional review board (IRB).

In terms of capacity development, a PhD student was identified and admitted to University of Sussex. Equity analysis of existing data and development of the equity framework and indicators were identified as the focus of his PhD work. We organized two short courses under the auspices of the project. The first one was a five day long short course of health informatics. The 2nd short course was titled “eHealth for Universal Health Coverage”. It was designed to enable participants develop an understanding of role and scope of eHealth in realizing Bangladesh’s health goals and instill a systematic way of identifying eHealth specific accountability and equity considerations among participants. The course design was novel as it contained case studies from ongoing eHealth initiatives categorized under common eHealth application based thematic areas like telemedicine, sms based services, web based applications, health information systems, from both public and private sector. The course was designed to involve the relevant eHealth stakeholders as participants and faculty so eHealth equity and accountability concepts can be worked out by the actual eHealth practitioners and actors.

The capacity development engagements also provided opportunities for networking. In the course of the project, we created a rich list of eHealth stakeholders. The interactions provided us opportunity to start dialogues on equity and accountability considerations of e/mHealth interventions and create opportunity for having further dialogues at different levels and institutes. As a result, our research team members were invited to present talks in different academic and technical institutions, as a part of curricular and extracurricular activities. From these different interaction, it became clear that there was demand for an e/mHealth knowledge sharing platform where eHealth enthusiasts can come and interact to share their knowledge, achievements, opinion, news, updates, experience. Such a platform will serve as a comprehensive place for updates on eHealth activities like list of e/mHealth initiatives, news of relevant capacity development engagements, achievements; eHealth related research findings and provide space for interaction. Due lack of sharing of experience and evidence many initiatives go unnoticed and often lead to duplication of efforts. A common knowledge and experience sharing platform can inform, educate, and improve the overall eHealth scenario and its drivers.

The implementation of eHealth remains in Bangladesh uncoordinated and often not aligned to national health priorities. We expect that the results of our study will allow diverse stakeholders to understand the gaps in terms of including equity and accountability within existing interventions and contribute towards debates on integrating these considerations within eHealth in the developing world.

## The research problem

We tried to explore the gaps in the way equity and accountability is addressed in current eHealth interventions. By developing a conceptual framework we made an effort to raise awareness of these critical issues, contribute to the knowledge base, and train people to incorporate these considerations in future interventions. eHealth interventions are rapidly increasing in Bangladesh with extensive patronization from government and participation of all relevant sectors and development partners. This has generated a lot of interest and investment. It is high time to raise the equity and accountability question of such interventions, if eHealth is to complement and strengthen the national health systems effectively.

### General Objective

The objective is to develop equity and accountability framework for integration of ICT applications (eHealth and mHealth) in health systems to analyse their role(s) in influencing the performance of the Bangladesh health system as it strives to achieve universal health coverage.

### Specific Objectives

- To examine the equity implications of the eHealth landscape in Bangladesh (how are eHealth interventions affecting demand, decision making, quality, access and affordability of health care for poor and hard to reach populations?).
- To develop new models, or refine existing models, of accountability for monitoring interventions with eHealth components (What challenges are arising for both vertical and horizontal accountability, what kinds of roles can citizens/local communities/national governments play in creating systems of accountability, how can the information system of an eHealth based service delivery model contribute to both vertical and horizontal accountability etc.).
- To explore the regulatory issues to consider when integrating eHealth/mHealth vis-à-vis governance, equity and systems integration.
- To examine the implications of system integration (including but not limited to matters of interoperability) of the conceptual model.
- To create a policy platform for uptake and translation of evidences for appropriate strategic direction and action.
- To develop a cadre of trained researchers for conducting research on eHealth system and informatics with specific focus on equity and accountability.

## Progress towards milestones

### *Equity implication of eHealth landscape:*

As a part of the project we mapped all the existing eHealth projects that were in existence from 2013 to 2016. We mapped a total of 60 eHealth intervention that were in existence. 43% of the interventions were public sector interventions which were mostly national scale. In terms of the type of intervention, 23% of the interventions focused on client education and BCC, 16% on data collection, 17% on supply chain management, 15% on provider to provider communication, 12% on registries and vital events and only 5% dealt with electronic health records. In terms of their focus 41% were about strengthening supply side, 28% addressed population health, 18% dealt with maternal and child health and only 12% were focused

on disadvantaged populations. About 26% of the intervention, especially those implemented by public sector, changed service fee. From the community end our PhD student dedicated his inquiry to understand equity in access and use of eHealth from the community perspective. The thesis is almost complete and the papers from it are being considered for SEARCH supplement (Appendix 1).

#### *Development of Conceptual model and indicators:*

We developed a 10 point conceptual framework through extensive literature review, stakeholder consultation, consensus building exercise and field testing of both themes and indicators on live projects. Systems integration is an important part of the conceptual model. The model is a practical tool that will allow policy makers and practitioners of eHealth to think through equity and accountability aspects of eHealth during design delivery and evaluation. (Appendix 2)

#### *Exploration of regulatory issues to consider for eHealth:*

Policy Landscaping- We identified 12 policy documents that mentioned the use of ICTs for health in the context of Bangladesh. We analysed the documents in terms of specific mentions of 2) leadership and governance, 3) services and applications, 4) standards and interoperability and finally 5) capacity building of work force. Among the documents identified, 8 were high level documents providing visions of the use of ICTs in general and in a few cases health was mentioned. In the 6th five year plan, eHealth was identified as a way to provide good quality health care for the remote and disadvantaged areas. There was also specific mention of development of capacity among women to provide and receive health services through electronic means. There was no mention of how ICTs can be used to increase accountability of health sector. In fact in consumer protection act through the spirit of which document eHealth was supposed to be implemented, only covered paid service which would automatically exclude most public services.

Among the 2 sector wide policy documents the Health Population Nutrition Sector Development Plan (HPNSDP) assigns 3% of budgetary allocation for ICTs for health and stresses upon mainstreaming GEV (Gender, Equity, Voice) in all sector wise components, operational plan, objective's, indicators with adequate budgetary allocation for this and strengthening GNSP (Gender, NGO, Stakeholder Participation) unit as focal point and aligning it other GoB functionalities. The document also describes the main legislations and regulatory activities under MoHFW and underlines the lack of regulatory framework and service quality standards for NGO and private providers. In the national health policy tele medicine and innovative use of ICT are mentioned as a way to ensure quality health care of all citizens. Special attention was given to residents of urban slums, indigenous population, remote areas, animal husbandry workers, factory workers, elderly, women especially pregnant and breastfeeding women. The policy described health workforce's lack of skills in using ICT and the apathy to use ICT tools and deficiency of infrastructural support as main challenges to fully realize the potential of ICT in Health. The policy identified three main challenges in health care delivery (supply side). Two of the challenges were weak governance and suboptimal quality of the services. The third was resource constraints. In the demand side the policy underlines general incapacity of population to receive health care and maintain a healthy life style.

Among the 2 implementation level documents the operations plan for HPNSDP contain results framework for use of ICTs for health. But the indicators are mostly on HIS and eHealth mainly focuses on mobile health service, telemedicine and video conferencing. The indicators are dedicated to supply side only. The community perceptions about the services and measurement how much these services are accountable and equitable are missing. There are 37 listed deliverables of MoHFW under the National

ICT policy. The Health Informatics Standards & Data Structure for Bangladesh is still in draft form. It only focuses on the public sector. (Appendix 3)

Stakeholder consultation about need for policy guidance- During our several engagement with different stakeholders we had rich conversations about importance of legislations and guidance in terms of eHealth landscape, leadership of public sector, importance of use of the data generated through use of ICTs to create a knowledge base as well as bring appropriate changes to the upstream and downstream implementation processes to enhance the reach and quality of health services.

#### *Creation of policy platform for uptake and translation of evidences:*

Our project started in July 2013. Soon afterwards, based on a few consultations of key players in the field of ICT for health, we created a Technical Advisory Group (TAG) with members from national and international communities, government, non-government organization, academia, researchers and private sector with the aim to help development of the conceptual framework and provide overall direction to the research activities of icddr,b. The SEARCH team members were asked to lead the ICT for Health research hub of the Centre for Equity and Health Systems at icddr,b with a mandate to create a common platform for all the researchers to convene to talk about the use of ICTs for health. The SEARCH team was invited to provide talks to academic organizations on the state of the use of ICTs for health in Bangladesh. The SEARCH team was heavily engaged in finding existing policy platforms where important ICT for Health studies could be placed. Through few research briefs and papers that were product on this topic through other projects were circulated through Health Policy Dialogue platform hosted in DGHS website for wide dissemination as well as Future Health Systems consortium network. Between February 2017 –July 2017, we synthesized the reflections of the short course participants and made efforts to conceptualize the need of a networking platform for eHealth enthusiasts. We also developed a draft concept note proposing development of a common eHealth knowledge and experience sharing platform. We held meeting with internal IT (information technology) department, communications to explore the practicality and feasibility of such a platform. We conducted discussions with multiple academic and national institutes for exploring the scope and possibility of developing the proposed platform so that discussions related to equity and accountability of eHealth continues beyond the project period.

#### *Capacity building:*

In terms of capacity development, a PhD student was identified and admitted to University of Sussex. Equity analysis of existing data and development of the equity framework and indicators were identified as the focus of his PhD work. We studied the availability and quality of masters and certificate courses available and decided to hold our own health informatics short course. The draft curriculum was created in collaboration with national and international experts. We anticipated that we would use this short course as well as other capacity development workshops within and outside icddr,b (related to ICT use in Health) to engage important stakeholders in discussion about equity and accountability considerations within eHealth. We held several meeting to introduce the TAG members to the SEARCH objectives and elicit their concerns about equity and accountability considerations within existing eHealth projects. Two short courses on health informatics and ICT for achieving universal health care coverage were conducted. SEARCH Cross-Team learning and sharing workshop as well as mHealth and health systems conferences provided an opportunity to discuss equity and accountability concerns of international stakeholders for eHealth. We developed 2 public forums for developers as well as general people interested in working in eHealth arena. These online forums were used to disseminate research findings, circulate important toolkits and provide linkage to national and international capacity development activities.



## Synthesis of research results and development outcomes

Our project started in July 2013. We obtained activity clearance from icddr,b's research administration. Core team members initiated research related activities. We started literature review for development of the equity and accountability conceptual framework. After extensive literature review a list of themes were generated for incorporation of equity and accountability and system integration considerations within eHealth framework. We also started a process of stakeholder mapping and mapping of existing interventions in Bangladesh Advisory Group (TAG) with members from national and international communities, government, non-government organization, academia, researchers and private sector with the aim to help development of the conceptual framework. Based on the first draft of the framework various stakeholders within and outside icddr,b were engaged in consultations and themes from engagements were mapped against the themes obtained from literature review. As a result of stakeholder engagement we reduced the framework themes from 11 items to 10 items. Through literature review and team discussions on available frameworks on accountability and governance, health systems and eHealth, a list of major equity and accountability constructs were made. The framework had 11 conceptual themes initially. The draft themes were shared with icddr,b researchers, SEARCH Kenya team members and IDRC. Through iterative discussions within the research team and incorporating the feedback, 10 concepts and underlying illustrative issues selected for inclusion in the draft framework. We shared our framework and indicators with IDRC's Gender Consultants to explore the scope highlighting gender in the framework and indicators. We received a positive feedback from the gender team regarding inclusion of gender under equity in our framework and some recommendations on how to make the indicator more gender focused. We included specific gender related indicators, as a part of integrating gender in the framework. To develop and finalize the indicators we finalized the methodology for formal stakeholder consultations and received approval from icddr,b's institutional review board (IRB) to carry out this consensus building exercise (Delphi rounds). We finalized the framework and its indicators through formal consultations with chosen relevant expert panel members and consensus building exercise (Delphi). Between August 2016-January 2017, we conducted the 2nd and the final round of the Delphi consensus building workshop. There was overall good agreement on the indicators (proportion of category 4 and 5 responses). In the 2nd round, the agreement improved when we addressed the concerns expressed in the first round. The agreement was 95% or more for all of the indicators.

Table 1: Expert affiliation by stakeholder category in Delphi consensus building meeting

Characteristics	Round 1 Frequency (%)	Round 2 Frequency (%)
Sex		
Male	19(90.5)	18(90)
Female	2 (9.5)	2(10)
Involvement		
Public sector implementer/policy maker	14 (66.7)	14(70)
Private sector /NGO implementer	2 (9.5)	1(5)
University/Academia	1 (4.8)	1(5)

Researcher	3 (14.3)	3(15)
Telecom	1 (4.8)	1(5)

The accountability framework was tested by analyzing selected eHealth interventions in the short course held in January 2017.

Some insights for the exercise are given below:

There is a great need for regulatory and legal standards for eHealth initiatives. This need was felt by both implementers of eHealth projects as well as policy makers. For example, for telemedicine projects there needs to be a guideline about what conditions and medication can be provided through telemedicine without actually examining the patients. Participants also emphasized on the need for trained healthcare providers to be present on both ends of telemedicine to abide by existing regulation with quality of healthcare in mind. Currently there is no regulatory or legal protocol or standards for operating such initiatives. Regulatory and legal guidelines for operating different categories of initiatives (for example certification, regulatory authority) can help implementers design and develop projects appropriately.

Ethical guidelines for different eHealth and mHealth initiatives are missing. Ethical boundaries and moral obligations of ICT based health initiatives that provide health service or consultation are not well defined. Issues like providing prescriptions, involving non registered health care practitioners in tele-consultation raise many ethical debates which needs discussion around the topic. Ethical guidelines for different categories of eHealth/mHealth initiatives articulating boundaries, scope, obligations of such initiatives will be very helpful for future implementers.

Information governance is not systematic and at nascent stage especially in the private sector initiatives. Explicit policy guideline articulating information and data management requirements, capacity building on information governance for different type of initiatives both in public and private sectors are needed. Policy directives regarding collection of patient or client information, rational use and sharing of information needs attention.

mHealth/eHealth services provided by private sector implementers are expensive. Stakeholder participation is varied in different categories of initiatives. Guiding principles for involving different categories of stakeholders depending on the type of initiatives will help improve participation and responsiveness. Most of the initiatives are developed as isolated projects. There is lack of horizontal and vertical transmission of health data and information. The automated systems are closed systems and limited to serving selected institutional purposes. The functionality of the institutional and small initiatives are limited due to financial, programmatic and technical constraints. Technical interoperability guidelines were very important especially for private initiatives and sharing of health data and information with national systems have lot of scope for improvement. For national interventions, responsiveness of the systems to the end user were least attended to. For those with interventions with potential to improve health systems accountability were limited in scope due to lack of capacity in the human resources and due to the lack of guidelines about how the information obtained from the intervention would result in upstream and downstream changes in the system. The exercise using the framework brought into focus the gaps in the initiatives from accountability perspective. The discussion the ensued improved the understanding of accountability issues among the stakeholders and created a demand for both the framework and such open discussions.

## Capacity building

Capacity building an integral part of the project was envisioned to create young leaders who will guide development and delivery eHealth initiatives to make them more equitable and accountable and ready for health systems integration.

PhD Coursework: With support from SEARCH one PhD student was enrolled in University of Sussex and identified health equity as his thematic area of research. Our work around ICTs encouraged two additional icddr,b researchers to engage in understanding the role of ICTs in promoting equity and accountability in health . the PhD topics are as follows-1)

Examining access to maternal health services for women of reproductive age from ethnic communities in Chittagong Hill Tracts (CHT) of Bangladesh, University of New South Wales, Australia, 2016; 2) Health Information Messages: Knowledge, Perception and Cultural Response among the Bangladesh Women, Mahidol University, Thailand, 2017.

Short courses: We conducted 2 short courses to develop the capacity of eHealth stakeholders during the project period in collaboration with Technical Training Unit(TTU) of icddr,b.

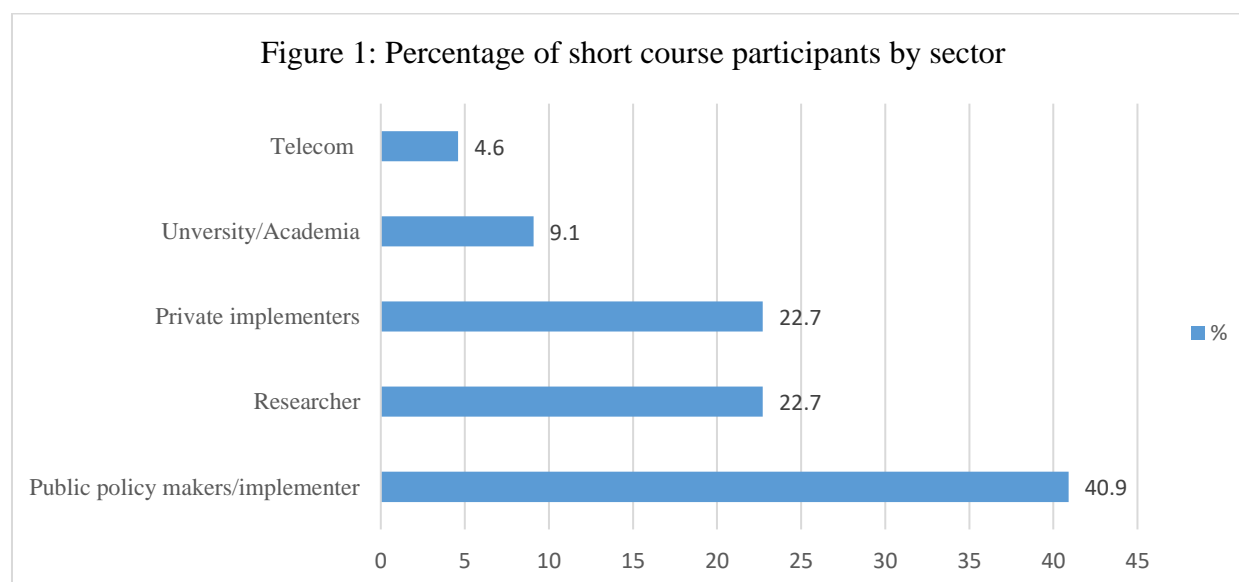
Health Informatics Short Course- A Health informatics short course was organized between 7-11th December 2014 in icddr,b to orient participants to the current issues, techniques, knowledge and standards used in health informatics that increases quality in health care. It was designed to impart the ‘how and why’ science behind the technological platform /approach. The aim was to convene researchers and program managers who are willing and able to use ICTs for health. The certificate course had lecture, discussion and extensive online exploration sessions. (Appendix 4). A total of 20 participants attended the course and received certificates. Thirteen were from icddr,b , five from public sector and two were private candidates . Thirty five percent of the participants were women. Forty percent of the participants were primarily engaged with research. Another 30% were made up of programmers and monitoring and evaluation personnel. The participants also included clinicians, health programs managers and academics.

In the course evaluation, (7 was the highest score and 1 the lowest) participants rated the course in the following manner which showed that the course has been accepted and appreciated by the participants

Aspects	Mean score
Instruction Methodology	6.11
Visual Aid	5.65
Achievement of stated objectives	6.23
Utility of the course in your work	5.68
Quality of the facilities	6.59
Overall Rating	6.18

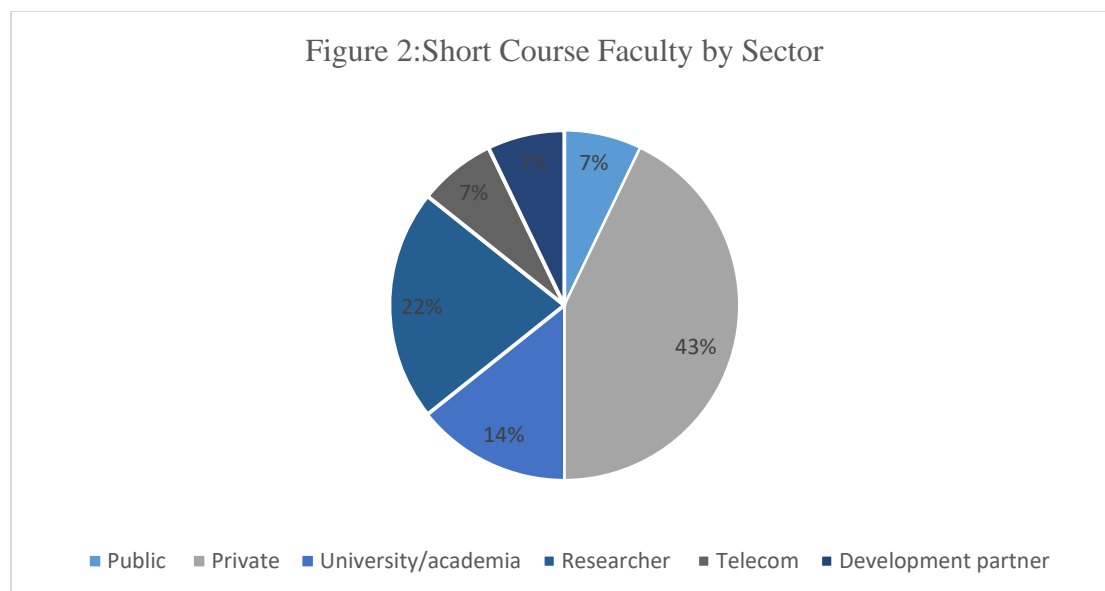
A synthesis of the individual participant recommendation showed that people wanted more of these courses and refresher’s courses. The participants wanted to visit different projects that use informatics for health during the course and also wanted to have a forum to ensure connectivity and sharing between the participants and after the course is over.

Short course on eHealth for Universal Health Coverage-We conducted a four day long course on, “eHealth for Universal Health Coverage” from 16-19th January , 2017 in icddr,b (Appendix 5). It was conceived to enable participants develop an understanding of role and scope of eHealth in realizing Bangladesh’s UHC (Universal Health Coverage) goals and instill a systematic way of identifying eHealth specific accountability and equity considerations among participants. The course design was novel as it contained case studies from ongoing eHealth initiatives categorized under common eHealth application based thematic areas such as telemedicine, sms based services, web based applications, health information systems, from both public and private sector (Appendix 6). The case studies were followed by interactive discussion sessions between the faculties and the participants on relevant equity and accountability aspects of the initiatives. The course was designed to involve the relevant eHealth stakeholders as participants and faculty so eHealth equity and accountability concepts can be worked out by the actual eHealth practitioners and actors. A total of 22 participants from Government of Bangladesh (Directorate General of Health Services and Directorate General of Family Planning), private implementers like DNet, Criticalink, MSH Bangladesh, academic institutions like NIPSOM (National Institute of Preventive and Social Medicine) and BUHS (Bangladesh University of Health Sciences), telecom companies like Robi and research institutes like icddr,b took part in the short course (Appendix 7).



The closing ceremony was presided by Director, MIS and Line Director HIS & eHealth, Directorate General of Health Services, Government of Bangladesh. The faculty members included some members of the SEARCH Bangladesh team, Directorate General of Health Services, BSMMU, UNICEF, Johns Hopkins Bloomberg School of Public Health, Jeeon, DNet, MSH Bangladesh, Robi, Criticalink and TTU (Figure 2). The participants were asked to analyze the case studies in light of the equity and accountability framework.

Figure 2:Short Course Faculty by Sector



The framework developed was tested in 5 different types of eHealth project to understand its feasibility and applicability. We conducted a detailed assessment exercise of projects in 5 thematic areas to analyze the applicability of the framework developed. The thematic areas were 1) Telemedicine 2) SMS based health intervention 3) Web application 4) Hospital automation and 5) Health information system. Based on the analysis for telemedicine and web based application projects all the themes of the framework were applicable. For SMS based intervention it was recognized that there was no laws or guiding principles governing the development and deployment of such interventions right now. For hospital automation projects strategic vision was not considered very useful as these project were meant to make service delivery more efficient. For all the interventions the use of the framework resulted in a nuanced understanding of the intervention and identification of important areas for improvement.

### Platform for uptake of evidence and networking

*ICT for Health research group:* The core research team of SEARCH formed ICT 4Health Research Group (ICT 4Health RG) in icddr,b to ensure that a platform for working together using ICTs for health exists within icddr,b to nurture partnership, provide capacity development opportunities and avoid duplication in research efforts within icddr,b in the future.

*Developer's Forum:* It was initiated by the SEARCH researchers Developer's Forum was envisioned as a platform for interaction between developers working within different programs in icddr,b to help researchers to use ICTs for both research and healthcare services. It also helped us to identify possible stakeholders for the stakeholder consultations. It consisted of analyst programmer, programmer, data management personnel, statistician, program managers, and IT personnel. There were a few representatives from public and private sector.

*Online Communities:* Two online communities were created for people who were interested in using ICTs for health in general and those who wanted to be a part of the developer's forum.

<https://www.linkedin.com/groups/Health-Informatics-Network-Bangladesh-8219439?home=&gid=8219439>

<https://www.facebook.com/groups/1547275842182696/>.

*Other networking opportunities:* The research team took part in Cross-Team Learning and Sharing Workshop from 4-5 October 2014, as well as SEARCH cohort meeting in Vancouver organized by IDRC from 13-14th November, 2016.

Apart from this, we took part conferences and presented finding from the project poster entitled, “Constructing a conceptual framework to address accountability and equity considerations within eHealth initiatives in Bangladesh” in the 9th European Congress on Tropical Medicine and International Health taking place in Basel, Switzerland on September 6-10, 2015; “International Conference on Maternal and Child Nutrition “in Colombo, Sri Lanka, 23-24 November, 2015. A core research member was invited and delivered a speech on “Use of information Communication Technologies (ICTs) for health in Bangladesh” at International Conference on Maternal and Child Nutrition in Colombo, Sri Lanka and also presented a poster titled, “What is the current status of Information Communication Technology (ICT) based health and nutrition interventions in Bangladesh?” which was based on the findings of the mapping of e and mHealth interventions. A poster titled “What are the current status of Information, Communication Technology (ICT)-based health interventions in Bangladesh?” was presented at the Geneva Health Forum to be held from 19 to 21 of April 2016 in Geneva.

The team attended the 4th Global Symposium on Health Systems Research from 14-18th November, 2016 in Vancouver Canada. Our core member presented an ePoster “How does access and use of electronic devices for health information seeking in Bangladesh look through the equity lens?” in the symposium. Another core member was an invited speaker in an organized session entitled, “ Opportunities and Challenges: Integrating mHealth into Low- and Middle-Income Health Systems” conducted by our collaborative partner IDS, University of Sussex.

We were invited as speakers in 2 public health courses held by BRAC University and 2 workshops to talk about equity and accountability issues for a developers forum organized by Bangladesh University of Engineering and Technology (BUET). Along with our collaborators in IDS, the PhD student, took part in creating “ mHealth, Health Systems and Development A Self Study Module” which is aimed to build awareness on the current use of mHealth in low and middle income countries and critically analyse the opportunities and challenge around this area.

#### *Networking platform development:*

The short course specially the 2nd one generated considerable amount of demand from participants for a networking platform to sustain the networking among eHealth stakeholders beyond the short course. Because, earlier experience suggests that it is difficult to sustain networking activities after completion of a certain event. A formal wide inclusive platform is needed to share and update eHealth related experience, events, lessons and also networking. It will also provide rich evidence to policy makers for future policy and strategy making purpose. To understand the scope and feasibility of such a platform we conducted a series of discussion meeting with internal and external stakeholders. We have developed the draft concept note outlining the knowledge sharing platform. Within icddr, we approached the IT and communication department to see whether they would be willing to host the developed online forums so that collaboration between the divisions is possible and the ICT works are highlighted. BUHS showed interest in hosting the forum and convening the discussion groups. DGHS showed interest in leading the ICT interest group but did not commit any resources or manpower for this. Their main interest is to be involved in the discussion. Finally, BMRC was interested in using the conceptual framework but thought that they would not be in a position to implement it beyond the research project that are submitted through

their system. We will continue engaging BUHS for the networking platform and looking for funds to sustain it.

Name of institution	Type of stakeholder	Purpose
Communication	Internal	Sharing the idea and possible format
IT	Internal	Sharing the idea and possible format
BUHS (Bangladesh University of Health Sciences)	External	Sharing the idea and possible format Possible component and funding agencies
DGHS	External	Feasibility and collaboration
BMRC (Bangladesh medical research council)	External	Feasibility, collaboration, hosting

## Project outputs

1. The framework with 10 themes and indicators
2. Case studies of live ICT for health projects we analyzed using the conceptual framework
3. Knowledge products

Draft paper on “Access and use of mobile phones for health”

Draft paper on “Systematic review to identify the themes around equity and accountability concepts important for eHealth” (Appendix 8)

Draft paper on “Developing indicators for eHealth accountability framework through consensus building” (Appendix 9)

Policy briefs on Knowledge, Attitude Towards, and Use of mHealth Services in Chakaria, Bangladesh. Abbas Bhuiya, Tanvir Ahmed, Sabrina Rasheed. (FHS policy brief)

BLOG : <http://www.healthsystemsglobal.org/blog/126/Dimensions-of-equitable-eHealth-how-can-we-take-it-to-the-next-level-.html>

Concept note for the Networking platform (Appendix 10)

4. Forums

Developer’s forum

ICT for Health forum

Lectures for eHealth capacity building - given in JPGSPH, BRAC University

5. Conference presentations and posters

Oral presentation “Use of information Communication Technologies (ICTs) for health in Bangladesh” at International Conference on Maternal and Child Nutrition in Colombo, Srilanka, 2015

Oral presentation “Opportunities and Challenges: Integrating mHealth into Low- and Middle-Income Health Systems” at Health systems conference, Vancouver, Canada, 2016

Poster on “What is the current status of Information Communication Technology (ICT) based health and nutrition interventions in Bangladesh?” at International Conference on Maternal and Child Nutrition in Colombo, Srilanka, 2015

Poster on “Constructing a conceptual framework to address accountability and equity considerations within eHealth initiatives in Bangladesh” at 9th European Congress on Tropical Medicine and International Health, Basel, Switzerland, 2015.

## **Problems and challenges**

The stakeholder needed a lot of time before they were on the same page about equity and accountability and multiple engagements with them through short courses, TAG meetings and other meetings were necessary. The mapping exercise generated a lot of interest as no one had a comprehensive list of eHealth projects implemented in Bangladesh.

Engaging the Telecom implementers became a big problem. Initially we were able to interest manager of Grameen Phone health portfolio to be a part of TAG but after one meeting he remained unreachable due to the shift in GP program strategy. Also we felt that they were unwilling to let us analyze their health strategy. Eventually we managed to engage with another program from a different Telecom. However, during interactions with him he was unwilling to talk about their own health strategy. Other private sector implementers were not very interested to engage with us if their program was not yet stable.

As a group this was our first time for developing a conceptual framework. The work was complicated by having to look at multiple disciplinary domains such IT, health, health systems and Governance from where we looked for conceptual models and themes to include. The initial literature review conducted by IDRC was very helpful in terms of providing us access to different conceptual models. During the literature review we also realized that our efforts will not be publishable unless we used a systematic review methodology. So we went to systematic review short course. We took some time to search for an appropriate methodology to construct contextualized indicators for the concept. We ended up using Delphi as a consensus building method. We as a team had no expertise of using Delphi. We had to read and learn the methodology before we could implement it.

In general the initiative we mapped and assessed, we found that equity and accountability were inadequately addressed. The systems were designed for organizational strengthening, increasing the staff efficiency and accountability. Mostly the needs of the users were not considered during the design. Although the major portion of the users was women, gender was not considered as an issue during the design. In the private sector the small scale interventions were designed to constantly based on needs of the context however, the public sector interventions were implemented top down without and flexibility to change the design or delivery. Importance of putting aside resources for eHealth projects so that they could be responsive to the needs of end users was important to consider. None of the project followed any established ethical guideline. All the implementers felt that there was a need for Government to create an ethical guideline for eHealth projects. All stakeholders agreed that eHealth projects should be used to make health systems accountable. However, as most of the interventions were in the first phase of implementation or struggled to gain acceptability among end users, they thought that accountability discussions should take place after some time has evolved and experience gained. This created a problem in terms of finding acceptance for the conceptual framework developed.

We felt that our project was very ambitious and forward thinking and generated much thinking among the wide range of stakeholders who engaged with us. However, it would take strong leadership, sustained effort and time to incorporate such thinking in into interventions in the future.



## **Administrative reflections**

Project initiation and conduction has been interrupted in 2013 due to 2 month long political turmoil. So we concentrated on getting ready with all things that need to happen before. Due to the change in the leadership of MIS formation of TAG was delayed. Also as we wanted important stakeholders in the eHealth landscape we needed time to construct a list of interventions. The interest in the project did not pick up until the formation of TAG and the first short course.

During the course of the project the Canadian dollar values plunged against the US dollar. As a result we had to reduce the scope and breadth of our activities severely.

In April 2015 the building where we had the offices were declared unsafe and we were relocated to a temporary space. The dislocation and subsequent aftermath slowed down the project activities significantly for 2-3 months.

In June 2016 Dr. Bhuiya retired from icddr,b creating a large vacuum in the SEARCH project leadership. Also our team member Tanvir Ahmed became less active as a contributor to the project as his PhD assignment became more rigorous and time consuming. Although we had decided to create an accountability conceptual framework for the project he concentrated on equity. All this created a problem of strategic leadership and lack of a critical mass of people working to complete project objectives

In August 2016 the Dr Azad who was the head of MIS and our TAG became the promoted to DG Health. As this was the time for dissemination his handing over the responsibilities to the new head of MIS meant that we could not get much accomplished in terms of engaging the MIS in TAG. However, our link to DG Health was very important to get good attendance in the final sort course.

In December 2016 we decided to ask for a 6 month no cost extension for the project. Although the decision was approved by the program officer the formal approval and contract amendment arrived in April. This problem in releasing funds for project activities and a lot of anxiety among the team members who were struggling to finish the deliverables for platform creation. After April we did not have enough time to put together a viable platform that would sustain beyond project period. In terms of reporting there were time lags. We often could not make the deadline for both financial and technical reporting. Our finance people found it difficult to use with excel sheet that was provided before the each time they had to make the reports. For the technical report we initially found it hard to report our activities as we were unclear about how detailed a report was being asked for. The final report was delayed as we wanted to include the draft paper from different team members who had moved on to different projects.

## Appendix 1:Equity paper

### Paper on ACCESS AND USE OF MOBILE PHONES

#### Introduction

Globally, there has been remarkable increase in number of cell phones and internet users and price of services and devices has gone down (Lewis, Synowiec, Lagomarsino, & Schweitzer, 2012; WHO, 2011b). It's now a thriving market characterized by seven billion subscribers. About 95% of world's population is covered by at least 2G network, which is more than nine-fold increase in internet users in just seven years (4% in 2007 to 37% in 2014). There are millions of apps are now available for the users and it's increasing (ITU, 2015, 2016). While the developed countries are reaching towards 100% subscription, the developing countries are racing fast, too. Since 2010, most of the new subscriptions are coming from the developing countries (ITU, 2015; World Bank, 2011). From the health standpoint, the question remains, is this growth equitable and how is it affecting people in need of health care? Have mobile phones and internet been successfully able to ensure access to health services especially in resource poor contexts? Considering such growth, Angela Jean Ahrendts, the senior vice president of Apple INC., once said *"It's all about people... the true measure of our success will be the number of people touched and transformed by our success."* To understand how mobile phones and internet is influencing the lives of people in need to health care (and information), this paper presents the concept of *growth* and *use* of technology separately.

The growth and use of ICT innovations in general may be intriguing to conclude that it has dissolved group specific boundaries. But the truth is, despite large subscription base, there is growing evidence of *digital divide*. It is the disparity between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities (OECD, 2001; Wilhelm, 2002). Based on the review of documents on digital divide, technological growth and uptake of ICT to health domain, there can be three summary points; a. access and use of technological innovations are influenced by sociodemographic traits i.e. age, gender,

income disparity, geographic location, education etc. b. ownership of device and/or network is often used as a proxy to suggest/determine access to electronic health services/information and c. not much is known about the use of (not access to) technology/electronic means for health. From the equity standpoint, these summary points thus raise number of questions related to the rapid spread of ICT and its endorsement for health; are factors related to digital divide also influences the access and use of electronic means for health and if yes, what are those? Does owning an electronic device mean people have access to health services/resources? Does people with access to device and electronic health services/resources also use electronic means for health services/resources? What are the sociodemographic factors hindering the access and use of electronic health services/resources? etc. To answer these questions (at least in parts), in this paper, we will discuss the access and use of electronic means to health services/resources by the people in the context of low and middle-income country, in this case Bangladesh.

Alike global trend, Bangladesh, too is experiencing the rapid growth in ICT and related innovations. A substantial number of health stakeholders are also in the process of testing and/or adopting ICT solutions in the country (Ahmed, Lucas, et al., 2014). There can be number of reasons why Bangladesh is such a fertile ground for electronic health (eHealth). These include; a. huge mobile-cellular subscription base and high household ownership; more than hundred and eight million in both rural and urban Bangladesh and increasing (GSMA, 2013). The household ownership of mobile phones has reached up to 81% (Khatun et al., 2014), b. political mandate of digital Bangladesh is fostering rapid adoption of electronic platforms for improved management of healthcare delivery system, ensuring quality healthcare, improved awareness of and access to healthcare by the community and enhancement of the capacity of the healthcare delivery system (GED, 2012; MoSICT, 2009) and c. abundance of eHealth initiatives with more than a decade long experience in implementing eHealth initiatives (Ahmed, Lucas, et al., 2014). As a result, there has been a rapid growth of government, NGO and private-for-profit eHealth and mHealth initiatives in the country (Ahmed, Bloom, et al., 2014; Ahmed, Lucas, et al., 2014; DGHS, 2012; WHO, 2011a). Examples includes raising health awareness regarding women's maternal health, drug and alcohol abuse, smoking cessation, HIV/AIDS, general healthcare delivery etc. (Afroz, 2012; Ahmed, Lucas, et al., 2014; Ansari, 2010; Azad, 2013; DGHS,

2012). Studies have identified 42 of such initiatives in three platforms; internet, SMS and voice calling (call centre based) (Ahmed, Lucas, et al., 2014; BKMI, 2014). Thus, the main question for this paper is to understand who has access to and use electronic health services and/or resources in Bangladesh?

For the purpose of operationalization, a combined descriptive and social epidemiology approach has been assumed; time (when), place (where) and person (who) (Byass, 2001; CDC, 2012; Honjo, 2004). In epidemiology time (when) refers to a very specific period and is more chronological in nature; i.e. date or period in month and year. For this paper, time refers to both period and context. The data for this chapter was collected in two steps; in 2014 and in 2016. So, the chronological time for the question refers loosely to 2014 to 2016. And the context is the availability of electronic health services and/or resources in Bangladesh; eHealth and mHealth. eHealth refers to a spectrum of technologies including computers, telephony and wireless communications providing access to healthcare and mHealth is a subset of eHealth that refers to the same via mobile phones (Ahmed, Bloom, et al., 2014; Ahmed, Lucas, et al., 2014; ITU, 2014; Oh, Rizo, Enkin, & Jadad, 2005). Therefore, in summary, time and context for this paper refer to availability of health call centre, web based health information sites including institutional (formal) and patient groups (informal) ones, internet and/or call centre based counselling services, SMS (text) based services to receive and/or send health related information (i.e. convey health status, receive advice, make complaints etc.) during 2014 to 2016. Place (where) refers to the location from where the data originates. Data presented in this chapter originates from peri urban Bangladesh, a sub-district called Mirzapur which is about an hour from (~60 km north of) the capital city Dhaka. This is also the other part of the context mentioned under time. And lastly person (who) is the people of Mirzapur in general.

Next is to take a closer look at the question itself. The most obvious two parts of the question are; i. people who have access and ii. people who use; electronic health services and/or resources. Access to healthcare underlies the very fact that people can be treated unjustly even if they are treated equally. "It is the ability to ensure a set of healthcare services, at a specified level of quality, subject to personal convenience and cost, based on

specified amount of information”(Oliver & Mossialos, 2004). This paper is more interested in people’s access to eHealth and/or mHealth; whether people can access available electronic health services and/or information or not; access to eHealth. For this, ownership of device and network is considered as the proxy to access to eHealth. This means, if one has subscription of mobile-cellular network and/or internet and a cell phone (regular, feature or smartphone) or computer or both, has access to electronic health services and/or information. And use of eHealth and mHealth has been operationalized as the use of electronic devices; using phone to call a health call centre and discuss about illness (for treatment or advice regarding a disease, asking about healthcare cost or possible doctor etc.), using internet to look for health information from any formal and/or informal group (patient group, health portal etc.), using any internet based and/or call centre based consultation/counselling services, using text messages to make enquiry about specific health related issue (i.e. convey health status, receive advice, make complaints etc.). Point to be noted that calling for making appointment or casual health related discussion or sharing experience with the peers as seeking health information was considered as using electronic health services and/or information.

The final part of the question is to understand the equity dimension; the relationship between the use of mobile phone (any) and/or computer (PC/laptop) and socio-demographic features. Based on socio-demographic features like age, gender, education and socio-economic status, the aim is to identify various groups who has access and use electronic health services and/or information. Such socio-demographic categorization is often used to understand the equity of access to and use of health services and a core concept of digital divide. Point to be noted that, geographic distribution is also a core component for both, but this paper has used data from a part of Bangladesh due to time and resource constraints. Therefore, geographic distribution was not considered. (Bloom, 2000; Braveman & Gruskin, 2003; Davies et al., 2014; Evans, Whitehead, Diderichsen, Bhuiya, & Wirth, 2001; OECD, 2001; Solar & Irwin, 2007; Stevens, 2003; Wilhelm, 2002). Thus, to understand who has access to and use electronic health services and/or resources in Bangladesh, following three questions were considered in this paper; a. Does people in Mirzapur, who own electronic device, use it for seeking healthcare? b. How is age, gender, education and socioeconomic status related to ownership and use of

electronic devices for seeking healthcare? and c. Why do users in Mirzapur choose to/not to use digital platforms to access health information?

## Method

The inquiries of this paper required both description of pattern(s) as well as its inherent understanding. Therefore mixed-method design was deemed appropriate. The quantitative component of the study comes from a household survey conducted during March to May 2014 at three locations in Bangladesh; Chakaria (a rural sub-district), Mirzapur (a semi-urban sub-district) and Dhaka (five largest slums of the capital city). It was conducted to explore the role of ICTs in health information seeking, jointly by the Institute of Development Studies (IDS), UK (<http://www.ids.ac.uk/>) and the International Center for Diarrhoeal Disease Research, Bangladesh (<http://www.icddr.org/>). For this study, semi-urban (Mirzapur) location was chosen because; a. it has both rural and urban flavour and b. its typical sub-district in Bangladesh and fairly close to Dhaka (60 km north of Dhaka and takes 2 hours by car). After the analysis, the findings were further followed up using qualitative technique during February to March 2017 as part of a PhD fieldwork. This helped in understanding the underlying clarifications of the pattern; mostly the WHY part of the inquiry. This PhD student also contributed substantially to the design and implementation of the survey.

In the absence of prior variance estimates of the outcome variables, a value of 0.5 (the maximum for dichotomous variables) was used to calculate the required sample size to obtain 95% confidence limits with a precision of  $\pm 10\%$ , assuming a design effect of 2. This suggested a sample size of 2520 households (for all three location) with 5% buffer for the probable non-response rate. Thus 840 households were selected using systematic cluster sampling from a Health and Demographic Surveillance in Mirzapur, from 28 villages (30 households/village). In most cases (over 81%) information was gathered from the head of the household or the spouse of the head. Where this person was not present or unwilling to respond, the respondent was usually an adult child of the head or the spouse of a child. The survey questionnaire was devised on a browser based platform thus which

runs on both Windows and Android OS. It had two components: front-end (or user interface), and back-end (or administration database). The front-end was used both for data collection and management while the back-end was exclusively used for data management and extraction. The questionnaire was developed both in Bangla and English and was pre-tested before implementing in the field to understand the overall quality of the questionnaire and effectiveness of the electronic version (on android based 7 inch tablets).

A team of 14 trained researchers; one supervisor, ten enumerators, a quality controller, a data manager and a technical support officer, conducted the survey using 11 standard android tablets (7 inch). Data was uploaded to a central server at the end of each day (Day 1) and the synchronization process automatically deleted the data from local storage (Tab). After the uploading, a data management team (located centrally) randomly selected 5 to 10 questionnaires and emailed identifiers to the supervisors and the quality controller to recheck the collected data (day 2). At the end of day 3, the supervisor uploaded the rechecked data into the server and on day 4 the data management team updated the data to the main database. The data management team used a dedicated Wi-Fi based internet connection but the field team used the mobile phone network if Wi-Fi was not available. All the respondents were asked to provide written consent after explaining the ethical aspect of participation.

Considering there was not enough information in the survey to indicate the reasons for not using, follow up discussion was done with various population groups; focus group discussion (FGD). The survey was conducted in 2014 and the FGD was conducted in 2017. Due to the gap, it was difficult to track the respondents as most of them were unavailable (largely out-migration). Therefore, respondent groups were created using the Health and Demographic Surveillance System (HDSS) of Mirzapur and snowball technique, based on socio-economic status (rich/poor), gender (male/female) and age (young and adults, middle aged and elderly) and education (student and general population). Altogether 20 FGD in 6 groups were conducted. Other than the demographic characteristics, the only inclusion criteria used was have never used electronic devices to seek health services and/or information (in case of respondents outside the survey sample frame) (Table 1). Point to be noted that, within middle aged group few chosen participants were in fact

adults. Considering their non-student status, engagement is livelihood and household work and group cohesion, they were deemed to be important addition to the groups.

Table 1: FGD group; composition and number

Groups	Composition	Number	Age Range
1	Rich and poor female college students representing young female educated adults; 4-5 in each group	4 (2+2)	19 to 22 years
2	Rich and poor male college students representing young male educated adults; 4-5 in each group	4 (2+2)	20 to 24 years
3	Rich and poor general female population representing working call and middle age population	4 (2+2)	18 to 40 years
4	Rich and poor general male population representing working call and middle age population	4 (2+2)	18 to 50 years
5	Rich and poor elderly female population	2	56 to 68 years
6	Rich and poor elderly male population	2	58 to 72 years

As a standard rule, all FGD were conducted in places preferred by the participants; often household in case of female and around any local gathering place in case of male. Discussion was facilitated by the PhD student (primary author) to help the group stay focused on the discussion and seek for agreement among the participants as much as possible. However, disagreement was also noted in addition to participants' body language. Each FGD lasted for about 25 to 30 minutes. All discussion was documented with



observation notes as detailed as possible and was also audio recorded. Discussions were given unique ID and was later transcribed into Bangla, then into English and finally back to Bangla to ensure that nothing is lost during transcription. Before beginning the FGD, all the participants were asked to provide written consent after explaining the ethical aspect of participation. Each FGD was conducted following an open-ended and flexible guideline, which was developed on mainly two themes; a. non-use of electronic devices for seeking health services and/or information and b. people's expectation for electronic source of health services and/or information. This paper presents the findings from the first there.

The distribution of the quantitative data has been presented through simple univariate analyses which included measures of central tendency. This also showed the differences (both in numbers and proportions) between the users of digital means for healthcare and/or information and the non-users in terms of age, gender, education, income and ownership of mobile devices. To establish the statistical significance of these differences *chi square* test was done between the groups considering the variables were categorical in nature. Household and personal *ownership of devices* (mobile phone or laptop or both) was considered as the proxy for access to electronic platform. *Use of electronic devices to seek health services and/or information* was operationalized as; using phone to call a health call centre and discuss about illness (for treatment or advice regarding a disease, asking about healthcare cost or possible doctor etc.), using internet to look for health information from any formal and/or informal group (patient group, health portal etc.), using any internet based and/or call centre based consultation/counselling services, using text messages to make enquiry about specific health related issue (i.e. convey health status, receive advice, make complaints etc.).

The qualitative analysis followed up on the distribution shown in the quantitative analysis. Patterns were identified to describe the relationship with non-use of mobile phones and/or PC/laptops considering the context, a qualitative technique popularly known as content analysis (Krippendor, 2004; Mayring, 2000). Focus group discussions were conducted mainly to understand the reasons for not using electronic devices for seeking health services and/or information. The findings were grouped as three broad themes; i. reasons for not using (intention was make list of reason), ii. awareness (to

understand if the participants were aware of such electronic sources) and iii. role of intermediaries (asking anyone in the family or peer network to look for health information using electronic devices). For the purpose of alignment and arrangement of information, iterative analysis will be done. This means, audio-recorded interviews was listened to and transcribed regularly. In addition, a field diary was maintained to record the day-to-day details of the fieldwork, i.e. field experiences, personal feelings, body languages of the informants and any remarkable incidents. This will help to identify new/emerging issues, the strengths and weaknesses of interview techniques and any missed opportunities for further exploration. To group and present the findings, consistencies was sought. At the same time, deviant responses was carefully noted to interpret the variations across the context, an inductive method of analysis often known as thematic approach.

## **Findings**

### Socio-demographic profile of the respondents

During the survey, 854 respondents were interviewed. The respondents were aged between 16 to 80 years with somewhat normal distribution and mean age was 41.3 ( $\pm 14.5$ ) years. For the purpose of descriptions, age was divided into six groups similar to demographic and health surveys (DHS) and the surveys of Bangladesh Bureau of Statistics (BBS) (REF); 16-24, 25-34, 35-44, 45-54, 55-64 and 65+. About 67% respondents constituted adult and middle age groups and least was from the eldest group (8.55%). These age group was later grouped as young adults (14-24 years), adults (25-34 years), middle age (35-54 years) and elderly ( $\geq 55$  years) for the purpose of analysis. About 72% of the respondents were female; about 2.5 times more than male with a male-female ratio of 1:2.6. This is because the survey was conducted at households and during day times when the males were away. About 38% respondents had no education and about 3% of the respondents were graduates or higher. More than half (58%) household had four to six household members, which resembles a usual Bangladeshi family size (REF)+ALSO THE TFR OF MIRZAPUR. This is because there were more than two children and/or in-laws residing in the sample households.

About 73% respondents were reported as unemployed. However, this doesn't refer to the exact household status since most of the respondents were female and often female are housewives and it's usual for the housewives to be considered of being unemployed (REF). When asked for household head's employment status, about 76% reported of having one. To understand the socio-economic status (SES) of the sample household, five groups were considered; poorest, poor, middle, rich and richest. These groups were determined by using a list of assets, a popular method called *asset index*. These five groups of SES were equally distributed, meaning there were about 20% respondents from each of these SES. About 96% household had no menial labour as a source of income, indicating households with stable income sources. To support this further, about 93% households had no social security cards. Table 2 shows the distribution of Socio-demographics of the respondents and their households.

Table 2: Socio-demographics of the respondents and their households in Mirzapur (n=854).

Socio-demographic traits	Distribution (%)
<b>Individual</b>	
<i>Age groups</i>	
16-24	11.36
25-34	25.18
35-44	22.25
45-54	19.79
55-64	12.88
65+	8.55
Range: 16-80 years	
Mean ( $\pm$ SD): 41.3 ( $\pm$ 14.5) years	
Median: 40 years	
<i>Gender</i>	
Male	28.1
Female	71.9
<i>Education</i>	
No Education	38.29
Primary	24.12
Secondary	29.74
Higher Secondary	4.8
Graduation & Above	3.04
<b>Household</b>	
<i>Member per household</i>	
1-3	30.09
4-6	57.85
7+	12.06
<i>Respondent employment status</i>	
Yes	26.93
No	73.07
<i>Household head working status</i>	
Yes	76.35
No	23.65
<i>Socio-economic status (SES) of the household</i>	
Poorest	20.37
Poor	19.79
Middle	22.37
Rich	17.56
Richest	19.91
<i>Presence of menial labour</i>	
Yes	4.1
No	95.9
<i>Household's social security card</i>	
Yes	7.14
No	92.62
DK (Don't Know)	0.23



## Ownership of electronic devices

As explained earlier, ownership is considered as mean/requirement to access to electronic health services and/or information. This means if a person and/or household owns an electronic device (i.e. Mobile phone, laptop or both), it implies that the person (or the household) can access electronic services and/or information (including health). Further to this is, ownership was also explored as people's subscription to mobile cellular network (network ownership) and number of subscription (one vs. multiple ownership of mobile sim cards). The latter two was not considered for equity measure. However, they helped in understanding the context.

Among the 854 respondents, about 54% mentioned that they have their own (personal) electronic devices (mobile phone, laptop/computers or both) and about 90% reported of having devices at their household. In both cases, ownership was exclusively mobile phone with a very small proportion who had both mobile phones and laptop/PC. The household ownership is similar to what was reported in previous studies (Khatun et al., 2014) (MORE). But the personal ownership found to be quite lower. The closest data on personal mobile phone is found to be about 81% which is the current number of mobile-cellular subscribers of Bangladesh (BTRC, 2017). But this includes multiple SIM card as well (subscription to more than one networks). Therefore, the actual number subscriber as person is expected to be lower. Table 3 shows the distribution (%) of electronic devices at both households and personal level in Mirzapur.

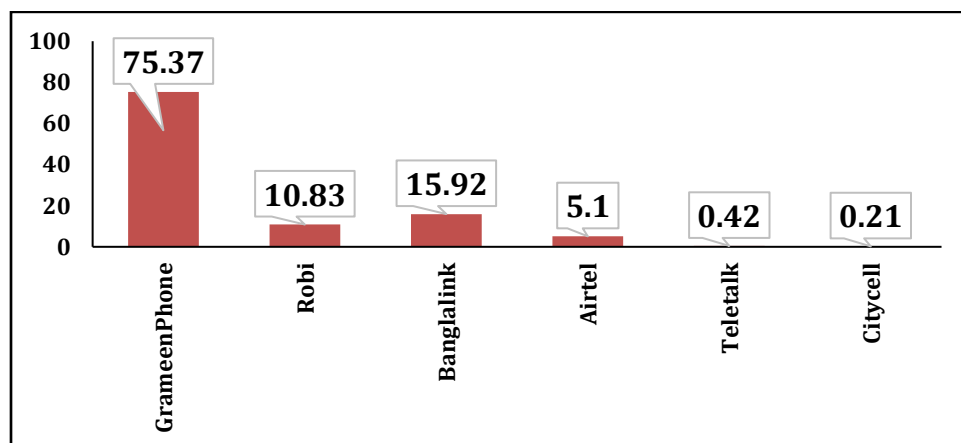
*Table 3: Distribution (%) of household and personal ownership of electronic devices in Mirzapur (n=854).*

Ownership of devices	Percentage (%)	
	Household	Personal
Yes	90.28	55.2
Mobile	87.94	53.2
Laptop	0.23	0
Both	2.11	2
No	9.72	44.8

Bangladesh has six mobile network providers and subscribers of all were found in Mirzapur. Figure 1 shows that the Mirzapur mobile network market is dominated by the GrameenPhone (75%) followed by Banglalink (16%), Robi (11%) and Airtel (5%). This also resembles the general market share of various mobile cellular subscription in Bangladesh (BTRC, 2017). To understand the influence of socio-demographic traits over network ownership, further analysis showed no pattern. It is likely that subscription may be subject to various packages that offers greater comfort and freedom for the use of mobile phones. For example, the small group of Teletalk subscribers were probably attracted by some offers which was designed for the younger age groups.

Figure 1: Distribution (%) of mobile network subscriber by providers in Mirzapur (n=471).

	N	%
Grameenphone	355	75.37
Robi	51	10.83
Banglalink	75	15.92
Airtel	24	5.10
Telitalk	2	0.42
Citycel	1	0.21



Respondents were also asked to report number of subscription they have. There was significant relationship between subscription(s) of SIM cards and gender and education. More than one SIM cards was found to be higher among men (15%) than female

(4%). And people with more education have more subscription to more than one SIM cards (Table 3).

*Table 3: Distribution (%) of subscription of SIM cards by gender and age, education and SES in Mirzapur (n=471).*

Socio-demographic traits	One SIM	More than One SIM
<i>Age</i>		
16-24	86.44	13.56
25-34	92.11	7.89
35-44	93.46	6.54
45-54	93.15	6.85
55-64	93.48	6.52
65+	100	0
<b>P-value</b>	0.299	
<i>Gender*</i>		
Male	85.45	14.55
Female	96.41	3.59
<b>P-value</b>	0	
<i>Education*</i>		
No Education	97.64	2.36
Primary	89.66	10.34
Secondary	94.58	5.42
Higher Secondary	89.47	10.53
Graduation & Above	70.83	29.17
<b>P-value</b>	0	
<i>Socio-economic status (SES)</i>		
Poorest	95.95	4.05
Poor	93.1	6.9
Middle	92.47	7.53
Rich	92.05	7.95
Richest	90.7	9.3
<b>P-value</b>	0.756	

*Note: \* - statistically significant (p value  $\leq 0.05$ )*

#### Access to information (including health) through electronic means by the owners

In Mirzapur, owners of mobile phone, laptop or both were found to be aware of the use and most of them also used their device to seek or exchange information. Table 4 shows that everyone (100%) in the survey with personal devices was found to have sought electronic services and/or information while about 89% of the household owner of devices reported that they have sought electronic services and/or information and the rest were



aware. For both types of ownership, voice call was found to be predominant followed by SMS and internet. For all type of use, mobile phone owners were predominant (figure 2). Such use of mobile phones and voice calls reflects the current scenario of Bangladesh and supports the global understanding. Seeking services and/or information is about having a conversation with the concerned person or peer largely. Clearly SMS and internet use requires more technical skill than making calls. In the context of digital divide, there are evidences suggesting use of devices to perform a task requires skills. Finding of this survey also suggests the same. And when

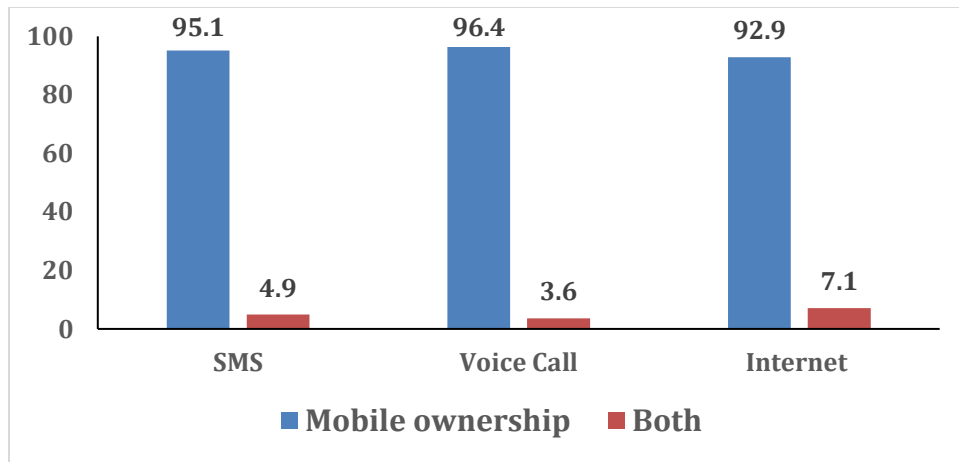
*Table 4: Percentage showing people who owned devices (cell phones, laptops or both) and used or are aware of use of devices for seeking/exchanging any information (n=471)*

Trait	Percentage (%)	
	Household	Personal
<b>Used and aware</b>	<b>89</b>	<b>100</b>
Voice Call*	99	100
SMS*	35	47.98
Internet*	4	8.92
<b>Not used but are aware</b>	<b>11</b>	<b>0</b>

\* Multiple Response

Figure 2: Percentage showing use of mobile phones, laptops/computers and both to access any information through SMS (n=226), voice call (n=471) and internet (n=42).

	Number	Mobile Ownership	Both
SMS	226	95.1	4.9
Voice call	471	96.4	3.6
Internet	42	92.9	7.1



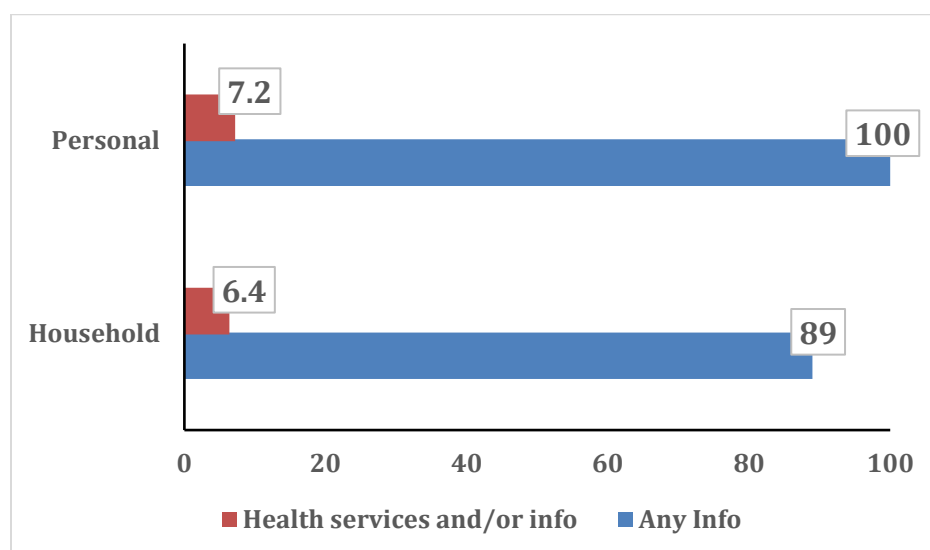
Use of devices dramatically reduced when it comes to seeking health services and/or information. About 6% household owners used and/or were aware of use of their devices for health services and/or information and about 7% of the owners of personal devices were same (Table 5). Use of devices for electronic health and/or services becomes vivid when viewed against use of devices for any information. Figure 3 shows people who owned devices sought electronic health services and/or information about 14 times and people who owned devices at their household about 15 times lesser that they did for any information.

*Table 5: Percentage showing use and/or awareness of seeking/exchanging health information electronically among the device owners; household (n=771) and personal (n=461).*

Trait	Percentage (%)	
	Household	Personal
<b>Used and aware</b>	<b>6.4</b>	<b>7.2</b>
Any health issues	59.2	64.7
Serious health issues	36.7	35.3
Only aware	4.1	0
<b>Not used</b>	<b>93.6</b>	<b>92.8</b>

Figure 3: Comparison between household and personal ownerships by their use for any information and health services and/or information (percentage).

	Number of respondent	Any Info	Health service or info
Personal	471	100	7.2
Household	771	89	6.4



### Socio-demographics and use of any information health services and/or information

In this section, I will discuss the use (and non-use) of devices for seeking electronic health services and/or information in comparison with any information in regards to socio-demographic characteristics in Mirzapur. This will help us to understand which socio-demographic group or groups are using electronic health services and/or information mostly and thereby outline the equity dimension of eHealth. As explained in the method section, age, gender, education and SES will be used. To do this, I have used both household and personal ownership and see who is using devices to identify any pattern regarding use of any information and health services and/or information.

In Mirzapur, figure 4 shows that everyone who had their own devices (personal ownership) sought information at some point since their device ownership, thus there was no pattern. But for the health services and/or information, the middle aged (35 to 54 years), female, no education and least (primary) educated and lower (poorest and poor)

and middle socio-economic groups were found to be the lowest in use (proportion) and the pattern was statistically significant. In these socio-demographic groups people of 65 to 74 years, male, higher secondary education and the rich (4<sup>th</sup> SES quintile) were the groups who used devices for seeking electronic health services and/or information. For household ownership, there was a pattern in using devices for any information. Younger age groups, male, more educated groups and higher SES groups were found to have used the devices in their household to seek any electronic information. But pattern of personal ownership and household ownership for use of devices for seeking health services and/or information was similar except that in case of household ownership, pattern for age and gender was not significant.

Figure 4: Proportion (%) of people who sought information electronically (both any and health) by personal ownership (n=471) and household ownership (n=771) devices and sociodemographic traits in Mirzapur.

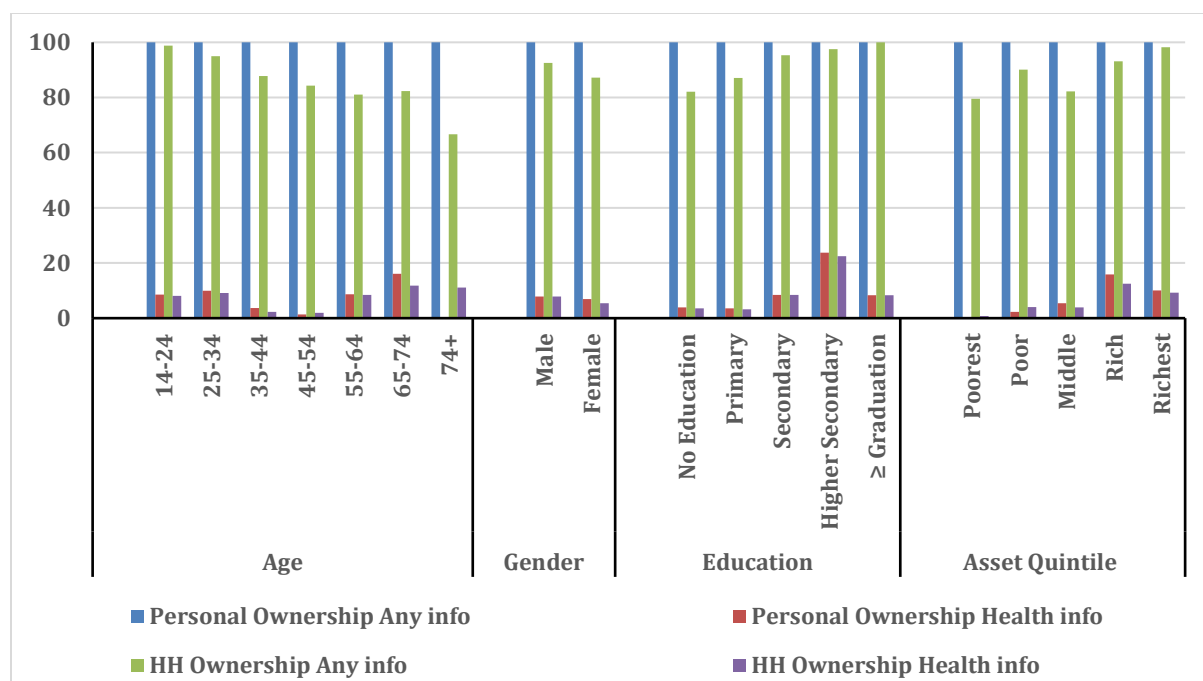
Table: information seeking based on Socio demographic status (Personal ownership) (n=471)

Characteristics	Number of respondent	Information seeking	Health Information seeking
age			
14-24	59	100	8.47
25-34	152	100	9.87
35-44	107	100	3.74
45-54	73	100	1.37
55-64	46	100	8.7
65-74	31	100	16.13
74+	3	100	0
Gender			
Male	165	100	7.88
Female	306	100	6.86
<b>Education</b>			
No Education	127	100	3.94
Primary	116	100	3.45
Secondary	166	100	8.43
Higher Secondary	38	100	23.68
Graduation & Above	24	100	8.33
<b>Asset Quintile</b>			
Poorest	74	100	0
Poor	87	100	2.3

Middle	93	100	5.38
Rich	88	100	15.91
Richest	129	100	10.08
Total	471	100	7.22

Table: information seeking based on Socio demographic status (household ownership)  
(n=771)

Characteristics	Number of respondent	Information seeking	Health Information seeking
age			
14-24	87	98.85	8.05
25-34	198	94.95	9.09
35-44	172	87.79	2.33
45-54	159	84.28	1.89
55-64	95	81.05	8.42
65-74	51	82.35	11.76
74+	9	66.67	11.11
Gender			
Male	216	92.59	7.87
Female	555	87.21	5.41
<b>Education</b>			
No Education	285	82.11	3.51
Primary	185	87.03	3.24
Secondary	237	95.36	8.44
Higher Secondary	40	97.5	22.5
Graduation & Above	24	100	8.33
<b>Asset Quintile</b>			
Poorest	132	79.55	0.76
Poor	151	90.07	3.97
Middle	180	82.22	3.89
Rich	144	93.06	12.5
Richest	164	98.17	9.15
Total	771	79.55	6.1

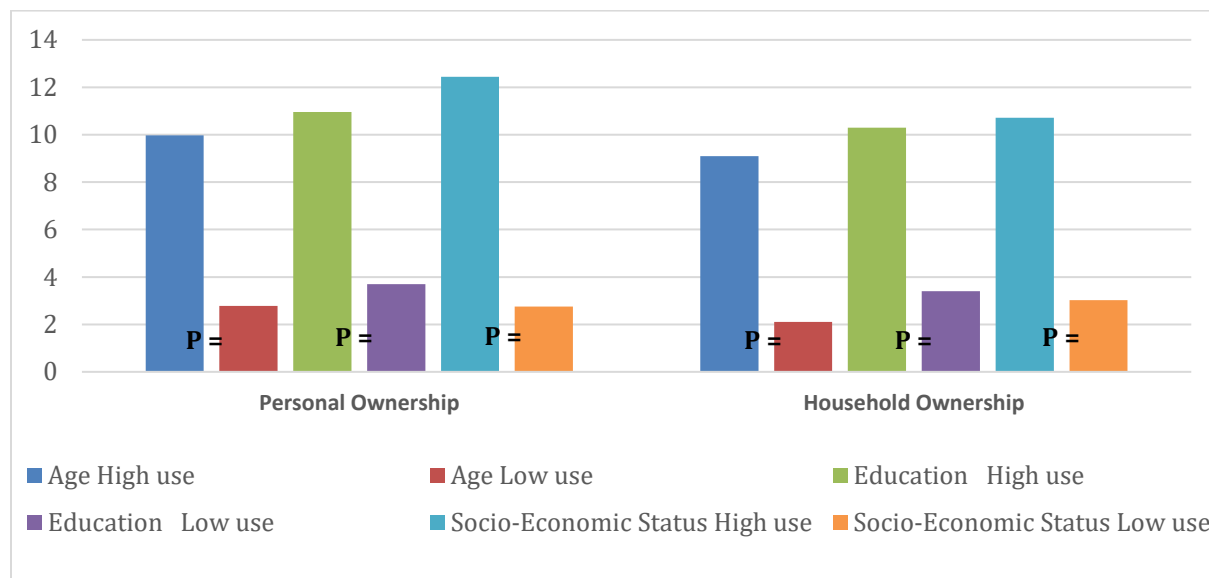


The aim of this thesis is to explain the equity dimensions of use of electronic health services and/or information, users (of any and health information) were grouped into two, to confirm the pattern; high and low use for age, education and socioeconomic groups by both household and personal ownership. In case of all three socio-demographic traits (age, education and socio-economic status), differences between the two groups was found to be statistically significant for both personal and household ownership (figure 5). Gender was also significant for personal ownership but was not for household ownership.

Figure 5: Proportion of people for high and low use of devices for electronic use of health services and/or information by age, education and socio-economic status for both personal (n=471) and household (n=771) ownership of devices.

	Personal ownership (n=471)			Household ownership (n=771)		
Age	Number	Health Information seeking	p-value	Number	Health Information seeking	p-value
High use	291	9.97	0.003	440	9.09	0.000
Low use	180	2.78		331	2.11	
Education						
High use	228	10.96	0.002	301	10.3	0.000
Low use	243	3.7		470	3.4	
Asset						

High use	217	12.44	0.000	308	10.71	0.000
Low use	254	2.76		463	3.02	



Based on the findings, I can say that being young and elderly, more education and people with better socio-economic status have used electronic devices more for health services and/or information. And role of gender was more (more male use compared to female) for use of household devices compared to personal devices. However, this does not explain despite high ownership and high use of electronic devices for seeking information, why the use of electronic devices is so low for seeking health services and/or information? Based on the finding, I tried to make a model to explain the reason considering use of devices for health services and/or information as an independent variable and age, education and SES for both and gender for personal ownership. The logistic regression model failed to indicate the odds to signify the influence of these socio-demographic characteristics. That's because there was very low use, hence the cells couldn't satisfy the condition of the model. As a result, the relation of socio-demographic characteristics (based on the found pattern) with the use of devices for health services and/or information was explored through qualitative method.

#### Socio-demographic barriers of the use of electronic devices for health services and/or information

During FGD, participants were very clear and open about their reasons for not using electronic devices to seek healthcare or relevant information. However, almost all of them mentioned to have accessed some form of electronic information at some point, mostly through mobile phones. And the most popular form was making calls to any office (i.e. local agriculture office) and ask for information (i.e. availability of fertilizer or price of crops etc.); more of a conversation. One of the male students mentioned, *“eHealth word-ta ajke ami prothom sunlam. Khokono amader keo boleni je e vabe shastho shomporke information paoa jai. Tobe kokhono kokhono to amra ei office shei office-e phone kore eita sheita jante chai-e. Eibhabe shohje information pawa jay.”* (I heard the word eHealth first time today. Noone told us that one can get health related information in this way. But sometimes we call some office to know about things. In this way we can get information easily). It was same for everyone, irrespective of age, education and SES variation. The female college students had a slightly different view. They often preferred to call their friends and/or family to look for information. As one said among the group; *“Mobile use kore amra bibhinno bishoye kotha boli. Kichu jante hole bondhu ba boro kauke phone dei. Kintu aj porjonto eHealth niye kotha hoise bole mone pore na ba amra oitate obbhosto-o na.”* (We use mobile phones to talk about many things. If we need to know about something, we call our friends or elder. But can’t remember if we have ever talked about eHealth. We are also not used in talking about that). Considering this, *none of them have ever used the same for seeking health* may not be entirely true and this is the trickiest part. All most all of them have asked someone in the family or someone who has relevant medical/health knowledge (i.e. doctor, a peer with experience of seeking help for similar health need). During FGD, one of the participants, a housewife, mentioned that, *“Amer kokhono proyojon porle ami amar chachato bonre phone dei. Tar shathe ek daktar er porichoy ase. She tar kase shuina amare Janay. Echara tuk tak bishoy ma-re phone dei. eHealth er bishoy eamar poribarar keu jane na.”* (When I need information about health, I call my cousin. She knows a doctor. After consulting with him, she suggests me. Besides for the little ailments, I usually call my mom). When explained about seeking health information electronically as per the study concept, none mentioned of using their devices for that. As per another housewife, a participant in the FGD, *“Amra mukkhhu manush, eto shob bhujhina. Ar eta to proyojon porena. Call asle shudu dhorte pari, eta chara ar kichu parina.”* (We are rural ignorant people, we don’t



understand all these. Besides we don't need this (eHealth), it's enough if you can receive and make a call on a phone). The FGD findings can be summarised into following reasons;

- i. Awareness of eHealth services: When asked, the first reason mentioned by the participants was, *not being aware of eHealth services*. It was surprising given so much ongoing marketing activities of different Telco in the country. To stir up the discussion, one of the campaign of GrameenPhone (one of the Telco) called '789' was mentioned. While the younger age groups and students were more aware of 789, the rest lacked in clear understanding of what it was. Being heard and seen the marketing, people knew that it was about calling doctors over mobile phones but did not know how it work. As a result, many shared a common fear that calling these services will require more money and time. One of the male student mentioned during discussion; *"eHealth asole ki sheta amra akebare Janina. Eta amader kache notun ekta poddhoti mone hoe. 789-e shunsi je tara medical sheba dey. Kintu kivabe call dite hoi, ki bolte hoy, koto shomoy lage ta amra Janina."* (Actually, we know nothing about eHealth. This sounds like a new system of receiving healthcare. I have heard about 789 that they provide health services, but I don't know how to call them or what to tell or how long does it take). Other than the Telco run services, nobody mentioned about the other eHealth services; i.e. government and private providers.

While discussing the issue of awareness further, main reason of not being aware mentioned by the participants was frequent marketing campaigns of the mobile phone companies. In Mirzapur, there is abundance of kiosks/outlets where various mobile phone services are found, ranging from a country tea stall to somewhat larger grocery stores and medicine stores located in the *bazaar* (local market). These kiosks often found to be displaying colourful banners and posters informing about different services; i.e. mobile top-up, SIM card packages etc. Since so much marketing is going on in just a small shop and everywhere else (including media), people find it very difficult to focus on information related to eHealth services. As one of the male participants mentioned;

*"Ei dhoroner shasthya beboztha niye amader ashe pashe tamon kono advertisement ba kormoshuchi nai je ata somporke amar janbo. Eta jodi amra na jani tahole kivabe janbojje"*

*erokhom akta sheba ache?"* (There are no advertisement or activity around us that such type of health service (eHealth) is available. If we don't know, how would we be able to know that such services exist).

Compared to the rest of the groups, the younger and educated groups were found to be more aware regarding the existence of eHealth services run by the Telco. However, most of them did not had clear understanding of how these services can be used especially regarding the cost and time. In addition, social media based eHealth services were mentioned by some students. Almost all of them had social media account (Facebook) and had seen various adverts and information related to health. While most of such information were related to diet, healthy life style and beauty tips, a few mentioned of seeing posts on more serious issues like cancer, HIV and AIDS etc. However, nobody mentioned of using or engaging with such posts. One of the female student participants mentioned that;

*"Amra e bisoy obogoto na je eta ki ebong etate kivabe shastho information paoa jay, kinba eta kivabe kaj kore, koto taka ney eishob... Amra motamuti sabai Facebook use kore ba deksi. Majhe majhe shekhane ami roopchorcha ba khaddo khawa niye pust pai, kokhono cancer niye jante pari. Kintu eHelath ki sheta Janine. Amer mone hoy Facebook er moto eta shohoz korte hobe, tahole shabai obogoto hobe."* (We don't know what it is (eHealth) and how do we get health information through this. Or how does it work, how much money it takes etc. Most of us use Facebook or have seen it. I sometimes get post related to beauty or diet tips. Sometimes get information on cancer. But I don't know what eHealth is. I think if eHealth can be made as easy as Facebook, then everyone will come to know about it).

- ii. Personal comfort and acceptance: Almost everyone in the FGD groups mentioned that they are not comfortable in using eHealth services. This means, the groups lacked in knowledge about such services; who provides treatment, how to speak about personal issues and illnesses etc. Thus, eHealth services were somewhat unacceptable to people. This led to overwhelming fear and shame indicating concern for privacy. This was more common with the women groups. During FGD, one of the housewives mentioned;

*"Amra geramer oshikkhito manush. Amra jare chini na, dekhi na, tar dhare kono osukher kotha mobile dia bolmu kemne? Eta to lojjay-e bolte parbo na."* (We are rural ignorant people. How can we talk about illnesses to someone, whom we don't know or see? We are shy and just can't do it).

In addition, the middle age group mentioned about their distrust regarding the accuracy and quality of eHealth services. To them, face to face consultation is preferred. When probed further, the reason was found to be underlying healthcare seeking behaviour that is being practiced for generations in the community. Almost everyone mentioned that during healthcare need, they prefer to discuss it with their friends and family (social network), then with the local drug sellers and/or village doctor and lastly with more formal ones i.e. medical doctors and specialists. eHealth services do not fit in this model and that's why is not acceptable. One of the participants from this group mentioned;

*"Amader kono kichu shastho somossha hole, sorasori amder barir pashe pharmacy ache shekhane jai. Tate kam na hoile medical-e jay."* (If we have any health issue, we go the nearby pharmacy. If the problem persists, we prefer to go directly to the hospital).

The younger and educated groups differed with the rest of the participants. To them discomfort and unacceptability was more related to cost and time. Most of them thought that availing eHealth service may incur more cost and consume much of their talk time and data (internet). However, they were found to be somewhat positive regarding the confidentiality and privacy especially for the intimate healthcare need. One of the young male participants mentioned that;

*"Online ba call centre-e shastho sheba Kemon hobe sheta bola mushkil kintu etete to onek taka kata jabe mobile theke. Internet er dam onek, abar talk time-er o dam beshi. Tobe eita thik, phone koir a onek kichu shohoje bola jay, jemon porichito manushre bola jay na."* (It is difficult to know that quality of health services on internet or call centre. But it takes money which comes out of mobile account. Both internet and talk time are expensive. But it's true that you can say many things over phone which sometimes is difficult with a person whom you know).

- iii. Literacy and skill: Except for the younger and educated groups, rests think using eHealth services requires specific skill set and literacy. To them this requires enough understanding of medical signs and symptoms, English proficiency and technical skill to use the device correctly. Even calling a health call centres requires pressing specific buttons for navigation or texting requires a combination of numeric and alphabetical typing. For internet based services, nobody had specific idea of what it may need, but everybody unanimously thinks browsing require literacy in English and technical skill to set up one's device for internet use. Also,

almost all think that it requires a computer and/or smartphone to avail eHealth services. One of the participants from middle age group mentioned;

*"Eigula chotoder jonno shohoj, ora mobile ba computer diya onek kichu korte pare. Amra eigula parina abar shomoy-o nai. Tachara eigular jonno jei rokom gyaan thakte hoy iota oder ase. Tai amar mobile-e internet o nai."* (Its easier for the young people, they know how to do this using their mobile phone or computer. They also have the skills to do that. That's why I don't have internet in my phone).

The younger and educated groups did not mentioned about this as a reason except few. Participants who mentioned mainly stated language (English) as a barrier to use eHealth services with their devices. As one mentioned; *"Amra Bangalee, amder bhasha Bangla. Amra ashole Engrajee eto bujhina ar etai amader main samossha."* (We are Bengali and Bangla is our language. We are not very good at English that is our main problem). Participants also mentioned that they have asked or have heard about someone else who was asked the members of their household and extended family to seek eHealth services (especially information) on their behalf. However, they never did it by themselves. The elderly groups also think if they will ever use eHealth services, they will probably ask the younger in the household to do it on their behalf. One of the participants from the elderly group mentioned that;

*"Amader onek boyosh hoye gache. Eta amra tai eto bujhi na. Kono rokome call asle dhorte pari. Kokhono kokhono message ashelo thik moto dekhite parina. Tokhon barir onnoder kache nia jai. Ar kichu jante hoileo tai kori."* (We are old and that's why know don't know much about this. We can only receive and make call. Sometimes if someone sends SMS, we take the phone to the other members of the house to find out what it is. We do the same when we want to know something about the phone).

- iv. Proximity to health centre: This was unique to places like Mirzapur, who has a functional Upazila (Sub-district) Health Complex and a philanthropic hospital (Kumudini) with effective communication. Considering the presence of these two hospitals, for any medical emergencies (even during the odd hours), people end up visiting those hospitals instead of calling a call centre or seeking other eHealth services. It also came up during the discussion and most of them agreed that it can be one of the reasons for them not to be much aware of eHealth services that are currently available and accessible through their devices. One of the participants from the middle-aged group mentioned;

*“Amader barir pashe hashpatal, amader kono oshukh-bishuk hoile amra kono kichu na vabe douray jai hashpatal-e”* (The hospital is just beside our house, if we need healthcare, we run to that hospital).

## Discussion and Conclusion

Globally eHealth and mHealth is being appreciated as a potential tool to address gaps in healthcare services regarding access, coverage and equity especially in the context of low and middle income country (Beratarrechea et al., 2013). The main aim of this paper is to understand the relation between use of eHealth services and socio-demographic characteristic of a low and middle-income country (LMIC), in this case semi-urban Bangladesh. Hence the core of this chapter is to identify socio-demographic group(s) with whom eHealth services are most popular. The general research questions that has been addressed is; in the context of rapid growth of ICT, how socio-demographic factors are influencing access and use of eHealth services. Keeping the complexity regarding the concept of access aside, this chapter has taken a more simpler and loose approach towards both; anyone who has mobile phone and/or computer has access to eHealth. The use is if people have used their devices to access eHealth services (health service and/or information). Keeping this mind, age, sex, education and SES was used to see which group(s) has(have) used their devices to access eHealth services; equity measure. Considering the complexity of the question, mixed-method approach was used; a population survey and FGD. The sole purpose of mixing the method was to triangulation and gain deeper understanding of the survey findings.

In this paper, access to eHealth was conceptualized based on ownership of devices and availability of mobile-cellular network. The idea was derived from the rapid growth of ICT and how it is claimed to have been able to touch/change people's lives. In Bangladesh, there is abundance of eHealth services available through internet, SMS, social and voice call. So, in theory mobile phone owners should be able to access eHealth services when in need. In addition, availability of all mobile-cellular networks was also considered as a potential contextual factor that can hinder access. Findings shows that Mirzapur, a semi-urban population in Bangladesh, has high access to eHealth services. The personal

ownership (having own device) was about 55% and household ownership was about 90%; in both cases, mobile phone was predominant. This was in contrast with the existing work. Some of the previous works have reported lower ownership (BBS, 2011; GSMA, 2014; Khatun et al., 2014; Tran et al., 2015) with an upward trend. Considering the data of this paper was collected later than those, the findings seems plausible. Besides, Mirzapur, being a semi-urban context, has higher access to technology and resources compared to rural Bangladesh and this paper is among the first reporting mobile phone and/or laptop ownership of a semi-urban locality in Bangladesh. Also, Mirzapur has subscribers of all six network providers (Telco) in the country (BTRC, 2017; GSMA, 2014). Thus, presence of all the network thus provided the opportunity to include everyone; if there is any internet, SMS and/or call centre based health services available, people could access them (given that they are financially acceptable to the community and/or in any other respect).

The survey also indicated that use of electronic devices to seek (or exchange) information or services (in this case largely through mobile phones) is known to people of Mirzapur. All those who owned devices at home were found to be aware of seeking (and/or exchange) information electronically and 89% of them have sought (and/or exchanged). Everyone, who had a personal device did so. When looked at by socio-demographic characteristics (i.e. age, sex, education and SES) proportionally, younger age groups, more educated ones and male owners showed more use compared to older age groups, less educated ones and female. SES categorization showed mixed patterns but at the extreme ends, poorest were found to be least users while the richest were the highest. This was in line with a recent paper which reported the same trend in a rural context (Khatun et al., 2015). This finding also supports the discussion on digital divide which reports greater uptake of ICT devices among the males, rich and younger age group (Acılar, 2011; GSMA, 2015; GSMA & Cherie Blair Foundation for Women, 2010; ITU, 2015; Shah & Jaisinghani, 2014; Shih, Kraemer, & Dedrick, 2008). But these differences were very subtle, lowest being ~80% (with an exception of eldest which was ~65%) while highest being ~100%. Thus, sociodemographic characteristics was not found to be significant. We think the reasons for this probably is high use of electronic devices and related awareness. In the survey, the question was designed as; “are you aware that information can be seek and/or exchanged electronically?” In Bangladesh, SIM card selling and mobile top-up is a very

popular business, be that urban, rural or peri-urban areas. Even the informal tea-stalls have such products. Also, there are regular adverts on national electronic and print media promoting attractive packages and benefits of mobile phones for easier and effective communication. And when it comes to seek or exchange information, it can be anything ranging from day to day chat to difficult and urgent inquiry. In a population where there is high mobile ownership, it is not surprising that people will call their peers or any person of interest (i.e. officer at the local agriculture office) to chat and/or seek information. In Mirzapur, 99% of those who sought information did it by making voice call, followed by SMS (35%) and internet (4%). And that's why such high usage and awareness across various socio-demographic groups has been found in the survey. Therefore, like global trend, it can be safely conclude that digital divide related to access to use of mobile phone and/or computer is narrowing in Bangladesh (Aker & Mbiti, 2010; GSMA, 2014).

However, use of devices for eHealth services was found to be very low; 6.4% for the household owners and 7.2% for the personal owners. Khatun et al., 2014 suggested a bit lower in the context of rural Bangladesh; 2%. The differences in access to technology and resouires between rural and semi-urban context may be reason for theis discrepancy. With such low use, it was not possible to see the statistical significance. However, the pattern suggested that for both type of ownership young and elderly, more education and people with better socio-economic status have used electronic devices more for health services and/or information. One of the reasons for such low use may be because the use of devices for eHealth in this survey excluded information seeking/exchange through casual conversation among the peers and kin. For voice call, it was restricted to calling a doctor or any other form of healthcare provider. It is important to recognize that, in a context like Bangladesh, a large part of healthcare seeking involves advice and opinion from the family, relatives, friends and other acquaintances through conversation (Shahabuddin et al., 2017) (MORE). Lack of reflection of the general healthcare seeking model of the community in eHealth services was also mentioned during FGD. Therefore, more discussion is needed weather to consider healthcare seeking through electronic means when exploring access and use of eHealth especially in a context like Bangladesh.

The other reasons mentioned during FGD were lack of skill and literacy, concern about cost and money, not being aware of the eHealth services and proximity to health centre. A paper on rural Bangladesh also mentioned low technical skill and awareness of availability of mHealth services (Khatun et al., 2014; Khatun et al., 2015). While existing evidences have documented the skill to use eHealth services regarding mobile phone to the ability around SMS and internet use, this paper is inclined to argue that skill and literacy associated with the use of electronic means to access and use healthcare including information is not merely the technical skill only; skill related to hardware and software operation. In the survey elderly were found to be using their devices for eHealth services. It was explained in the FGD that often elderly are dependent on using their devices on the other household members, typically the younger members of the family. Also, literacy and skill wise, younger groups are more comfortable for using electronic devices; mobile phones. It should bear in mind that seeking eHealth is not only pressing the keys but also composing words around the use. Evidence suggests that young age groups and students show more skill towards use of internet and other digital platforms (Islam & Grönlund, 2011; Ono & Zavodny, 2003). Thus, the skill and literacy associated to the use of electronic means for seeking healthcare and/or information requires more understanding considering the current knowledge gap. This can further strengthen the uptake of ICT for health in Bangladesh and related context.

From the equity point of view, an important socio-demographic characteristic was not found to be of much importance that is gender. Globally gender is one of the core issues for digital divide (Fallows, 2005; Faulkner, 2001; Hilbert, 2011; Puente, 2008). But this paper did not find that. Perhaps if there was enough use, it would have found significant. Findings from this paper suggest that eHealth services are more suited for the young and educated adults in Bangladesh. This makes the young and educated adults the change agent, an intermediary for maximum uptake of eHealth (Rogers, 2003; Scott, 2012). On the other hand, it also indicates that in the current form, it is more accessible to part of the community and the rest is either left out or are dependent on another segment of the population. Thus, making the rest of the population groups marginalised as in *information-poor*. Although the survey was unable to answer why a certain segment of the population was found to be more suited, but findings from the FGDs suggest that it is probably the skill



and literacy that makes them more suited for eHealth. At the same time, even for the young and educated adults, use was very low. Hence more exploration is needed to understand the skill and literacy needed to use electronic devices to access eHealth services. It is expected that once understood, this will not only help design and operate of eHealth services in Bangladesh and related context, but will also strengthen the ongoing movement around UHC and SDG by ensuring equitable access.

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## **Appendix 2: Conceptual framework and the indicators**

### **Concept 1: Strategic Vision**

- 1.1 Articulation of equity and accountability as an objective in the program's mission statement
- 1.2 Articulation of role of ICT applications in achieving overall health program goal
- 1.3 Presence of authorized entity/individual to lead the ICT based initiative
- 1.4 Clearly defined and documented expertise, roles, and responsibilities of the leadership

### **Concept 2: Participation**

- 2.1 Seeking and incorporating supply side users' input at different phase of the program
- 2.2 Seeking and incorporating demand side users' input at different phase of the program
- 2.3 Seeking and incorporating collaborative partners' input at different phase of the program
- 2.4 Seeking and incorporating policy makers' inputs at different phase of the program
- 2.5 Sex disaggregated analysis of the supply or demand side user inputs to identify any existing gender based differentials

### **Concept 3: Transparency**

- 3.1 Established mechanism to make guidelines and information on the initiative available to the public (general public, collaborative partners, policy makers, implementers, end users)
- 3.2 Established mechanism to make guidelines and information on the initiative available to the associated stakeholders in accordance to "Right to Information Act"
- 3.3 Established mechanism to make guidelines and information on the initiative available to the initiative staff
- 3.4 Established mechanism to make guidelines and information on the initiative available to people internal to the initiative
- 3.5 A process for regular updating of project information for sharing with internal and external audiences
- 3.6 Informing the general public about the initiative's collaborative partners and their interests

### **Concept 4: Responsiveness**

- 4.1 Assessment of local need of the ICT based intervention before designing
- 4.2 Assessment of the local demand of the ICT based intervention before designing
- 4.3 Staff training to ensure client satisfaction with the program(i.e-autonomy , respect, dignity, communication, timeliness)
- 4.4 Established mechanism to assess client satisfaction
- 4.5 Established mechanism to initiate next level of action around the generated data

- 4.6 Established process of connecting the client to other/next level service provider/facility (internal /external) as per the need of the client

### **Concept 5: Equity**

- 5.1 Seeking participation of disadvantaged users during the design and development of the content
- 5.2 Consideration of disadvantaged user groups' access and comfort to the technological platforms (hardware, software) and infrastructure (network, power) during the design and delivery
- 5.3 Existing strategies to overcome barriers to utilization faced by disadvantaged users
- 5.4 Generation of service utilization data disaggregated for Place of residence (urban /rural/Race/ethnicity/Occupation/Gender/Education/Socio-economic status by the system)
- 5.5 Consideration of any gender related issues that might influence the uptake of the intervention during the design and delivery phase. (Barriers to access, power relation, norms, values, roles)

### **Concept 6: Ethics**

- 6.1 Follow ethical standards from any established body
- 6.2 Regular staff monitoring for breach in ethical conduct

### **Concept 7: Information Governance**

- 7.1 Established separate body (individual /team) to monitor the information governance in the initiative
- 7.2 Training of staff who handles data on information governance
- 7.3 Generation of summary statistics for decision makers to improve the service delivery
- 7.4 Consideration of any gender differentials that might influence health worker's capacity to use the ICT application during the design and delivery phase, if the eHealth intervention involves routine data collection using ICT tools by health workers

### **Concept 8: Rule of Law**

- 8.1 Abiding applicable law of the land for setting up the initiative
- 8.2 Existing articulated guideline to ensure participation of interested parties at different phases of the program
- 8.3 Existing articulated guideline for providing program related information to interested parties
- 8.4 Existing articulated guideline to ensure responsiveness of the program and its staff towards its clients
- 8.5 Existing articulated guideline to address noncompliance to established rules/guidelines

### **Concept 9: Performance**

9.1 Existing indicators to measure effectiveness, quality and efficiency of the ICT based initiative

9.2 Regular measurement of the indicators

9.3 Use of indicators to initiate actions

9.4 Sex and age disaggregated data collection and analysis of performance indicators

**Concept 10: Sustainability/ Viability**

10.1 Existing financial sustainability plan for the system/initiative

10.2 Articulated scale up /health system integration/business plan for the initiative

10.3 System's interoperability with the system it will scale up to

10.4 Existing articulated succession plan for the present leadership

### Appendix 3 : Policy matrix

Matrix showing domain addressed by ICT for Health related policies

Matrix showing domain addressed by ICT for Health related policies										
				Support for ICT for Health						Further details
	Name	Type and level	Source and Year	Legislation, policy, compliance	Leadership and Governance	Services and applications	Standards and interoperability	Work force	Infrastructure and budget	
1.	The National ICT Policy	Generic and high level	Ministry of Science and ICT 2009	Cross cutting policy support for ICT in health.	×	Under the 4 strategic themes the 20 actions items it describes the desired services and applications.	×	Training of field level works in using ICT tool mentioned as medium term deliverables.	×	<p>The policy has 1 vision, 10 objectives, 56 strategic themes and 306 action items. ICT policy is a cross cutting policy document which gives an outline related to use of ICTs in 10 sectors of government including health.</p> <p>In health sector the use of ICTs is explained under 4 themes. There are 20 action items to achieve these 4 strategic themes through short (2013), medium (2015) and long term (2018) deliverables. ICT applications are envisioned through creating:</p> <ol style="list-style-type: none"> <li>1. Database of government health facilities, equipment, infrastructures, properties, health HR.</li> <li>2. GIS for emerging disease surveillance and health sector planning.</li> <li>3. HMIS software creation and capacity building</li> <li>4. Using mobile for communication, monitoring of field workers.</li> <li>5. Use of ICT and telemedicine for MCH, FP and website creation.</li> <li>6. Helpline and telemedicine till subdistrict level.</li> <li>7. Communication network and mobile health unit with electronic data and image sharing.</li> <li>8. Video conferencing.</li> <li>9. ICT for surgical treatment and education, pathological observation and pharmaceutical quality control.</li> </ol>



										<p>10. ICT for health HR capacity development, information exchange, call centres and other innovative approaches.</p> <p>In different approaches implementation of ICTs will involve NGOs and private sector. There is special mention of providing healthcare through technology for poor and hard to reach population.</p> <p><i>Interestingly for quality care there are no specific action themes set for implementation. There is no mention of privacy and confidentiality of information collected and there is no mention of need for taking user perspective or creating a responsive health system. Transparency is mentioned as an expected result of database creation. Many of the action items are at pilot stage. As a generic policy guideline it describes how and where ICT applications can be brought into the present health system to make it more equitable to all citizens. However it doesn't mention improvement of accountability, responsiveness, transparency of the HS as a result of introduction of ICT application in public health system.</i></p>
2.	Consumer Right Protection Act 2009	Generic and high level	2009	Legislation	×	×	×	×	×	<p>Generic legislation to preserve rights of consumers. Its scope includes all paid services including health. Health has been listed under “services”. The legislation describes in generic terms anti consumers practices related to selling goods, services, medicines, food. This legislation specifies the punishments for anti-</p>

										<p>consumer practices. Although health is listed under services and not described explicitly but it serves as a good primary legislative document which clearly articulates both monetary and criminal punishment for anti-consumer practices in providing paid services. Mandatory accountability measures for service providers (price listings) are described in relation to punishable anti-consumer practices.</p> <p><i>Free of cost services are excluded from this scope of this act. Health is generally listed under definition of services but its scope is not clearly described unlike products such as medicines. eHealth and mHealth or health service provided free of cost in a digital environment is not mentioned anywhere. Responsiveness is not addressed at all. Privacy and confidentiality of the data collected is not addressed as well.</i></p>
3.	Right to Information Act (RTI) 2009	Generic and high level	Bangladesh Gazette 2009	Legislation	×	×	×	×	×	<p>This is generic legislation to preserve citizen's right to access information and describes rules, procedure for ensuring RTI.</p> <p><i>The legislation does not cover non licensed providers and those with no contracts with government or foreign donors. It does not include individual service providers and only addresses organizations. Health data/report is not mentioned in the definition of "information". There is no explicit mention about right to access to health related data/information, health records and their preservation and publication. There is no set boundary regarding collecting,</i></p>

										<i>preserving and sharing health related data.</i>
4.	Sixth Five Year Plan Part 2 Sectoral strategies, programs and policies	Generic and high level	Planning Commission, Ministry of Planning 2011	Broad strategy road map for the whole country	×	×	×	×	×	<p>It is national development plan for 2011-2016 period and the health sector plan is described as Health Population Nutrition Sector Development Program (HPNSDP). The document identifies the inequitable health conditions and health care consumption among different groups as major challenges. This articulates in generic terms the utilization of ICT for achieving the highest standard of health for every citizen based on core values of equity and ethics. ICT in health care has been taken up as a strategy to realize vision 2021 in health sector. Under its public health service delivery strategy, telemedicine and eHealth are supposed to ensure referral and specialist care for remote and disadvantaged population only. <i>Use of ICT to tackle other issues under public health service delivery strategy is not discussed.</i> It also stresses on increasing the number of women in both supply and demand side of eHealth. Telemedicine and eHPN is also a strategy to strengthen health inputs by connecting facilities, data generation and evidence based decision making and audio visual conferencing using mobile technology for providing care.</p> <p><i>The focus is on few application of eHealth like video conferencing, telemedicine, HIS. But the document fails to capture different use of ICT for strengthening wider public service delivery capacity, accountability and governance. There are no specific mention of using ICTs to address the challenges of</i></p>

										<i>transparency, good governance and responsiveness of the public sector health services.</i>
5.	National health Policy 2011	Generic and high level	Ministry of Health and Family Welfare, Government of Peoples' Republic of Bangladesh 2011	Generic policy guideline articulating country's general health goals and ways to achieve them	×	×	×	×	×	<p>Ensuring optimum use of ICT for overall management of health sector has been articulated as a goal of the health policy. Innovative use of ICT and eHealth and telemedicine are mentioned as ways to ensure quality health care for all citizens. The policy described health workforce's lack of skills and the apathy to use ICT tools and deficiency of infrastructural support as main challenges to fully realize the potential of ICT in Health. The policy identified three main challenges in health care delivery (supply side). Two of the challenges were weak governance and suboptimal quality of the services. The third was resource constraints.</p> <p>Creating an integrated management information system and computer based communication system to formulate work plan, implementation, monitoring are mentioned as broad strategies.</p> <p><i>The policy doesn't articulate use of ICT in mitigating the described demand and supply side challenges. The potential of ICT is recognized in the policy but it does not recognize its role in mitigating health challenges, improvement of quality of care or improving state of equity and accountability of the system.</i></p>
6.	Health Informatics Standards & Data Structures	Low level and operational	Ministry of Health and Family Welfare, Government	×	×	×	Data standards	×	×	<p>Currently in draft version. It describes creation of eHealth National Oversight Body implementing the standard in both public and private sector. It provides</p>

	e for Bangladesh (Version 1.0)		ment of Peoples' Republic of Bangladesh, 2012							technical guidance for data structuring, coding, migration of existing database, creation of different registries, interoperability standards. Privacy, confidentiality, security standard for data are not covered in it.
7.	Perspective Plan of Bangladesh 2010-2021	High level and generic	General Economics Division Planning Commission Government of the People's Republic of Bangladesh 2012	Vision statement	×	×	×	×	×	The document is an articulated generic policy paper sketching an ideal Bangladesh in 2021 and the sectorial strategies to achieve the vision.
8.	Health Population and Nutrition Sector Development Program (HPNSDP) 2011-2016	Mid level and implementation	Ministry of Health and Family Welfare, Government of Peoples' Republic of Bangladesh 2011	Strategic direction given on how ICTs will be used in the health sector	×	Few ehealth services are piloted	×	×	Budget allocation	3% (664.05 Crore tk) of the total HPNSDP budget has been earmarked for eHealth and HIS. A separate operational plan for HIS and eHealth has been formulated under HPNSDP. Strengthening of the HS will be through revamping. eHealth and medical biotechnology have been described as two components of support service delivery. The strategy document also stresses upon mainstreaming GEV (Gender, Equity, Voice) in all sector wise components, operational plan, objective's, indicators with adequate budgetary allocation for this and strengthening GNSP (Gender, NGO, Stakeholder Participation) unit as focal point and aligning it other GoB functionalities. The document also describes the main legislations and regulatory activities under MoHFW. <i>Although there is mentions of inadequate legal framework to maintain the quality of</i>

										<i>services of NGO and private health care providers' specific guidelines of how this should be done is not highlighted. How can ICTs help mainstream voice, equity in HS is not addressed and how eHealth and HIS be made accountable is also not discussed.</i>
9.	HIS and ehealth OP (Operational Plan) under HPNSDP	Low level and operational	Ministry of Health and Family Welfare, Government of Peoples' Republic of Bangladesh, 2012	Detailed strategic plan of HIS and eHealth	×	√	×	×	√	<p>There are 37 deliverables of MoHFW under the National ICT policy described in this OP. The policy provides micro budget and, logistics for implementing the HIS and eHealth OP. It gives relevant result framework (RFW) and OP level indicators to measure output and outcome.</p> <p><i>The indicators listed are mostly focused on HIS. In terms of eHealth, mobile health service, telemedicine and video conferencing are mentioned. The indicators are dedicated to supply side. There are no mentions of how the demand side information collected will be used for decision making There are no demand side indicators for equity and accountability. There are no mentions of increasing responsiveness, effectiveness of the systems using ICTs.</i></p>

#### Appendix 4 : Health informatics short course content

Date	Topic	Method	Faculty/Facilitator/ Resource Person
<b>Day 1 Sunday; December 07, 2014</b>			
9:00-9:30	Registration and welcome speech		
9:30-10:30	Introduction and course outline. Expectations from the course	Interactive exchange	
10.00-10.30	Pretest		
10:30- 11:00	<b>Tea/coffee break</b>		
11:00-11:30	Informatics in health care sector in Bangladesh	Lecture	Nazrul Haider
11:30-12:00	Introduction to health informatics: definition, scope, challenges, and its intended contribution in health care.	Lecture, and interactive exchange	Badal Dhar
This session will set the background of using informatics in health care. Participants will be provided with an understanding of the area where health informatics is working and what health informatics is trying to provide in health care.			
12:00-12:20	Information regarding Bangladesh related to health informatics	Lecture	Badal Dhar
Some facts from “Health Information System Assessment: Bangladesh Country Report” will be discussed.			
12:20-1:00	Evidence based care and challenges for health system in providing evidence based care.	Lecture	Badal Dhar
Discussion will focus on the extent of information and evidence is used in health care practice. Participants will gain understanding of evidence-based medicine that is aiming to increase the quality of health care service.			
1:00-1:45 pm	<b>Lunch break</b>		
1:45-2:15	Surveillance and use of information in surveillance activity. SARS story in Canada.	Lecture	Badal Dhar
2:15-3:00	Overview on health information systems: EHR, EMR, other information systems and their use	Lecture	Badal Dhar

Date	Topic	Method	Faculty/Facilitator/ Resource Person
	Information system in Bangladesh (Health Metrics Network Report)		
3:00-3:30	Discussion on Bangladesh Country Report	Interactive discussion	
<p>In this session discussion will be on different sources of information and evidence. Participants will gain understanding on electronic health records, electronic medical records, laboratory information systems etc. This discussion will be followed by some information how some other countries are planning their health information systems. And there would be some discussion on what is the status of Bangladesh from Health Metrics Report.</p> <p>Ontario SARS story will be discussed to show the importance of Information in public health surveillance activity.</p>			
3:30-3:45	Tea Break		
This session will introduce the challenges in implementing these information systems.			
3:45-4:00	Introduction to GIS and its use. Example: HealthMap, an outbreak alert system, and its technology.	Lecture	Badal Dhar
4:00-4:30	Explore HealthMap	Online activity	
Short introduction on GIS.			
4:30-5:00	Syndromic surveillance/ aberrancy detection	Lecture	Badal Dhar
There would be discussion on syndromic surveillance and some online tool, and their technology			
<b>Day 2, Monday; December 08, 2014</b>			
9:00-9:30	Recap of previous day's sessions	Interactive discussion	Badal Dhar
9:30-10:45	<u><b>Health care data sources and integration</b></u> <ol style="list-style-type: none"> <li>Process of data integration and its different form</li> <li>Registries and their use in health care.</li> <li>Problems in data integration</li> <li>Standards and codes required in data integration</li> </ol>	Lecture	Badal Dhar
<p>Participant will learn how data from different systems and different sources can be integrated. Requirement of code and standard in health care data will be discussed.</p>			



Date	Topic	Method	Faculty/Facilitator/ Resource Person
10:45-11:00	<b>Tea/coffee break</b>		
11:00-12:30	<b><u>Health care data integration: standards</u></b> a. Code and standards: ICD-10 b. ICD-10 Explore b. implementing ICD-10 by ICDDR,B c. Use of integrated data: Public Health Ontario Snapshot: an example of benefit of integrated data (continue after lunch if required)	Lecture and (interactive, internet)	Badal Dhar  Dr. Iqbal
Participants will learn about standards and codes, especially ICD code, being used to solve the problems in data integration and will also learn the benefits of using these standards. Exploration of an online interactive public health indicator tool using internet.			
12:30-1:30	<b>Lunch break</b>		
1:30-2:30	<b><u>Health care data integration: standards</u></b> a. Interoperability b. Code and standards: HL7, CDA . Use of HL7 in syndromic surveillance and other health care data. b. Other codes, standards and interoperability: SNOMED, UMLS	Lecture and internet	Badal Dhar
There will be discussion on vocabulary, coding, and interoperability, UMLS, SNOMED, and their contribution in data integration and interoperability.			
2:30-3:00	<b>Tea/coffee break</b>		
3:00-3:30	a. Code, standards and interoperability: SNOMED, UMLS (contd.)	Lecture	Badal Dhar
3:30-4:00	Barriers in implementation of EHR/EMR and, Experience of EMR implementation in other countries (Infoway in Canada)  Interactive discussion: barriers in Bangladesh	Lecture and Interactive discussion	Badal Dhar
4:00-4:30	a. Implementing standards and codes in health data in Canada. (CIHI, and Infoway)	Lecture	Badal Dhar

Date	Topic	Method	Faculty/Facilitator/ Resource Person
	b. What is Meaningful Use that is being used in some country		
This section will provide some understanding on how an organized effort can play a positive role in providing guidance and support in implementing standards and codes.			
4:30-5:00	Hands on experience on exploring ICD-10 and use of MeSH in PubMed	Demonstration and exercise.	
Usual barriers in implementing in EMR/EHR would be discussed. This would be followed by an interactive discussion what could be the barriers in implementing those technology in Bangladesh. An exercise: find ICD codes for some specific disease, using the resources in internet. And explore vocabulary in MeSH.			
<b>Day 3; December 09 2014</b>			
9:00-9:30	Recap of the previous day's session	Interactive discussion	Badal Dhar
9.30- 10.45	<b>Knowledge management in health care</b> <ol style="list-style-type: none"> <li>Knowledge and information,</li> <li>Health care knowledge management</li> <li>Different types of knowledge in health care and their source.</li> <li>Critical appraisal and CAT</li> <li>Social networking and CoP to capture tacit knowledge</li> </ol>	Lecture	Badal Dhar  Critical appraisal: Dr. G.C. Dhar
In this session participants will learn about knowledge in healthcare, how knowledge can be classified and how knowledge can be managed. How social networking can be used to manage knowledge will be discussed. Critical Appraisal and Critical Appraisal Topic, (CAT) an initiative some have taken to bring current to knowledge to practice would be discussed.			
10:45-11:00	<b>Tea/coffee break</b>		
11:00-11:30	Exploring an online diagnostic decision support system	Online interactive	
An online decision support system will be explored by the participants to have an understanding what is a clinical decision support system.			
11:30-12:30	<b>Expert systems and knowledge management</b> <ol style="list-style-type: none"> <li>Understanding of Expert systems, Knowledge based system, machine</li> </ol>	Lecture	Badal Dhar

Date	Topic	Method	Faculty/Facilitator/ Resource Person
	learning, supervised and unsupervised learning.		
Introduction to some terminology and concepts that are being used in knowledge management and in decision support system.			
12.30-1.30	Lunch		
1.30- 2.45	b. Classifiers. c. Decision support systems and rule based reasoning.	Lecture	Badal Dhar
In this session participants will learn about clinical decision support system (CDSS). Participants will have understanding how decision support systems, implemented in EMR, can support decision taken by the clinicians. Participants will also have understanding how this systems are trying to bring knowledge and evidence to the decision makers at point-of-care.			
2.45-3.00	<b>Tea/Coffee break</b>		
3:00-4:00	Case based and rule based reasoning.	Lecture	Badal Dhar
4:00-4:30	Clinical practice guide line, Care path and expert systems	Lecture	Badal Dhar
4.30 -5:00	Informatics in patient education and empowerment	Lecture	Badal Dhar
Discussion will cover understanding of case based and rule based systems that are being tried in CDSS. This section will also discuss clinical practice guidelines and clinical pathways and what kind of support CDSS can do here. This section will also discuss if CDSS can support patient education.			
<b>Day 4, December 10, 2014</b>			
9:00-9:30	Recap of the previous day's session	Interactive discussion	Badal Dhar
9.30-10.45	<b>Other issues related to health informatics</b> a. What is Ontology and its use in knowledge and information management?	Lecture and internet	Badal Dhar
Participants will learn about Ontology and how it is helping in vocabulary and knowledge management in different section of health care.			
10:45-11:00	<b>Tea/coffee break</b>		
11:00-12:00	a. Explore ontology, Example: Gene Ontology	interactive using internet	

Date	Topic	Method	Faculty/Facilitator/ Resource Person
12:00-12:30	a. Telehealth: a project that is providing health service in Ontario, Canada. (what can be done in Bangladesh: Interactive) b. Role of privacy and security in implementing health informatics	Lecture and interactive discussion	Badal Dhar
<p>Discussion will continue here with ontology and other related technology related to ontology. A successful system using ontology, Gene Ontology will be explored.</p> <p>An example of providing health service using telephone in Ontario will be discussed. Interactive discussion will be done, how far that type of system can benefit in Bangladesh.</p> <p>Privacy section will discuss the importance of privacy and security and how an infostructure can support implementation of informatics</p>			
12:30-1:30	<b>Lunch break</b>		
1:30-2:45	<b><u>Data mining and decision support</u></b> What is data mining, functions of data mining and process of data mining, pre-requisite of data mining?	Lecture	Badal Dhar
This discussion will educate participant on concept of data mining and process of data mining.			
2:45-3:00	<b>Tea/coffee break</b>		
3:00-4:00	Association rule and decision tree.	Lecture	Badal Dhar
Participants will learn how data mining may help in decision support system and how data mining can help discover knowledge from database. And participants will be provided some general understanding of association rule and decision tree.			
4:00-5:00	a. Revisit machine learning, classifiers, decision support system and data mining b. Open discussion on data mining activity	Lecture and interactive discussion	Badal Dhar
This section will provide understanding of combination of data mining algorithms with machine learning, expert systems and classifiers. HealthMap, Global Public Health Information Network will also be discussed to see if they are using any of these systems.			
<b>Day 5, December 11, 2014</b>			
9:00-9:30	Recap of previous day's session	Interactive discussion	Badal Dhar
9:30-10:45	<b><u>Hands on experience in data mining</u></b>	Interactive session and group work	

Date	Topic	Method	Faculty/Facilitator/ Resource Person
	Data mining exercise with a sample dataset		
10.45-11.00	<b>Tea break</b>		
11.00-12.30	Data mining exercise with a sample dataset (Continued)	Interactive session and group work	
12:30-1:30	<b>Course lunch</b>		
1:30-2:30	Describe individual experience on learning.	Interactive session	
2:30-3:00	<b>Tea/coffee break</b>		
3:00-3:30	Post test		
3.30-4.30	Wrapping up and certificate giving		

## Appendix 5: eHealth for Universal Health coverage course schedule

16<sup>th</sup> January – 19<sup>th</sup> January 2017

### Purpose and Goal

The course will help participants develop an understanding of role and scope of eHealth in realizing Bangladesh's UHC goals. It will instill a systematic way of identifying eHealth specific accountability and equity considerations among participants. This will enable them to critically analyze equity and accountability challenges during eHealth initiative design and implementation through a framework based approach, so eHealth can realize its potential as a transformative innovation and health system strengthening tool.

### Objective

Upon successful completion of the course, the participants should be:

1. Aware of the potential of eHealth as health system strengthening tool especially in the context of resource poor setting.
2. Able to critically analyze and understand the gaps and challenges in eHealth initiative implementation.
3. Develop an understanding of relevant equity and accountability issues for implementation of eHealth initiatives.
4. Understand and develop skill for using a framework based accountability and equity approach for better eHealth initiative design and implementation.

### Intended Audience

The intended audience for this course are

- Policy makers
- Strategic leaders of eHealth initiatives
- Senior level program managers of eHealth initiatives
- Technical experts
- Development partners
- Academicians

### Course schedule: Day 1: 16<sup>th</sup> January 2017 (Monday)

Date	Topic	Method	Proposed Faculty/ Resource Person
9.00-10.00	Registration		
10.00-11.00	Icebreaking, pretest, mapping expectation	Interactive Session	
11.00-11.30		Tea break	
11.30-12.00	eHealth – Global perspective	Presentation	Sabrina Rasheed icddr,b
12.00-12.30	eHealth- Bangladesh perspective	Presentation	Md. Abdul Hannan Khan Secretary and project Lead DHIS2

<b>12.30-13.30</b>	<b>Lunch Break</b>		
<b>13.30-14.00</b>	ICTs for health-Opportunities and Challenges	Presentation	Sabrina Rasheed icddr,b
<b>14.00- 15.00</b>	eHealth and UHC goals in Bangladesh	Presentation	Dr. M. Iqbal icddr, b
<b>15.00-15.15</b>	<b>Tea Break</b>		
<b>15.15-15.45</b>	Critical issues-How eHealth can help UHC goals?	Interactive session	Sabrina Rasheed, PhD & Dr. M. Iqbal icddr,b
<b>15.45-16.15</b>	Reflections of the day and planning for the next day		Facilitators

## Day 2: 17<sup>th</sup> January 2017 (Tuesday)

<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Proposed Faculty/ Resource Person</b>
<b>9:00- 9:30</b>	Recap of 1st day session	Presentation	Group 1
<b>Thematic area</b>	<b>Telemedicine</b>		
<b>09.30-09.45</b>	Case study1 : Doctor in Tab	Presentation	Rubayat Khan Jeeon
<b>09.45-10.00</b>	Q & A session		
<b>10:00-10:30</b>	<b>Tea Break</b>		
<b>10.30-10.45</b>	Case Study2: Robi telemedicine	Presentation	Maksud Hossain Robi Axiata
<b>10.45-11.00</b>	Q & A session		
<b>Thematic area</b>	<b>SMS based service</b>		
<b>11.00-11.15</b>	Case study3: Aponjon	Presentation	Dr. Fida Mehran & Tahsin I Sayeed Dnet
<b>11.15-11.30</b>	Q & A session		
<b>11:30- 13:00</b>	Group Work- Synthesis		
<b>13.00-14.00</b>	<b>Lunch Break</b>		
<b>14.00-14.30</b>	ICT and disease self-management	Recorded Presentation	Henry Lucas IDS, UK
<b>Thematic area</b>	<b>Web application-based service</b>		
<b>14.30-14.45</b>	Case study4: Critical Link		Rahat Hossain Critical Link
<b>14.45-15.00</b>	Q & A session		
<b>15.00-15.15</b>	<b>Tea break</b>		
<b>Thematic area</b>	<b>Health information system</b>		
<b>15.15-15.30</b>	Hospital automation (icddr, b)	Practical Demonstration	Dhaka Hospital Personnel



<b>15.30-15.45</b>	Q & A session
<b>15.45-16.00</b>	Group Work- Synthesis
<b>End of 2<sup>nd</sup> day session</b>	

**Day 3: 18<sup>th</sup> January 2017 (Monday)**

<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Proposed Faculty/ Resource Person</b>
<b>09:00-09:30</b>	Overview of technology acceptance models	Presentation	Dr. Fatema Khatun icddr,b
<b>Thematic area</b>	<b>Health information system</b>		
<b>09:30-10:00</b>	Case study 5 –Public HMIS	Presentation	Dr. A.S. M Sayem UNICEF
<b>10.00-10.15</b>	Q & A session		
<b>10.15-10.30</b>	<b>Tea break</b>		
<b>10.30-10.45</b>	Case study 6 –SIAPS	Presentation	Md. Golam Kibria MSH Bangladesh
<b>10.45-11.00</b>	Q & A session		
<b>11.00-12:30</b>	Group work- synthesis		Group members
<b>12.30-13.30</b>	<b>Lunch Break</b>		
<b>13.30-13.45</b>	Case study 7– BSMMU	Presentation	A.R Azimmul Hoque BSMMU
<b>13.45-14.00</b>	Q & A session		
<b>14.00-15.00</b>	Group Work - Synthesis		Group member
<b>15.00-15.15</b>	<b>Tea break</b>		
<b>15.15-15.45</b>	Group : Telemedicine		Group members
<b>15.45 -16.45</b>	Group: SMS + Web Application		Group members
<b>End of 3<sup>rd</sup> day session</b>			



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**Course Schedule: Day 4: 19<sup>th</sup> January 2017 (Thursday)**

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<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Proposed Faculty/ Resource Person</b>
<b>9:00-9:30</b>	Recap		Group 3
<b>09.30-10.00</b>	Thematic group-HIS	Presentation	Group members
<b>10:00-10:30</b>	Thematic group- Hospital automation	Presentation	Group members
<b>10.30-10.45</b>	<b>Tea break</b>		
<b>10.45-12.00</b>	Introduction to the Equity and Accountability Framework		Sabrina Rasheed, icddr,b
<b>12.00-12.30</b>	Feedback and Post test		
<b>12.30-1.30</b>	<b>Prayer and Lunch Break</b>		
<b>1.30-2.00</b>	Closing ceremony		DGHS Personnel

## Appendix 6: Case studies

### Analysis of the short course case studies based on the Framework

*Thematic area: Telemedicine*

#### Brief description of the project under consideration

The intervention connects underserved populations with registered doctors through intermediary village medics (informal doctor) with the help of tablets. The enrolled village medics registers the patients, takes the necessary history and examines the patients and relays the information to the registered doctors over internet . The village medic also facilitates the communication between the patient and the formal physician using the tablet. Based on the consultation the patients are given prescription and medications.

#### Assessment of a telemedicine project using the framework

Framework concept	Scope of the specific accountability concept in the initiative	Any specific measure the initiative has used to measure the concept
Strategic vision	√	Achieving equity in health care access through technology was an explicit vision behind the initiative
Participation	√	Local administration, policy makers, supply side user (Village medics) were involved. Plans to involve collaborative partners
Transparency	√	Provision of timely aggregated data to general public and administrative staff Provision of transmission of impact data to policy makers
Responsiveness	√	Provision of local need and demand assessment and client satisfaction Future plans for referral and health insurance will increase responsiveness
Equity	√	Disadvantaged patients need and access addressed, though the high pricing is deterrent for extremely poor Inequity in terms of disease condition and gender , for example non communicable diseases and male patient are less represented
Ethics	√	Digitally signed prescription given. But the ethical boundaries of providing health care in absence of face to face consultation and examination needs to be investigated. Also patient's privacy (the village doctors examine the patient) and creating competition amongst village doctors are few issues.
Information Governance	√	No provisions made in the project so far. But information governance system should be thought of in case of scaling up.
Rule of Law	√	Village medics are not registered care givers. The participants found this is unethical as well as unlawful.

Performance	√	Performance is ensured by punitive measures taken against the centres after receipt of 3 complaints, use of limited number of standard pharmaceutical companies' medicine, registered medical practitioners prescribe the medicine. External evaluation is also undertaken.
Sustainability	√	The programmatic sustainability is through the program design, acceptability and trust of the community. There are some proposed sustainability measures which includes addition of services for emergency and chronic disease, referral. For technical interoperability link up to DHIS2 was suggested.

*Thematic area: SMS based intervention*

The project under consideration

Under this project pregnant women and new mothers are registered. The pregnant women, new mothers and their gatekeepers (usually husbands and mother in law) receive SMS and voice based messages that contain critical health information in relation to maternal and child health. This leads to improved health knowledge, behavior and outcome

Assessment of a SMS based intervention using the framework

Framework concept	Scope of the specific accountability concept in the initiative	Any specific measure the initiative has used to measure the concept
Strategic vision	√	The strategic vision was initially linked with creating health awareness regarding MNCH using technology.
Participation	√	Depending on the service and program design participation of stakeholders was ensured. Reflection of user need and preference drives the design and delivery.
Transparency	√	Partially transparent. Any government directive or guideline for ensuring transparency will be helpful for such initiatives
Responsiveness	√	Local need and demand assessment done and addressed in program design and content delivery. Client satisfaction was also assessed.
Equity	√	Very less number of users are from the poorest section of the society (in terms of income). Also illiterate users are not using the service. They are the most disadvantaged and in acute need of service.
Ethics	√	The content for health promotion has been developed after meeting ethical rules and procedures
Information Governance	X	No provisions made in the project. How information governance for such initiatives should be done needs to be discussed.

Rule of Law	X	Not very useful for this project.
Performance	√	Performance monitoring done through impact evaluation (internal ) and external evaluation Participants suggested that provision of formal complaint registration would be a good addition
Sustainability	√	The programmatic sustainability is through good performance and responsive design. Financial sustainability is dependent of available funds

*Thematic area: Web application*

#### The project under consideration

The initiative has a component that uses technology platform to build up an emergency medical system. It uses location based mobile app, SMS, and a call center to allow people to report accidents and send alerts to nearest first responders who are trained by the initiative and dispatch help for the victims. The app is available in Android and i-phone .

#### Assessment of a web application project using the framework

Framework concept	Scope of the specific accountability concept in the initiative	Any specific measure the initiative has used to measure the concept
Strategic vision	√	The initiative has a very specific vision which uses mobile technology to rescue and provide linkage to formal care facilities in the local context of Dhaka, Bangladesh.
Participation	√	Scope of participation of different stakeholders is limited. Participation of community members is mainly through training session to create volunteers which ensures delivery of services. The training session included law enforcement agency, university students, medical students and community members.
Transparency	√	Visibility through media campaign, online publication, newspaper coverage, social media activity. Linking up with government emergency response mechanism and more media campaign can improve transparency
Responsiveness	√	The initiative responds to a critically important local need. The design of the app has provision for different type of user, i.g volunteer, team leader, general public. The provision of making calls through the app, taking photographs, geo location of facilities (police station,

		<p>fire brigade, hospitals) and the accident spot adds to the responsiveness of the app.</p> <p>The participants proposed active involvement of government emergency response agencies and local hospitals in the initiative to increase responsiveness. Inclusion of feedback from service recipient, provision of follow up were suggested .</p>
Equity	√	The participants suggested inclusion of more of female volunteers and gender specific alert generation for making it more gender sensitive.
Ethics	√	The ethical context for this kind of initiative is still emerging. The participants suggested that involvement of professional societies and welfare associations can help raise and resolve ethics issues regarding this platform to emerge.
Information Governance	√	Not much provision is made in the project. But the participants suggested storage of backend data in government server; periodic analysis of the data; conducting audit trial and use of data for responding to other emergency situations will help establish a system for information governance.
Rule of Law	√	<p>Lack of enabling laws and policies are challenges for the initiative. Law regarding the role of ICTs in emergency care is absent.</p> <p>Participants suggested periodic evaluation of existing laws to facilitate the emergency medical system functioning and punitive action against care facilities refusing victims</p>
Performance	√	<p>Lack of good starting data on emergency care is a big challenge for impact evaluation.</p> <p>Periodic training opportunity and mapping of facilities according to service availability, performance based incentives to improve performance</p>
Sustainability	√	<p>The programmatic sustainability is through community engagement and acquisition of volunteers.</p> <p>Financial sustainability is dependent of available funds and is an issue.</p> <p>Programmatic sustainability can be improved by involving government's emergency response facilities like police, fire brigade, hospitals; enabling legal environment</p>

*Thematic area: Hospital Automation*

The projects under consideration

Under this thematic area two case studies of hospital automation were presented. One was a multi-specialty tertiary level teaching hospital and the other was large specialized hospital. Both the hospitals were automating patient and service management processes.

#### Assessment of a hospital automation project using the framework

Framework concept	Scope of the specific accountability concept in the initiative	Any specific measure the initiative has used to measure the concept
Strategic vision	X	Not very useful for this intervention.
Participation	√	Participation of the automated service users is limited in the automation process
Transparency	√	Service providers are audited for quality assurance through different process benchmarks (checklist, guidelines) available due to the automation process.
Responsiveness	√	Client satisfaction is due to decreases time at each level. The participants suggested that provision for complaints, exit survey, follow up information can be made for increasing responsiveness
Equity	√	Digitization of registration process in on going in both hospitals. There were suggestions of low registration or service cost for poor clients based on information gathered during registration
Ethics	√	The hospitals use unidentifiable ID/code , cc tv for monitoring breach of ethics by service provider
Information Governance	√	Staff training on data quality control
Rule of Law	√	Existing institutional, HRM, medical rules. No initiative specific rules or legislation
Performance	√	Automation used for improving logistic preparedness. Suggested use of the process for improving performance through monitoring of staff attendance and absenteeism, patient flow, medical documentation, procurement, comparison with other facilities and region, total quality management (TQM), reduce duplication of lab service and missing data
Sustainability	√	Sustainability of the initiative are limited but can be increased. The data can be shared with national databases and the initiative can be utilized for shared decision making , research using patient data and adding functionalities like disease surveillance , cause of death , birth and death registration. The utilization of data will improve the programmatic sustainability and scope for ensuring financial resources

*Thematic area: Health Information System*

The projects under consideration

The public health information system of Bangladesh has been undergoing digitization. A case study on the digitized HIS was presented in the short course. The overview

Assessment of a health information system using the framework

Framework concept	Scope of the specific accountability concept in the initiative	Any specific measure the initiative has used to measure the concept
Strategic vision	√	Strategic leadership was very important. The implementation depends on dynamism and vision of the leadership.
Participation	√	Effective participation of stakeholders is limited. Usually the partners and technical experts are involved.
Transparency	√	Transparency is ensured through making dashboard accessible depending on the role of the users and publishing reports.
Responsiveness	√	Reporting on actionable changes and need with priority and timeline, public opinion through SMS enhance responsiveness.
Equity	√	Accessibility and availability of data on supply chain management, HRM, service delivery and safety have created more opportunity for evidence based planning and strive for equitable distribution of resources
Ethics	√	Security and confidentiality of health information of clients as well as users are ensured. But explicit legal protocol on what information should be collected, how the information should be handled, who should have access to the information, under what conditions the information should be disclosed should be present as well as guideline on moral obligation
Information Governance	√	Practice of evidence based decision making based on local data is increasing. Policy framework for rationality of information management, data quality assurance, reporting requirements of stakeholders and public private facilities are needed.
Rule of Law	√	There are national or international laws to govern such systems covering ethical, legal, privacy, security issues, roles, responsibilities, data ownership, compliance. A certifying authority is needed to provide clearance.

Performance	√	Internal and external auditing processes are in place for measurement of performance indicators. Both operational and managerial performance measurement are needed.
Sustainability	√	Contextual design of the initiative, strategic planning aligned with financial systems, ongoing process to identify future leadership, capacity building efforts are in place. Sustainability in terms of finance, operations and management are important.



## Appendix 7 Engagement with SEARCH

SEARCH engagement participants			
<i>Short courses</i>			
Health informatics short course	7-11 December , 2014	20 participants Public (DGHS)-4 NIPSOM-1 BRAC university and other -2 Icddr,b-13	3 <sup>rd</sup> technical report February 2015
eHealth for Universal Health Coverage	16-19 th January , 2017	22 participants Public (DGHS and DGFP)-9 Icddr,b-5 MSH-2 Dnet-2 NIPSOM-1 BUHS-1 Robi -1 Criticalink-1	7 <sup>th</sup> technical repot. February 2017
<i>Networking platform</i>			
Developer’s forum	20 <sup>th</sup> January , 2015	25 participants	3 <sup>rd</sup> technical report February 2015
<i>Updating of eHealth initiative inventory</i>			
Number of initiative identified		42 initiatives – initial updating  52 initiatives in the next update	3 <sup>rd</sup> technical report February 2015  4 <sup>th</sup> technical report August 2015
<i>Framework development</i>			
Key informant interview		7 initiatives	4 <sup>th</sup> technical report August 2015
Online survey (field testing of draft indicators)		6 respondents completed the online survey	5 <sup>th</sup> technical report February 2016
Delphi round 1		21 experts	7 <sup>th</sup> technical repot. February 2017
Delphi round 2		20 experts	
<i>Application of the framework for analyzing eHealth initiative</i>			
eHealth initiative analyzed using the framework by the eHealth for Universal Health Coverage	16-19 <sup>th</sup> January , 2017	6 initiatives analyzed	7 <sup>th</sup> technical repot. February 2017

Short Course participants			
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## **Appendix 8: Paper on Systematic review to identify the themes around equity and accountability concepts important for eHealth**

### **Introduction**

In the last few years, use of ICTs (information, communication technology) has increased exponentially all over the world. The number of mobile phone subscriptions, internet use have increased rapidly in the recent time, especially in low and middle income countries (LMIC)[1]. ICTs are increasingly being used for providing many types of citizen services including health. ‘eHealth’ is thus the use of information communication technologies (ICT) for health [2]. In 2005, World Health Organization (WHO) acknowledged eHealth as a potential tool to strengthen health systems and urged member states to endorse long term strategies and enabling environment to support its development[3, 4]. Post 2015, SDG (Sustainable Development Goal) is the new global development agenda. Health related SDG aims to ensure healthy life and wellbeing for all, at all ages. In the SDG era, national health systems across the globe are striving for more. The traditional way of health system functioning is unable to keep up with the health needs and demand of the population. The health system challenges of recent times have necessitated the search for new strategies to strengthen the struggling health systems. eHealth has emerged as a potential tool that can improve service delivery and health system performance in the SDG era [5].

eHealth can expand the boundaries of traditional health systems. Theoretically, eHealth can make health service delivery available at all time, to all, in all places. Apart from bridging gaps in service access and coverage, it can improve the quality, availability and use of information, evidences and services; build capacity of the health human resource through better learning options; improve performance monitoring and access to health service and knowledge[6]. Thus, eHealth is a powerful enabler for an “information intensive” sector like health. It not hard to

understand that an attractive platform like eHealth would generate huge expectation and attract much attention, investment and patronization all over the world . But despite rapid adoption of ICT for health innovations, it's impact of such innovations has been questionable [7].

Evidences to support claims like improved patient outcome, cost effectiveness, successful replication are scarce[8]. A transformative strategy like eHealth can make health system more responsive, equitable, efficient but in reality there are very few evidence that suggests so.

Pressure for adopting technological solutions often without contextual embedding with suboptimum policy framework, scarcity of skilled workforce, lack of adequate infrastructural and logistic support have often hampered the evolving eHealth landscape in many regions of the world [6].

It is important to understand how eHealth can be made accountable, to reduce the imbalance between the expectations and the impacts. Improper and unplanned development of eHealth drain valuable resources and even cause harm[9]. Accountability is thus critical for ensuring responsiveness, performance and efficiency of eHealth interventions, so that they can add value to the health system which it is supposed to strengthen and complement. Accountability and governance of the overall health systems as prerequisite to improve system performance have received much attention [10]. Many discourse, frameworks have been conceptualized to describe health system accountability and governance[11]. But, unlike health systems, accountability in eHealth needs conceptualization and contextualization. In this paper, we tried to explore the accountability/governance concepts in health systems in an attempt to embed relevant global system accountability concepts in eHealth , to develop an accountability framework for eHealth. This exploration will help develop more systematic approaches of exploring accountability in eHealth and better integration of eHealth in the broader health systems.

## Methods

This review was conducted as a part of IDRC (International Development Research Centre; funded activity (ACT00639). The objectives of this literature review were:

- a. To gain an understanding of the concepts of health system accountability
- b. To contextualize the accountability concepts in overall eHealth for drafting an accountability framework for eHealth

We conducted this literature review between January and December 2015. The research team identified the research questions and inclusion criteria through discussion meetings. The result of this literature review has been reported according to the PRISMA ( Preferred Reporting Items for Systematic Reviews and Meta –Analyses) guidelines [12].

### *Search Strategy*

We conducted a preliminary literature search to identify the relevant search terms and guide the development of the search strategy. The research question was developed using the SPICE strategy[13]. The setting was health and eHealth systems (setting); potential users were health and eHealth implementers, policy makers, evaluators (perspective); phenomenon of interest (intervention) was accountability concepts; any existing alternate mechanism for accountability with the framework was compared (comparison); any validation of the accountability concepts conducted (evaluation). Keeping in mind the multidisciplinary nature of the field of interest a total of four databases Pubmed, SCOPUS, Science Direct, Web of Science were chosen. The foci of the search were “health systems” and “eHealth” and “accountability.” We decided to consider both the term “accountability” and “governance” as accountability is a cornerstone of governance and both are closely linked. Keywords around the domain of “eHealth” were based on the literature and systematic reviews on the eHealth so that they touch upon the most

widespread terms associated with the field [14, 15]. So, the following search string was constructed: accountability OR governance AND “health systems” AND [“e-Health” OR “eHealth” OR “telemedicine” OR “mHealth”, “m-Health,”]. The search was performed using MeSH (Medical Subject Headings) and free text terms, combining the words appropriately with Boolean operators and wildcard truncation.

Limits used were English language, human subjects and time between 1990 and 2015. Although the search strategy included an electronic and manual search, the primary way of identifying relevant literature was electronic database search.

#### Additional search strategy

We also searched few additional databases like WHOLIS (Library and Information Networks for Knowledge Database)[16], UNiLibrary[17]. As the development agencies have done elaborate work on accountability and governance, we included them in the search strategy to develop an understanding of generic accountability and governance concepts

#### Inclusion criteria

Studies meeting the following criteria were included in this review.

1. Peer reviewed journals providing accountability or governance concepts on “eHealth” and “health systems”
2. Articles describing principles, concepts, constructs, criteria, model, guideline, tool, ideas, and themes of accountability or governance in “eHealth”, and “health systems”.
3. Accountability or governance framework on eHealth, health system, provided by development organizations which are available as “grey literature” retrieved through additional search strategy
4. Publication between 1990 and 2015.

## Exclusion criteria

1. Publication before 1990 and after 2015
2. Clinical trials
3. Abstracts
4. Publications in languages other than English

## Data abstraction and analysis

Two researchers conducted the literature search. The titles and abstracts obtained from the literature search were downloaded into an Endnote library. After removing duplicates the reviewers screened the title and abstract to establish eligibility for full review based on the inclusion/exclusion criteria. The reviewers then carried out full text review and extracted data into data abstraction sheet on Microsoft Excel. Any disagreement was referred to the researchers for resolution.

## Analysis of the selected literature

The full text articles that met at least one eligibility criterion were analyzed using ‘Conceptual Framework Analysis’, described by Jabareen[18]. Our main aim was to identify the global health system accountability concepts and contextualize them in eHealth to develop an eHealth accountability framework. The two researchers reviewed the full text articles and identified the concepts. The concepts were mapped, deconstructed by underlying attributes and similar concepts were integrated into a new concepts to create a limited number of concepts using the ‘Conceptual Framework Analysis Method’ [18]. The articles were cross-checked for acceptability of the identified concepts. Both the researcher reached on consensus regarding the identified concepts and it was submitted to the senior researchers for quality control check.

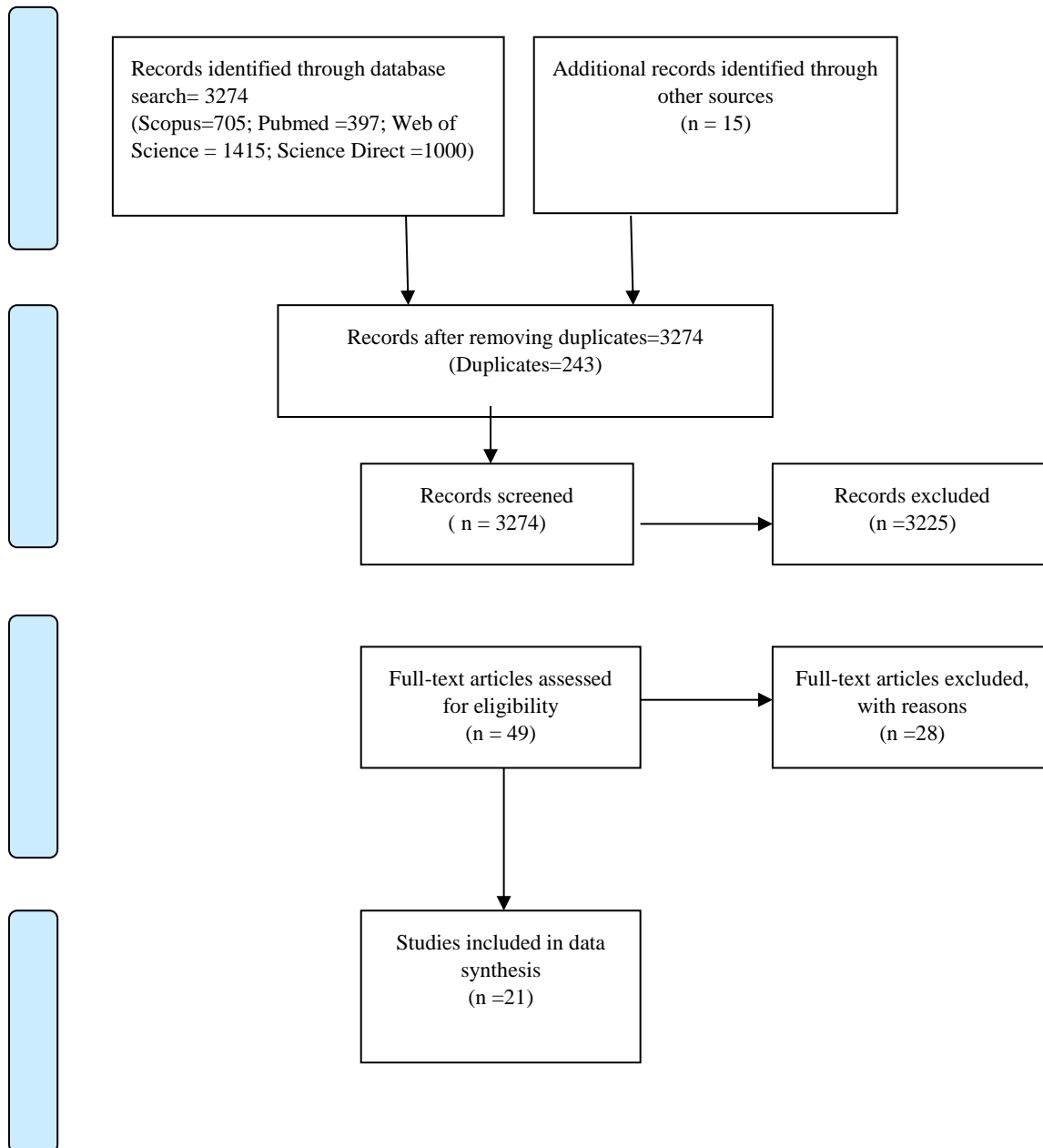


Figure 1: PRISMA flow chart depicting the literature search process

## Results:



The search yielded a total of 3274 articles and 15 publications from additional searches. After the initial screening, 243 duplicate records were excluded. We conducted a preliminary screening of titles and abstracts and as a result 3225 citations not meeting the inclusion criteria were removed. Remaining 49 full text documents were analysed and 29 were excluded for not meeting the inclusion criteria. The remaining 20 documents were retained for inclusion in the review. Of these, nine were peer reviewed journal articles and eleven were non article publications (working paper, research brief, report, manual). Most of the papers described accountability as an embedded issue of the larger governance concept. Majority of the papers (14) described governance concepts from a health systems perspective. Three papers described generic governance principles for development. Only two paper was on eHealth which described eHealth ethics and information accountability in digital platform.

**Table 1: Characteristics of the selected literature**

No	Authors	Year	Type of Publication	Objective	Concepts
1.	Anwari et al[19]	2015	Peer reviewed article	Assessment of Health system governance in conflict torn areas	Governance framework based on 4 guiding principle
2.	Barbazza et al[11]	2014	Peer reviewed article	Review health governance literature	Identifies different definition, dimensions, tools of health governance
3.	WHO[20]	2014	Report	Review of generic governance and health system governance description, available tools	Describes different governance and health system governance concepts.

4.	USAID 2012[21]	2012	Report	Targeted review of health governance literature	Describes different concept, principles of health governance
5.	Kirigia et al[22]	2011	Peer reviewed article	Describe governance in terms of health development	Composite index to measure health development governance
6.	Veillard et al[23]	2011	Peer reviewed article	Assess stewardship of national health ministries	Operational framework to assess central leadership
7.	Camargo et al [24]	2011	Working paper	To propose a health system framework for LMIC (low and middle income country)	A health system framework
8.	Mikkelsen et al[25]	2011	Peer reviewed article	Describe a health system governance framework based on building block approach	Concepts of governance aligned to the health system building blocks
9.	Lewis et al [26]	2009	Working Paper	Conceptualizes governance in health care delivery from a performance point of view	Governance principles for improving performance in health
10.	Siddiqi et al[10]	2009	Peer reviewed article	Propose a health system governance framework for national and subnational level	Framework with 10 governance concepts
11.	Kaufmann et al [27]	2009	Working Paper	Conceptualizes governance in general	Governance indicators to measure governance
12.	UN 2009[28]	2009	Manual	Characteristics of good governance	Description of governance characteristics

13.	Brinkerhoff and Bossert [29]	2008	Policy Brief	Discuss health system governance	A model describing health governance
14.	WHO 2007[30]	2007	Report	A health system framework for health systems strengthening	A framework for action – health system building blocks
15.	MSH 2007[31]	2007	Manual	Tool for health system governance	Assessment tool to measure health system governance
16.	Brinkerhoff[32]	2004	Peer reviewed article	Conceptualized accountability in health system	Three types of accountability
17.	Travis et al[33]	2002	Working paper	Conceptualized Stewardship	Stewardship concepts in health
18.	Rippen et al [34]	2000	Peer reviewed article	Describes ethical principles for ehealth	Ethics principles for eHealth given as code of eHealth ethics
19.	UNDP 1997[35]	1997	Policy Brief	Governance principles for sustainable human development	Governance principles
20.	Emmanuel et al[36]	1996	Peer reviewed article	Conceptualizes accountability in health care	3 types of accountability for health care
21	Gajanayeke[37]	2012	Conference proceedings	Information accountability principle for eHealth systems	Description of accountable ehealth information exchange

### Identifying and mapping the concepts

We have identified the broad accountability or governance concepts that emerged from the literature. We asked the question, “What are the concepts or elements used to describe accountability or governance?” We mapped the concepts in a matrix form (table 2).

**Table 2: Preliminary concepts as described in the literature**

		Emmanuel et al	UNDP	Rippen et al	Travis et al	Brinkerhoff et al	MSH	UN	Siddiqi et al	Kaufmann et al	Lewis et al	Camargo et al	Kirigia et al	Veillard et al	Lopez et al	Anwari et al
1	Stewardship															
2	Intelligence, information															
3	Policy Direction															
4	Policy formulation, planning,															
5	Policy design															
6	Strategic vision															
7	Incentives															
8	Participation															
9	Consensus orientation															
10	Public health leadership and management															
11	Evidence-based decision-making															
12	Voice and legitimacy															
13	Partnership															
14	Political stability and absence of violence/terrorism															
15	Ethics and integrity															
16	Rule of law															
17	Accountability															
18	Regulation															
19	Standards															
20	Control of corruption															
21	Transparency															
22	Responsiveness															
23	Equity and inclusion															
24	Effectiveness and efficiency															

### *Deconstruction of the concepts*

The preliminary concepts were analysed for underlying attributes. The concepts mentioned in the documents or included in the conceptual models or frameworks were listed. The concepts were deconstructed for their description/ attributes/ underlying role/assumption/function. Table 3 describes the deconstructed concepts, their description and main role served in the literature.

**Table 3: Deconstruction of concepts by attributes**

<b>Concept</b>	<b>Description</b>	<b>Role</b>	<b>Reference</b>
Accountability	<ul style="list-style-type: none"><li>• Justification of actions and taking responsibility of actions.</li><li>• Includes aspects like parties who are accountable, actions for which one is accountable, procedures or mechanisms of accountability</li><li>• A governance process</li></ul>	Ontological/met hodological	Anwari[19], Kirigia[22], Brinkerhoff[32],Emanuel[36], Lopez[25],Siddiqi[10], Camargo[24],MSH [31], UN[28],Lewis[26] UNDP[35]
Transparency	<ul style="list-style-type: none"><li>• Free flow of information to the concerned.</li><li>• Information on decision making, process, operations, institutions, monitoring.</li></ul>	Ontological	Lopez[25], Siddiqi[10], Camargo[24], UN[28], UNDP[35]
Participation	<ul style="list-style-type: none"><li>• Stakeholders take part in decision making.</li><li>• It can be through direct</li></ul>	Ontological	Camargo[24], Siddiqi[10], Lopez[25], UN[28], UNDP[35], Kirigia[22], MSH[31],

	<p>means or intermediaries</p> <ul style="list-style-type: none"> <li>• Stakeholders' capacity to participate constructively is important</li> </ul>		
Engaging with stakeholders	<ul style="list-style-type: none"> <li>• Participatory involvement of various group of stakeholders in relevant process design and decision making process</li> </ul>	Ontological	Anwari[19]
Stewardship	<ul style="list-style-type: none"> <li>• Sometimes known as “governance”.</li> <li>• Involves oversight and guidance for the system.</li> <li>• Generation of intelligence, formulating strategic policy direction, ensuring tools for implementation: powers, incentives and sanctions, building coalitions and partnerships, ensuring a fit between policy objectives and organizational structure and</li> </ul>	Epistemological	Anwari[19], Veillard[23], Travis[33], WHO[30]

	culture, ensuring accountability are functions of stewardship		
Responsiveness	<ul style="list-style-type: none"> <li>How far health systems can exercise respect for persons (dignity, autonomy in choice of interventions and confidentiality) and are client oriented (prompt, adequate basic amenities, access to social support networks, and choice of provider).</li> <li>Fulfilling needs of stakeholders.</li> </ul>	Ontological	MSH[31], UNDP[35], Bossert[29], UN[28], Camargo [24], Siddiqi[10], Kirigia[22]
Information	<ul style="list-style-type: none"> <li>System of data generation on output, outcome, performance; analysis of information.</li> <li>Available information is used for planning and</li> </ul>	Ontological	Lewis[26], MSH[31], Bossert[29], Siddiqi[10], Gajanayeke[37]

	decision making <ul style="list-style-type: none"> <li>• Information exchange in digital platform</li> </ul>		
Equity	<ul style="list-style-type: none"> <li>• Equitable access to health care and service across social determinants</li> <li>• Fairness in financing and resource allocation</li> <li>• Inclusiveness</li> </ul>	Ontological	Kirigia[22],Siddiqi[10], Camargo[24], UN[28], UNDP[35]
Strategic Vision	<ul style="list-style-type: none"> <li>• Long term perspective on health goals</li> <li>• The required strategic direction grounded in contextual understanding</li> <li>• Usually led by stewards and linked with policy formations and development of regulations and sanctions</li> </ul>	Ontological	Lopez[25], Siddiqi[10], Camargo[24], UN[28]
Ethics	<ul style="list-style-type: none"> <li>• The commonly accepted principles of health care ethics include respect for autonomy, nonmaleficen</li> </ul>	Ontological	Siddiqi[10], Rippen[34], Kirigia[22]



	<p>ce, beneficence and justice.</p> <ul style="list-style-type: none"> <li>• Ethics in health research is to safeguard the interest and the rights of the patients.</li> <li>• eHealth code of ethics charts out set of ethics principles for health information in digital platform based on honesty, candor , quality, informed consent privacy , professionalism and partnering</li> </ul>		
Rule of Law	<ul style="list-style-type: none"> <li>• Existence of relevant legislations on health and</li> <li>• Enforcement of rules of law</li> </ul>	Ontological	UNDP[35],UN[28], Siddiqi[10],Kirigia[22]
Efficiency and efficacy	<ul style="list-style-type: none"> <li>• Whether the process/ activities undertaken can achieve the outcome by making best possible use of resources.</li> </ul>	Ontological	Siddiqi[10], Camargo[24],UN[28], UNDP[35], Kirigia[22]

	<ul style="list-style-type: none"> <li>• Involves efficiency monitoring</li> <li>• Sometimes seen as governance outcome</li> </ul>		
Control of corruption	<ul style="list-style-type: none"> <li>• A process of governance.</li> <li>• Closely linked with accountability and transparency.</li> <li>• Improved accountability and transparency can reduce corruption.</li> </ul>	Ontological	Lopez[25], Camargo[24]
Standards	<ul style="list-style-type: none"> <li>• Set benchmarks for assessment of performance.</li> <li>• They are usually known to all and help inform policy makers</li> </ul>	Ontological	Lewis[26]
Incentive	<ul style="list-style-type: none"> <li>• Factors that motivate certain types of behavior/action</li> <li>• Can be positive or negative.</li> <li>• Linked with regulations</li> </ul>	Ontological	Lewis[26]
Regulation	<ul style="list-style-type: none"> <li>• Ensures efficacy, safety, quality of service.</li> </ul>	Ontological	MSH[31]

	<ul style="list-style-type: none"> <li>• Capacity for regulating service and care is necessary</li> <li>• Depends on standards or benchmarks.</li> </ul>		
Policy formation and planning	<ul style="list-style-type: none"> <li>• It is usually a function of the stewards</li> <li>• Linked with strategic direction and oversight</li> <li>• Sometimes considered as governance input</li> </ul>	Ontological	MSH[31], Lopez[25]
Public health leadership and management	<ul style="list-style-type: none"> <li>• Presence of able leadership for providing overall strategic direction , policy formulation</li> </ul>	Ontological	Kirigia[22]
Effective internal and external partnerships for health	<ul style="list-style-type: none"> <li>• Intersectoral, well coordinated action.</li> <li>• Forging partnership with different stakeholders both public and private sectors.</li> <li>• Well aligned and shared flow of information, priorities</li> </ul>	Ontological	Kirigia[22]
Evidence-based	<ul style="list-style-type: none"> <li>• Capacity to generate</li> </ul>	Ontological	Kirigia[22]

decision-making	<p>information, analyze, inform and advocate changes to decision makers.</p> <ul style="list-style-type: none"> <li>• Mechanism to generate meaningful evidence</li> </ul>		
Macroeconomic and political stability	<ul style="list-style-type: none"> <li>• Link with broad national economic strategies</li> <li>• Political stability for ensuring sustainability of capable leadership</li> </ul>	Ontological	Kirigia[22]
Voice	<ul style="list-style-type: none"> <li>• Expression of needs and demands of clients or citizens through different mediums</li> </ul>	Ontological	Bossert[29]
Compact	<ul style="list-style-type: none"> <li>• It's a relationship between state to providers to give directives, oversights</li> </ul>	Ontological	Bossert[29]
Strategic direction	<ul style="list-style-type: none"> <li>• Setting up strategic direction through participation of concerned stakeholders</li> </ul>	Methodological	Anwari[19]

### Integration of concepts

In this step we grouped similar concepts together and integrated them into a new concept. Concepts with similar attributes were grouped together and a new concept was created. As our objective was to contextualize the accountability concepts in overall eHealth to draft an accountability framework for eHealth, this step reduced 23 concepts retrieved from reviewed literature to a manageable 11 concepts. The following table gives the primary concepts that were integrated and the core similarity (ies) that formed the basis for integration

**Table 4: Resynthesized concepts**

Concepts for integration	New Concept	Common attributes
Stewardship Strategic direction Public health leadership and management Policy formation and planning Strategic Vision Compact Evidence based decision making	<i>Strategic Vision</i>	Functions
Participation Consensus orientation Effective internal and External partnerships for health Engaging with stakeholders	<i>Participation</i>	Engagement of relevant stakeholders according to their role and capacity
Transparency Control of corruption	<i>Transparency</i>	Free flow of information on process, outcome, performance to involved parties improves the system
Responsiveness Voice	<i>Responsiveness</i>	Consideration of clients' needs and expectations
Equity Inclusiveness	<i>Equity</i>	Fair distribution of benefits, services allocation for all
Ethics	<i>Ethics</i>	Implementation of ethics principle in service provision, research
Information	<i>Information and intelligence</i>	Information generation Use of information for decision making
Standard Regulation Rule of law	<i>Rule of law</i>	Presence of laws and regulation to control
Efficiency and efficacy Incentive	<i>Performance</i>	Achieving requires results through best use of resources Needs constant monitoring

Macroeconomic and political stability	<i>Sustainability</i>	Creation of enabling environment for sustaining any efforts Financial stability
Accountability	<i>Accountability</i>	Responsibility for actions Process for accountability Types of accountability

## Discussion

The recent times have presented unprecedented number of challenges for national health systems across the globe. These various challenges are often interlinked and serious enough to threaten the achievements of modern medicine and health care systems. Global trends like surge in non communicable diseases (NCD), rise in number or geriatric population, multiple number of co-morbidities have stretched capacities of health systems. The current trend has put emerging economies in a very precarious situation. The double burden of infectious as well as chronic diseases, need for provision of basic health services along with curative and preventive services for NCDs, coupled with weak infrastructure, scarce resources, climate change effects, conflicts, violence, accidents, socio-political instability etc all exacerbate the health systems weaknesses.[38]. The cost of health care is increasing rapidly which will outpace economic growth of emerging economies and the global deficit of critical health workforce is likely to worsen in coming decades [38] . As traditional strategies proved to be inadequate to achieve health systems goals, search for novel innovation to rejuvenate health systems ensued. The availability and affordability of internet technologies even in developing countries, along with tremendous increase in the number of mobile phone subscriptions worldwide, dependence on social media have created scope for ICT for health innovations. Interestingly, the expansion of ICTs has been phenomenal in developing countries which has created an excellent opportunity to use ICT for strengthening the struggling health systems[1].

Though eHealth is a promising area of innovation which has garnered much attention, investment and patronization at international and country level, evidence and experience suggest that it is not panacea for all the health system ailments[1]. ICT for health is a very complex platform with human, technological, business aspects, multiple stakeholders and interests. Experts acknowledged the inherent attractiveness of this platform that attracts implementers and funders alike, but advised cautious implementation of such innovations specially in resource limited settings [39]. The eHealth landscape faces many challenges like lack of demonstrable evidence, long term sustainability, legal and ethical boundaries, skilled manpower and other resources, ‘digital divide’ etc[40]. Experience and lessons from established eHealth initiatives are difficult to extract and share due to lack of monitoring and evaluation in many parts of the world[6, 41]. Issues like lack of user trust, interoperability, inadequate understanding and clarity of relevant legal issues, digital divide can also hinder uptake and impact of eHealth solutions [42]. Similar to health systems, it imperative to conceptualize and contextualize elements of accountability for eHealth landscape to streamline the development of this unique health system strengthening tool. Recent evidences suggest that need based design, enabling environment, IT system integration, effective stakeholder partnership, consideration of end user issues of access, trust, acceptance, management and operational capacities are needed for successful and sustainable eHealth innovations[1]. For LMICs the situation is even more critical. The decision to invest on eHealth needs to be backed up by evidence of eHealth’s impact, careful consideration of contextual setting and system thinking. Haphazard and unplanned innovations only for the sake of finding a technological fix will ultimately harm the reputation of this novel approach, waste scarce resources with out actually adding any value to the health systems. Thus it is important to raise accountability considerations of eHealth innovations.

The concept of accountability is intricately tied with the other governance concepts.

Accountability has been variously described, sometime as a function of leadership, or governance process or as governance output. Accountability, participation, rule of law, transparency, strategic vision, effectiveness and efficiency, equity, consensus orientation, responsiveness are characteristics of effective governance according to UNDP[35] which nearly matches UN's good governance characteristics [28].

Accountability models of health care usually took into consideration the multi stakeholder involvement in health, client provider relationship touching upon professional obligations, regulation to control, effective utilization of resources[36, 43]. As improving population health discourse ramified around an organized health system functionalities , importance of overall health system governance to improve health system performance came into focus[11]. The changing social, political, economic context, disease and health need provided impetus to improve how health systems functioned worldwide. The premise that good governance is essential for improve system performance led to increase in discussion on health system governance[11]. Our search showed that accountability is recurrent governance theme and intricately tied to other governance concepts like transparency, participation, responsiveness, information [10, 22, 24, 25]. Accountability is also function of system stewards and expected outcome of a well functioning system [23, 25, 33]. Accountability is powerful driver of health sector performance which needs tools to regulate and control [26]. In short , accountability is a concept which can't be conceptualized in isolation. Health is as such an information intensive sector and eHealth is entirely based on information exchange. This new digital platform of information exchange have given rise to another milieu of information management and relevant accountability concerns[34, 37].



## Conclusion

This exercise comes as the first step of developing an accountability framework for eHealth that will help install systematic consideration of accountability in the design and development of eHealth applications. Through this literature review we identified possible global health system accountability concepts for use in the next phase to develop an eHealth accountability framework. It is possible that our search terms have failed to identify other accountability concepts because of the search strategy. As our objective was to find out relevant accountability themes for eHealth in relation to health system, our focus was on health system accountability and not the technical aspect of eHealth.

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## Appendix 9

### Developing indicators for eHealth accountability framework through consensus building

#### Methods

This activity was a part of the IDRC (International Development Research Centre; funded activity (ACT00639). The Delphi rounds were conducted in 2016 (June and August). The instrument and inclusion criteria were established before start of the review process through discussion meetings among the team members. We obtained ethical approval from the Institutional Review Board (IRB) of icddr,b for this activity (PR16012).

#### *Study design*

A two round Delphi study was conducted in 2016 selecting the indicators of an accountability framework that was developed under the SEARCH project. The draft framework had ten concepts (strategic vision, participation, transparency, responsiveness, equity, ethics, information governance, rule of law, performance and sustainability) and was developed from literature review and stakeholder consultation. It consisted of two rounds of surveys that consisted of both online and traditional paper based data collection.

#### *Sampling*

Participant selection is one of the crucial steps of conducting a Delphi study. There has been no hard and fast guideline regarding how participants will be chosen for a Delphi process [1]. Scholars have put emphasis on well qualified experts who are capable and willing to contribute in the consensus making process [1]. Some recommends that the experts should be,

- a. “The top management decision maker who will use the outcomes of the study;
- b. The professional staff members together with their support team
- c. The respondents to the Delphi questionnaire whose judgement are being sought” [1]

Others include, selection criteria based on professional credentials and rank and through nomination[2]. The important issues regarding expert selection are “expertise” and “knowledgibility” [3].

We identified the eHealth stakeholders through a number of sources before identifying the expert panel members. We constructed a preliminary eHealth stakeholder list from a desk review which we conducted in 2015, to identify the eHealth initiatives and their implementers in Bangladesh. After that we conducted key informant interviews (KII) with selected eHealth initiatives implementers. We identified initiatives and its implementers for KII using the following criteria. Initiatives those fulfilled any of the following criteria were shortlisted

1. initiatives from different sectors (public, private)
2. mature (initiative running for more than a year)
3. large scale initiatives
4. initiatives for vulnerable population

The key informants from the initiatives were either single or multiple for an individual initiative depending on the nature and maturity of the initiative. Person (s) invited for KII fulfilled the 2 mandatory and any 1 additional criteria.

Mandatory criteria

1. Active member (s) of the e/mHealth initiative

2. Committed to attend the 2 hour discussion

Additional criteria

3. Member of the leadership who has conceptualized or initiated the intervention.
4. Leader of the design and delivery of the e and mHealth service
5. Leader of the technological part of the initiative
6. Decision maker of the initiative
7. User (demand/supply) side if applicable

We used snowballing to identify additional stakeholders from the KII. Lastly we used professional contact networks of the SEARCH Bangladesh team and Technical Advisory Group (TAG) of the SEARCH Bangladesh team. The TAG was formed in at beginning of the SEARCH project, with high level representation from relevant eHealth stakeholders from government, private, academic, researcher community. We used snowballing technique to identify additional the stakeholders to construct a comprehensive stakeholder list. We categorized the stakeholders into six broad groups by their affiliation.

Table 1: Stakeholder pool by category of sector of involvement

Category of stakeholders
Public sector implementers/policy makers
Private sector implementers
University/Academia
Telecom
Researcher
Consumer

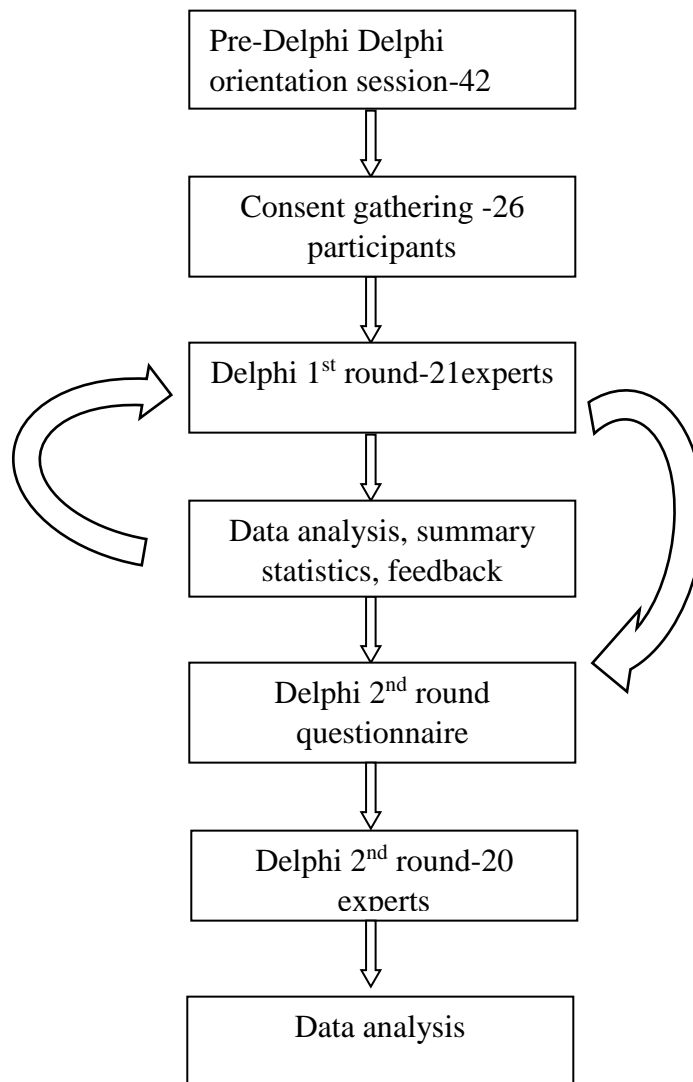
Between January to May 2016, we contacted the TAG, organization and initiative leaders obtained from the stakeholder list through emails and personal visits. We requested the leaders to nominate eligible expert panellists from their organization, to participate in the Delphi round. The eligibility of a potential panellist was decided by the following criteria.

1. Expertise or knowledge on eHealth for health landscape
2. Willingness to participate in all the Delphi session
3. Effective communication skills
4. Nomination by TAG members

We identified 42 eligible participants as potential expert panelist. We contacted each eligible member and gave them background material containing brief about the framework development process, draft framework and the indicators through personal communication and emails. The shortlisted members were invited for a pre Delphi orientation session. In this orientation session the participants were introduced to the draft framework and the indicators. The objective and outline of the Delphi session were explained to them. Out of the 42 shortlisted participants 24 experts attended this orientation session. At the end of the session all shortlisted experts were requested to take a short socio-demographic survey and give written consent to be part of the Delphi process. A total of 28 experts out of 42 shortlisted experts returned the survey and the consent forms. Out of the 28 experts 26 gave their consent to be a part of the Delphi rounds. The first round of the Delphi was conducted during June 2016 and 21 out of the 26 experts took part

in the first round of the Delphi survey. In the 2<sup>nd</sup> Delphi round conducted during August, 2016, total 20 experts took part.

**Figure 1: Flow chart of the Delphi Process**



***Instrument:***

The round 1 instrument was prepared from the KII and an online survey. The KII discussion guideline was developed based on the ten concepts of the draft accountability framework: strategic vision, participation, transparency, responsiveness, equity, ethics, information governance, rule of law, performance and sustainability. A list of 41 indicators were developed from the KIIs to measure these ten framework concepts. We developed an online survey to pilot test the indicators among the stakeholder group. An online survey hosted by “typeform” was developed and respondents were asked to answer “yes” or “no” in response to statements like , ‘the indicator is

relevant to eHealth /mHealth’, ‘Indicator represents the concept’, ‘the indicator is important for the framework,’ ‘data collection is important for the framework’. The respondents were also asked to suggest their modification for the indicators. The results were analyzed and after team meeting and discussion with in house researchers and gender consultants a preliminary list of 43 indicators were constructed (table 2).

**Table 2: Preliminary concepts and indicators**

No.	Name of the concept	Proposed indicators	Statement no
1	Strategic Vision	Articulation of equity and accountability as an objective in the program’s mission statement	Statement 1
		Articulation of role ICT applications in achieving overall health program goal	Statement 2
		Presence of authorized entity/individual to lead the ICT based initiative	Statement 3
		Clearly defined and documented expertise, roles, and responsibilities of the leadership	Statement 4
2	Participation	Seeking and incorporating supply side users’ input at different phase of the program	Statement 5
		Seeking and incorporating demand side users’ input at different phase of the program	Statement 6
		Seeking and incorporating collaborative partners’ input at different phase of the program	Statement 7
		Seeking and incorporating policy makers’ inputs at different phase of the program	Statement 8
		Sex disaggregated analysis of the supply or demand side user inputs to identify any existing gender based differentials	Statement 9
3	Transparency	Established mechanism to make guidelines and information on the initiative available to the public (general public, collaborative partners, policy makers, implementers, end users)	Statement 10
		Established mechanism to make guidelines and information on the initiative available to the initiative staff.	Statement 11
		A process for regular updating of project information for sharing with internal and external audiences	Statement 12

		Informing the general public about the initiative's collaborative partners and their interests	Statement 13
4	Responsiveness	Assessment of local need of the ICT based intervention before designing	Statement 14
		Assessment of the local demand of the ICT based intervention before designing	Statement 15
		Staff training to ensure client satisfaction with the program (i.e-autonomy , respect, dignity, communication, timeliness)	Statement 16
		Established mechanism to assess client satisfaction	Statement 17
		Established mechanism to initiate next level of action around the generated data	Statement 18
		Established referral mechanism/policy/guideline to refer the client to other/ next level of service provider/facility (external and internal to the program/project/organization) if the service is beyond the scope of the service delivery component of the program	Statement 19
5	Equity	Seeking participation of disadvantaged users during the design and development of the content	Statement 20
		Consideration of disadvantaged user groups' access and comfort to the technological platforms (hardware, software) and infrastructure (network, power) during the design and delivery	Statement 21
		Existing strategies to overcome barriers to utilization faced by disadvantaged users	Statement 22
		Generation of service utilization data disaggregated for Place of residence (urban /rural/Race/ethnicity/Occupation/Gender/Education/Socio-economic status by the system)	Statement 23
		Consideration of any gender related issues that might influence the uptake of the intervention during the design and delivery phase. (Barriers to access, power relation, norms, values, roles)	Statement 24



6	Ethics	Follow ethical standards from any established body	Statement 25
		Regular staff monitoring for breach in ethical conduct	Statement 26
7	Information Governance	Established separate body (individual /team) to monitor the information governance in the initiative	Statement 27
		Training of staff who handles data on information governance	Statement 28
		Generation of summary statistics for decision makers to improve the service delivery	Statement 29
		Consideration of any gender differentials that might influence health worker's capacity to use the ICT application during the design and delivery phase, if the eHealth intervention involves routine data collection using ICT tools by health workers	Statement 30
8	Rule of Law	Abiding applicable law of the land for setting up the initiative	Statement 31
		Existing articulated guideline to ensure participation of interested parties at different phases of the program	Statement 32
		Existing articulated guideline for providing program related information to interested parties	Statement 33
		Existing articulated guideline to ensure responsiveness of the program and its staff towards its clients	Statement 34
		Existing articulated guideline to address noncompliance to established rules/guidelines	Statement 35
9	Performance	Existing indicators to measure effectiveness, quality and efficiency of the ICT based initiative	Statement 36
		Regular measurement of the indicators	Statement 37
		Use of indicators to initiate actions	Statement 38
		Sex disaggregated data collection and analysis of performance indicators	Statement 39

10	Sustainability	Existing financial sustainability plan for the system/initiative	Statement 40
		Articulated scale up /health system integration/business plan for the initiative	Statement 41
		System's interoperability with the system it will scale up to	Statement 42
		Existing articulated succession plan for the present leadership	Statement 43

### *1<sup>st</sup> Round instrument*

The indicators were converted into statements for the constructing the round 1 instrument (table 2). The respondents were asked to rate their agreement on inclusion of the candidate indicator into the accountability framework on a Likert scale of 5 where threatening were given as ; 'strongly disagree' was given score 1, 'disagree' was given score 2, 'neutral/ not sure' was given score 3, 'agree' was given score 4 and 'strongly agree' was rated as 5[3]. If any indicator received score between 1-3, the experts were requested to give reason for their disagreement. The survey instrument was distributed either as online survey or paper survey. Each expert was given a unique confidential identification number to ensure privacy and confidentiality. The first round was conducted in June 2016.

### *2<sup>nd</sup> Round Instrument*

The results were analyzed. The aim was to identify the level of agreement for individual indicator and identify the emerging themes among the reasons for disagreement. The summary statistics containing proportion of responses in category 4 and 5 (4-5%) and disagreed themes were sent to the experts for feedback. Based on the feedback the 2<sup>nd</sup> Delphi instrument was constructed. The 2<sup>nd</sup> round was held in August 2016.

### *Statistical Analysis*

Descriptive analysis and **inferential analysis** (discuss with apa) were used to measure the frequency distribution, the central tendency (mean, mode median), interquartile range (IQR) and SD (standard deviation). The data was analyzed using SPSS version (detail).

### *Consensus criteria:*

Criteria for developing consensus is varied. An IQR of 1 or less than 1 is described as a consensus criteria for 4-5 unit measurement scale[4], while some experts suggest using combination of criteria like percentage of responses to certain category, IQR, SD [3]. For example, some experts used a combined criteria of SD below 1.5, certain level of agreement on selected categories for example 51% response in 'Strongly agree' and IQR less than 1 for 5 point scale measurement[3, 4] .

For our study our criteria for consensus was a combination of the following three :

- % response to category 4 (agree) and 5 (strongly agree)  $\geq 90\%$
- $IQR \leq 1$
- $SD \leq 1.5$

Inferential analysis by using Kappa statistics were used to test the level agreement between two rounds[5]. The reference value of Kappa for agreement is as follows[5]

<0=Poor agreement

0.00-0.20=Slight agreement

0.21-0.40=Fair agreement

0.41-0.60=Moderate agreement

0.61-.80=Substantial agreement

0.81-1.00= Almost perfect agreement

## Results

Table 1 describes the characteristics of the participants. Majority (66-70%) of the participant in the 1<sup>st</sup> and 2<sup>nd</sup> round were involved in public sector eHealth implementation in their respective capacity, followed by researchers (14-15%), private sector implementers (5-9%), university/academia (4-5%) and telecom (4-5%). Ninety percent of the participants were male.

**Table 1: Characteristics of the round one participants**

Characteristics	Frequency (%)	Frequency (%)
<i>Sex</i>		
Male	19(90.48)	18(90)
Female	2 (9.52)	2(10)
<i>Involvement</i>		
Public sector implementer/policy maker	14 (66.67)	14(70)
Private sector /NGO implementer	2 (9.52)	1(5)
University/Academia	1 (4.76)	1(5)
Researcher	3 (14.29)	3(15)
Telecom	1 (4.76)	1(5)

Table 3 describes the proportion of category 4 and 5 ratings for each indicator, SD and IQR. The 1<sup>st</sup> concept ‘Strategic Vision’ had four statements. One statement received 90.5% response (4 and 5) and rest 3 indicators received 95-100% category 4 and 5 rating. In the 2<sup>nd</sup> round the rating improved to 95-100%. IQRs were 1 or 0 for all strategic vision statements in both rounds. SDs were below 1. For the 2<sup>nd</sup> concept ‘Participation’ 90.5-100% respondents rated the five statements as 4 or 5 in the 1<sup>st</sup> round. The IQRs were between 0.5-1 for each five statement and SDs were below 1. In the 2<sup>nd</sup> round all five statements received all respondents rated the statements as 4 or 5 (100%) and IQR ranged from 0-1 and SDs were below 1. The third concept was ‘Transparency’.

It had four statement which received 4 or 5 rating from 90.5-100% of the responses in round 1. In round two the proportion improved to 95-100%. IQRs were 1 in round one for all statement and ranged between 0-1 in round two. SDs were below 1 in both rounds. ‘*Responsiveness*’ had six statements. 95-100% responses rated all six statements as category 4 and 5 in both rounds. IQRs were between 0-1 and SDs were below 1 for all statements in both rounds. ‘*Equity*’ had five statements. In round 90.5-100% responses rated all five equity statements as category 4 or five which improved to 100% in round two. The IQRs were between 0-1 in bot rounds for all statements and SDs were below 1. The two statements under ‘*Ethics*’ concept were rated either 4 or 5 by all respondents. While the IQRs in both round were between 0-1, the SDs were below 1 in both rounds. The concept ‘*Information Governance*’ had four statement. 95.2-100% responses rated the four statements as category 4 or 5. In round two the proportion of responses improved to 100% for all four statements. While the SDs were below 1, the IQRs were between 0-1 for all statements in both rounds. 90.5-100% of the responses rated the five statements under the concept ‘*Rule of Law*’ as category 4 or 5 in round one which improved to 100% in round 2. The IQRs were between 0.5-1 and SDs were below 1 in both rounds. ‘*Performance*’ had four statements. In round one, 95.2-100% responses rated the statements as either 4 or 5 in round 1 which improved to 100% for all statements in round 2. The IQRs were between 0-1 and SDs were below 1 in both rounds. Lastly, ‘*Sustainability*’ had four statements. In round one, 95.2-100% responses rated the statements as either 4 or 5 in round 1 which improved to 100% for all statements in round 2. The IQRs were between 0-1 and SDs were below 1 in both rounds

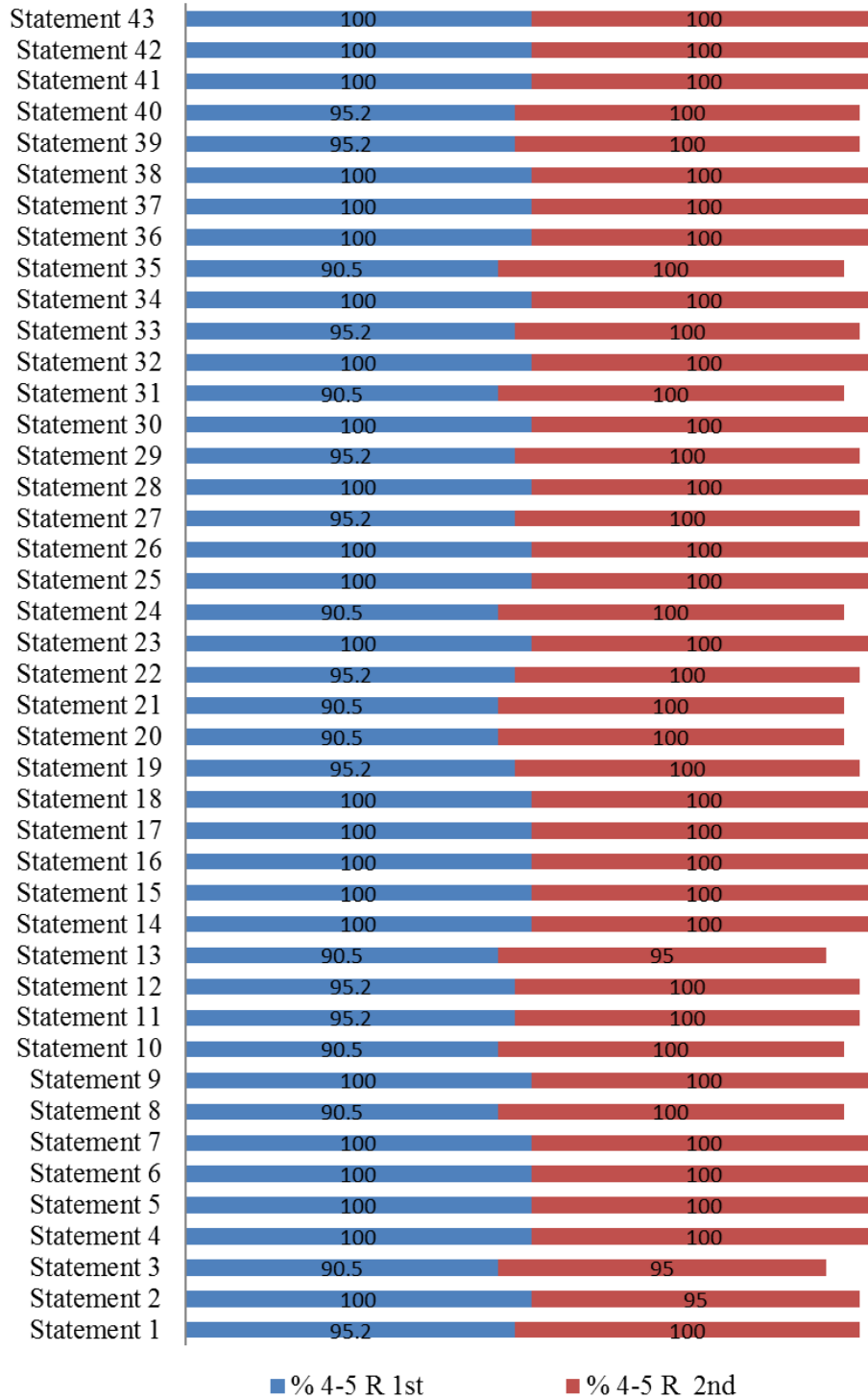
**Table 3: Statement consensus**

Statement	% 4-5		Mean		IQR		SD	
	R 1 <sup>st</sup>	R 2 <sup>nd</sup>	R 1 <sup>st</sup>	R 2 <sup>nd</sup>	R 1 <sup>st</sup>	R 2 <sup>nd</sup>	R 1 <sup>st</sup>	R 2 <sup>nd</sup>
Statement 1	95.2	100	4.33	4.45	1	1	0.91	0.51
Statement 2	100	95	4.38	4.65	1	1	0.50	0.59
Statement 3	90.5	95	4.19	4.50	1	1	0.75	0.95
Statement 4	100	100	4.71	4.80	1	0	0.46	0.41
Statement 5	100	100	4.33	4.60	1	1	0.48	0.50
Statement 6	100	100	4.48	4.65	1	1	0.51	0.49
Statement 7	100	100	4.48	4.45	1	1	0.51	0.51
Statement 8	90.5	100	4.62	4.50	0.5	1	0.81	0.51
Statement 9	100	100	4.67	4.80	1	0	0.48	0.41
Statement 10	90.5	100	4.52	4.85	1	0	0.81	0.37
Statement 11	95.2	100	4.33	4.60	1	1	0.58	0.50
Statement 12	95.2	100	4.38	4.55	1	1	0.59	0.51
Statement 13	90.5	95	4.57	4.65	1	1	0.68	0.75
Statement 14	100	100	4.67	4.85	1	0	0.48	0.37
Statement 15	100	100	4.29	4.85	1	0	0.46	0.37
Statement 16	100	100	4.57	4.70	1	1	0.51	0.47
Statement 17	100	100	4.86	4.75	0	1	0.48	0.44
Statement 18	100	100	4.67	4.80	1	0	0.48	0.41
Statement 19	95.2	100	4.19	4.70	0.5	1	0.51	0.47
Statement 20	90.5	100	4.33	4.70	1	1	0.66	0.47
Statement 21	90.5	100	4.24	4.50	1	1	0.77	0.51
Statement 22	95.2	100	4.24	4.65	1	1	0.54	0.49
Statement 23	100	100	4.71	4.80	1	0	0.46	0.41
Statement 24	90.5	100	4.24	4.65	1	1	0.89	0.49

Statement	% 4-5		Mean		IQR		SD	
	R 1 <sup>st</sup>	R 2 <sup>nd</sup>	R 1 <sup>st</sup>	R 2 <sup>nd</sup>	R 1 <sup>st</sup>	R 2 <sup>nd</sup>	R 1 <sup>st</sup>	R 2 <sup>nd</sup>
Statement 25	100	100	4.81	4.75	0	1	0.40	0.44
Statement 26	100	100	4.67	4.85	1	0	0.48	0.37
Statement 27	95.2	100	4.48	4.75	1	1	0.93	0.44
Statement 28	100	100	4.86	4.75	0	1	0.36	0.44
Statement 29	95.2	100	4.62	4.70	1	1	0.74	0.47
Statement 30	100	100	4.52	4.50	1	1	0.51	0.51
Statement 31	90.5	100	4.38	4.70	1	1	0.81	0.47
Statement 32	100	100	4.67	4.75	1	1	0.48	0.44
Statement 33	95.2	100	4.29	4.55	1	1	0.56	0.51
Statement 34	100	100	4.71	4.65	1	1	0.46	0.49
Statement 35	90.5	100	4.14	4.60	0.5	1	0.57	0.50
Statement 36	100	100	4.57	4.75	1	1	0.51	0.44
Statement 37	100	100	4.76	4.80	0.5	0	0.44	0.41
Statement 38	100	100	4.76	4.80	0.5	0	0.44	0.41
Statement 39	95.2	100	4.67	4.70	1	1	0.58	0.47
Statement 40	95.2	100	4.43	4.75	1	1	0.60	0.44
Statement 41	100	100	4.52	4.65	1	1	0.51	0.49
Statement 42	100	100	4.81	4.75	0	1	0.40	0.44
Statement 43	100	100	4.67	4.75	1	1	0.48	0.44

Figure 2 shows the distribution of the strong and very strong agreement on the 43 indicators in the two rounds. Overall agreement was good. In the first round the agreement on all of the indicators were above 90%. In the 2<sup>nd</sup> round the agreement improved so that agreement was 95% or more for all of the indicators.

**Figure 2: Distribution of category 4 and 5 responses for statements in Delphi rounds**



**Table 4: Measurement of agreement for statements**

Statement	Value of KAPPA	Level of agreement
Statement 1	0.24	Fair Agreement
Statement 2	0.33	Fair Agreement
Statement 3	0.26	Fair Agreement
Statement 4	0.29	Fair Agreement
Statement 5	0.26	Fair Agreement
Statement 6	0.30	Fair Agreement
Statement 7	-0.01	Poor Agreement
Statement 8	0.27	Fair Agreement
Statement 9	0.47	Fair Agreement
Statement 10	0.33	Fair Agreement
Statement 11	0.54	Moderate Agreement
Statement 12	0.15	Slight Agreement
Statement 13	-0.06	Poor Agreement
Statement 14	0.24	Fair Agreement
Statement 15	0.11	Slight Agreement
Statement 16	0.48	Fair Agreement
Statement 17	-0.09	Poor Agreement
Statement 18	0.15	Slight Agreement
Statement 19	0.02	Slight Agreement
Statement 20	0.46	Fair Agreement
Statement 21	0.09	Slight Agreement
Statement 22	0.22	Fair Agreement
Statement 23	0.57	Moderate Agreement
Statement 24	0.18	Slight Agreement
Statement 25	0.08	Slight Agreement
Statement 26	-0.25	Poor Agreement
Statement 27	0.09	Slight Agreement
Statement 28	0.17	Slight Agreement
Statement 29	0.40	Fair Agreement
Statement 30	0.10	Slight Agreement
Statement 31	0.51	Moderate Agreement
Statement 32	0.13	Slight Agreement
Statement 33	0.16	Slight Agreement
Statement 34	0.06	Slight Agreement
Statement 35	0.24	Fair Agreement
Statement 36	0.44	Fair Agreement
Statement 37	0.69	Substantial Agreement
Statement 38	0.38	Fair Agreement
Statement 39	0.16	Slight Agreement
Statement 40	0.26	Fair Agreement
Statement 41	0.38	Fair Agreement
Statement 42	0.00	Slight Agreement
Statement 43	0.38	Fair Agreement

Four statements; one from participation, transparency, responsiveness and ethics attained poor agreement based on Kappa values. Fourteen attained 'slight' and twenty two attained 'fair' and three attained 'moderate' agreement[5].

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## **Appendix 10: Concept Note:eHealth and mHealth Knowledge Platform**

### **Problem statement**

eHealth and mHealth interventions have proliferated rapidly in Bangladesh . Due to an enabling environment that includes political and policy back up, high mobile phone ownership, growing internet penetration, public and private sector patronage, growing number of innovations and innovators, eHealth landscape has gained tremendous momentum. Government is spearheading the growth of ICT (information, communication, technology) for health in Bangladesh. Apart from digitizing the public sector routine health information collection system and constructing an extensive ICT infrastructure across the health system tiers, the health ministry has launched many eHealth services. The private sector, the initial pioneers of eHealth innovations in Bangladesh, are also equally active in the field. But there is lack of effective sharing of information and interconnectedness among the various eHealth actors. There are very few capacity building and experience sharing opportunities around ehealth. Among the disjointed efforts and multiple stakeholders, there is lack of evidence pool that will support a balanced growth of the ehealth milieu- policies, programmes, services, financing.

### **Need statement**

The stakeholder engagements and capacity building events held under the mandate of an IDRC (IDRC - International Development Research Centre) funded research project “Making eHealth Equitable and Accountable for Health System Integration: Capacity building for evidence generation and translation” suggested that there is a need for an eHealth knowledge sharing platform. The stakeholders from different eHealth related fields raised concerns regarding lack of communication and information about ehealth related activities resulting duplication of efforts. This hampers the overall growth, future sustainability and wastes valuable resources. This uncoordinated growth will undermine the reputation and efforts of this important health system strengthening tool. This necessitates creation of an eHealth knowledge platform that will inform interested stakeholders and give them a space to communicate their eHealth related knowledge and experience.

### **Process Statement**

#### *Vision for the platform-*

This platform will provide information and evidence based support to the health ICT landscape of Bangladesh and contribute in its systematic and evidence based growth.

#### *Objectives*

##### *General objective:*

To create an ICT enabled eHealth related knowledge sharing platform.

##### *Specific Objectives*

- To provide information about existing eHealth initiatives in Bangladesh
- To serve as a platform for sharing experience from implementers , researchers, innovators , academics
- To provide notification about available eHealth related capacity building opportunities.

### *Structure*

#### Pre start-up phase:

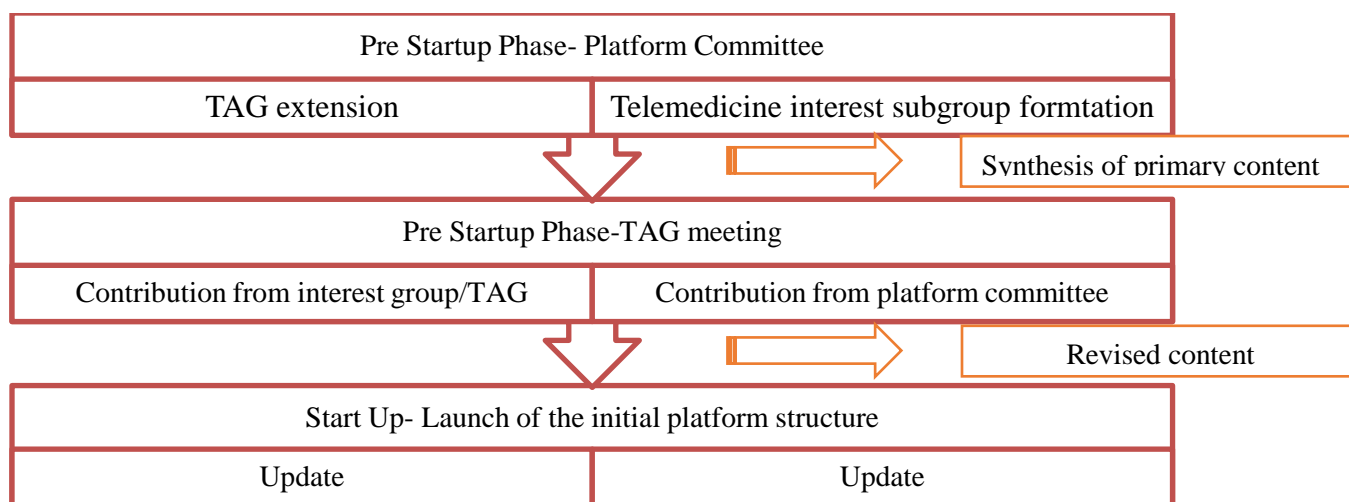
The existing TAG (Technical Advisory Group) of SEARCH research project will be extended and will be made functional. A platform committee will be formed. It will be formed by members from the host and co-hosting institutions. The committee formation details and mandate will be articulated and circulated. A detailed work plan for the committee will be formulated. The initial content of the platform will be finalized by the committee in the pre start-up phase. A TAG meeting will be convened. The tentative structure will be officially presented in the TAG meeting. A telemedicine interest group, which will be specialized offshoot of TAG will be convened at the end of the meeting for providing expert support to the platform committee.

#### The start-up phase:

The primary technical structure will be a web based platform. In the initial inception phase the web platform will host the ehealth related academic research activities of the host/ co-host institution under a specific thematic area (Telemedicine). In this phase, the primary output of the platform will be information on telemedicine initiatives, research briefs and capacity development opportunities on telemedicine. The telemedicine interest group will actively contribute to support the initial structure of the knowledge platform by providing information and updates regarding telemedicine.

#### Extension phase:

In the extension phase, new thematic groups with annexed thematic interest group will be formed in consultation with the TAG and the initial interest group and the platform committee. Information of initiatives, research experience and capacity building opportunity under the new thematic group will be put up in the web platform in an organized manner.



## Resources

The maintenance and sustainability of the platform will need partnership and funding. The initial programmatic, technical, financial support will be provided by the BUHS and icddr, b.

## Output

- What will be the platform's output?
- What will be the monitoring and evaluation parameters?
  - Research updates
  - Number of notification (unit? Per week/per month)
  - Monitoring and evaluation parameter

## Sustainability plan

- Financial
 

After the initial implementation, there will be an evaluation of the platform based on selected parameters to assess the effectiveness and the output of the platform. We will search for a future partnership and funding to fund the platform after the initial phase.
- Programmatic
 

Strategic tie up with public and private sector institutions will be sought for adding contents and functionality to the platform.

## Possible funding agencies:

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