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Climatic Variability, Societal Changes, and Dengue Disease in Bangladesh

Technical Progress Report — 08

Time Period: September 15, 2013 —March 14, 2014 (NSU);
March 15, 2013 – March 14, 2014 (UM & NML)

Jointly prepared by:

Dr. G.U. Ahsan

Professor and Chairman
Department of Public Health
North South University, and
Principal Investigator
Bangladesh

and

Dr. C. Emdad Haque

Professor
Natural Resources Institute
University of Manitoba, and
Principal Investigator
Canada

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BACKGROUND AND THE CONTEXT OF THE RESEARCH PROJECT

Dengue fever is a major public health concern in Dhaka and other major cities in Bangladesh which have experienced a resurgence of the disease in recent years. The recent trend of rapid climate change, a rapid rate of urbanization, a phenomenal increase in air travel and many other socio-economic processes and changes in infrastructure have collectively contributed to remarkable changes in the social-ecological conditions, and these are resulting in various vector-borne diseases in Bangladesh.

Recognizing these issues and problems concerning public and community health and development, the University of Manitoba, Canada, and the North South University, Bangladesh, along with the Public Health Agency of Canada (PHAC) and the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), have undertaken this initiative to conduct integrative research to enhance knowledge of dengue disease transmission and intervention to control its spread in Bangladesh. Exploration of the relationships among climatic variability, socio-ecological changes and the spread of dengue is critical in understanding the complex systems, in determining the appropriate interventions, and in assisting in the formulation of public health and development policies. In Bangladesh, these aspects have been constrained by the lack of reliable data, primarily because the country has a poor surveillance system, and the negligible involvement of local communities in dengue prevention and control. This research project also encompasses the development of a multi-scale (local, national and global) and multi-sectoral approach and interventions that could effectively prevent and control dengue in Bangladesh.

Major objectives of this research include:

1. to attain a better understanding of the role of, and interactions among, the climatic, ecological, biological, social, and human behavioural determinants of dengue disease transmission in Bangladesh;
2. to apply enhanced knowledge in a multi-scale, inter-sectoral, socio-ecological system management intervention for dengue disease prevention and control; and
3. to contribute to innovation and the formulation of a participatory public health policy and practice incorporating socio-ecological system management interventions for dengue disease prevention and control.

Goals of the project will be accomplished through three distinct temporal phases:

- The Discovery Phase;
- The Implementation Phase; and
- The Scaling-up Phase: Health Policy and Practice, Impact Assessment and Scaling-up Phase

The present IDRC-funded project will encompass the Discovery Phase during the 2010-2015 period.

This technical report covers the period between 15 September 2013 and 14 March 2014. By assessing the project scope, the progress in Year I to IV, the lessons learned from field experience, the institutional commitments, and the feasibility of implementation in terms of human and financial resources, a detailed revised Research Activity Plan (RAP) for the Bangladesh partners was formulated for the remaining periods of the project (i.e., Years III and IV). This RAP was formulated based on discussions with the local and international project partners, who critically reviewed the ongoing and future opportunities, barriers, and challenges to project implementation; the process was led jointly by the Principal Investigators in Bangladesh (Prof G.U Ahsan) and Canada (Prof. C. Emdad Haque). In the deliberation process, special attention was paid to the community development and mobilization activities for raising health and dengue awareness; exploration into the community-based dengue monitoring, control and prevention measures; conduct of the socio-economic, land-use and ecological surveys; the climatic and meteorological data collection; completion of the ethnographic studies of three selected communities; integrated data base creation and data analysis for publications and developing other knowledge-product; and dengue research capacity building in Bangladesh. The appropriate budgets were formulated with the aim to implement the RAP and they were submitted to IDRC for consideration. The submitted budgets were approved and a process to execute the revised activity plan began.

MAJOR ACTIVITIES AND ACHIEVEMENTS IN BANGLADESH (during 15 September 2013 – 14 March 2014) - By North South University, in collaboration with the Population Services Training Centre (PSTC) and the Director General of Public Health Services, Government of Bangladesh

North South University facilitated and successfully conducted the first, second, third entomological surveys during the earlier years by providing all necessary logistics, local experts and consultants, and by recruiting the field research assistants, data entry personnel and arranging deputation of entomologists and entomological technicians by the Directorate General of Health Services (DGHS), Ministry of Health and Family Welfare (MOHFW), Government of Bangladesh. Soon after completion of the fourth entomological survey a meeting was organized at North South University, Dhaka, Bangladesh with the participation of Population Services Training Centre (PSTC), University of Manitoba (UM), and a Consultant with her expertise in the field of Community Development and Participatory Research.

Under the leadership of both the Project Leaders (Bangladesh and Canada) four Research Assistants were recruited from the Department of Public Health, North South University and they were trained for checking data procured by the fourth entomological survey. Following this, a plan for preparing number research manuscripts was formulated by the Bangladesh research team. In this regard, research objectives were reviewed and a plan for data processing and data analysis was made. Subsequently, proposals for paper presentations at the Ecohealth 2014 conference to be held in Montreal, Canada in August 2014 were submitted. We were delighted to find that our proposals for papers were accepted by the Ecohealth 2014 conference organizers.

In order to implement the community mobilization and development component of the project, efforts were made to coordinate activities closely among North South University (NSU), the Population Services Training Centre (PSTC) and the University of Manitoba. The NSU and the University of Manitoba research teams facilitated a meeting at the Department of Public Health in early September 2013 to assess the progress of project activities. Upon the request of the local communities, a participatory research and need assessment has been conducted in the selected Wards again. The study was conducted in three selected wards of Dhaka city, namely Mohakhali (Ward no. 20), Meradia (Ward no. 26) and Chankharpul (Ward no. 69). These sites were purposively selected to represent three different types

of socioeconomic status -- Mohakhali representing high socio-economic status (SES), Meradia representing moderate SES and Chankharpul representing areas of low SES. Even though three different study areas were selected based on generalized socio-economic status, in each area there were mixed groups of residents. In order to reflect Ward SES characteristics, respondents were selected purposefully – in Chankharpul, respondents were selected from low socio-economic status; in Maradia, respondents were selected from moderate socio-economic status and in Mohakhali they were selected from high socio-economic status.

Based on the recommendations made by the Need Assessment report and decisions by both NSU and UM research teams, three volunteers have been selected and group formation among the general population of the selected communities began. The volunteers were school teachers and social workers by profession. Relying on the findings of the entomological surveys and expressed need of the local community members, it was decided that a water tank will be set up at a common place of Chankharpul Ward from where the community members will be able to access water for their daily usage and maintenance. The common needs as well as some differential needs for the prevention of dengue disease were identified in the need assessment and the activities listed below were undertaken by PSTC (the NGO partner), under the supervision of Dr. Quamrun Nahar who has been providing services to the Project as a consultant of community development program. Dr. Nahar is currently working as Associate Scientist at ICCDDR, B and as a part-time faculty member of the Department of Public Health and looking into how to prevent the dengue disease in local urban communities of the City of Dhaka. The activities carried out by PSTC included:

1. Distribution of printed materials such as, leaflets, brochures and posters on prevention of dengue; and
2. Organizing workshops, training sessions and meetings to raise awareness among the people living in the project areas about dengue risk and methods of prevention and control;

In addition, plan has been made to assist the local communities to implement their newly gathered knowledge about dengue prevention and control. Project support to infrastructure repairing such as, repairing drainage system, supporting the operation of children day care centers for working mothers and distributing mosquito nets among the needy was thought to be effective in this regard. Further assistance to community water storage system and construction of local waste disposal sites would be beneficial.

To order to carrying out in-depth ethnographic studies in one of the three selected communities of the City of Dhaka, a graduate student at NSU, Mohammad Sayket Ahmed Shakil, was recruited. He completed his research work on Mohakhali Ward, under the Supervision of Dr. Quamrun Nahar, and presently finalizing the report and the master's thesis.

To attain the objective of ecology and land-use, entomology, climate, GIS and community development components, consultants were recruited during the stated period. Dr. Shaikh Tawhidul Islam, Jahangirnagar University, was appointed as Climatic Consultant who is also working presently as a part-time faculty member of the Department of Public Health, NSU.

LESSONS LEARNED AND CHALLENGES AHEAD: A REFLECTION AND PROJECTION

- The precarious socioeconomic conditions of the masses, the massive urban sprawl, paucity of necessary infrastructure and the consequent traffic congestions, predominance of bureaucratic red tape – all create immense barriers against pursuing reliable research pursuits. These factors, in turn, hampered maintaining the implementation schedule. However, because of the dedication and commitment of the institutional partners of the project, both in Bangladesh and Canada, it was possible to overcome most of such barriers and implement the planned activities.
- Some elements of social conditions created serious setbacks in implementing the project activities. For example, in recruiting an entomologist and a medical anthropologist in the Department of Public Health at North South University, we faced enormous challenges. North South University has the provision to recruit only faculty members with North American, British or Australian academic degrees. After several rounds of advertisements, the responses were limited and many applicants did not meet the requirements. After using personal network, we succeeded to recruit four capable Consultants: i) Dr. Kabirul Bashar, Assistant Professor, Dept. of Zoology, ii) Dr. Sheikh Tawhidul Islam, Associate Professor, Department of Geography and Environment, Jahangirnagar University, iii) Mr. Hasan Mahmud, Assistant Professor, Dept. of Geography and Environment, Jahangirnagar University, and iv) Dr. Quamrun Nahar, Associate Scientist, Public Health Division, ICDDR,B. They are all working in the Department of Public Health as part-time faculty members.

- Institutional barriers often created serious obstacles against partnership and collaboration. Such barriers might have stemmed from variations in disciplinary orientation, professions, knowledge and administrative culture. To overcome such barriers, it was realized that close coordination and interactive research collaboration and exchanges among personnel from various fields including the vector and community development components (NSU and PSTC) and the serological component (NSU, UM and ICDDR,B) are vital to achieve the goals and objectives of the project. Establishing and strengthening bridges to achieve the goal of a transdisciplinary research were given priority in the implementation of research activities. The North South University (NSU) and University of Manitoba (UM) have been making serious efforts to assist in making such institutional linkages in Bangladesh among the government, NGOs, and other institutions. The success of dengue research collaboration in Bangladesh is being reelected in the community members' training, training of field research personnel on entomological research, student theses, conferences presentations, and publications in peer-reviewed journals.
- The research and administrative activities of NSU, PSTC, UM between 15 September 2013 and 14 March 2014 laid further ground for very reliable, authentic, transdisciplinary, and participatory research in Bangladesh. The teams developed necessary confidence that this challenging research work could be carried out with the dedication of the local communities, students, researchers and other stakeholders.

IN-KIND CONTRIBUTION MADE BY NORTH SOUTH UNIVERSITY

- Considering the national and international scope and significance of the project, the academic and research administration of North South University (NSU), along with the governing body, that is, the Board of Trustees, have been providing strong support to the project since its inception. They have demonstrated a high level of commitment by approving and meeting the human resource needs and other infrastructural facilities required for operating the project and its activities within and outside NSU. Administrative officers of the Logistics and Human Resource Department, Department of Procurement, Department of Public Relations, and Department of Information Services have been providing their vital support since the inception of the project. Such support has been critical in areas of event management, report preparation, media and press coverage, and public engagement.
- The North South University administration allocated five office rooms and an entomological laboratory space to the project. The utility services and other cost are being borne by NSU. The allocated office space has been approved for this project upto December 2015.
- The data entry infrastructure was provided by the Department of Public Health, NSU through establishing a computerized laboratory with five desktop computers. The necessary hardware and software were also provided by NSU.

MAJOR ACTIVITIES AND ACHIEVEMENTS IN CANADA AND BANGLADESH (during 15 April – 14 March 2014) – by the University of Manitoba, in collaboration with PHAC, National Microbiology Laboratory, Winnipeg, Canada, North South University, Bangladesh, and ICDDR,B, Bangladesh:

- Significant advancements have been made in the area of serological data storage, shipment from Bangladesh to Canada, and the processing and tests in the laboratory. A total of 817 blood samples were collected from 12 Wards of the City of Dhaka for the post-monsoon 2013 period. These blood samples were transferred by ICDDR,B, Dhaka to the National Microbiology Lab., in Winnipeg in February 2013 as they were received through a cold-shipment in February, 2014.
- Plaque Reduction Neutralization Test (PRNT) (at level 3 facility of the National Microbiology Lab.) of 100 randomly selected samples from pre-monsoon-2012 was carried out for pre-monsoon 2012 which reveal the presence of dengue virus only among the population, no exposure to JEE and West Nile virus (WNV) has been detected
- By mid-March 2013, IgM ELISA and IgG ELISA test results of a total of 1,128 samples of the pre-monsoon 2012 were obtained. The IgG ELISA results revealed that 80.2% of the samples were sero positive, whereas IgM ELISA results showed 18% of sero-positivity. This implies that 18% of the total samples have been exposed to dengue virus in recent months (within the last 3 months of the blood sample collection period). However, based on the recent procedure of detecting correct IgM positive results, the background subtraction of all IgM positive samples from pre-monsoon 2012 have been completed. The results revealed 2.1 percent of sero-positivity in the blood samples collected.
- The Canadian research teams, including Dr. C. Emdad Haque and Parnali Dhar Chowdhury of the University of Manitoba, and Dr. Robbin Lindsay of the National Microbiology Laboratory, in collaboration with North South University and the Directorate of Public Health, Government of Bangladesh, led and conducted the Fourth entomological survey in Dhaka, Bangladesh during August 19-September 5, 2013. In this regard, 15 entomological technicians and 35 NSU research fellows were trained in mosquito field data collection.
- Larvae and pupae samples were collected from a total of 1,131 households during the fourth entomological survey. The sample specimens were examined at the NSU Public Health laboratory for detecting type of *Aegypti* mosquito.

- The University of Manitoba research teams, including Dr. C. Emdad Haque, Parnali Dhar Chowdhury, and a specialist on statistical techniques, Dr. Shakhawat Hossain of the University of Winnipeg, systematically compiled all 4 entomological survey data. Integration of these data sets is being made by assigning a common identity mark (i.e., a global ID) to each case.
- The ethnographic field survey data from the Chankharpool Ward of the City of Dhaka was compiled and processed by the Department of Anthropology, University of Manitoba (Canada) graduate student, Ms. Afroza Sultana, under the supervision of Dr. Stacie Burke. The research methods included the survey of the Ward population, participation observation of dengue prevention and control measures, key informant interviews and focus group discussions. The data are being analysed for preparing a master's thesis.
- The University of Manitoba (Natural Resources Institute) graduate student and faculty member of North South University (Bangladesh), Ms. Sabrina Islam, has successfully passed her Candidacy Examination, and was awarded IDRC Doctoral Fellowship to pursue her field work in Bangladesh on climatic and ecological determinants of dengue in the City of Dhaka, Bangladesh. Her thesis work will complement the climate and socio-ecological component study of the present project.

Analysis and result dissemination

- During the stated period, analysis and dissemination of the project results were given special attention. The activities included the following:
- A book chapter, entitled on “Why is an Integrated Social-Ecological Systems (ISES) Lens Needed to Explain Causes and Determinants of Disease?” by Parnali Dhar Chowdhury and C. Emdad Haque (equal contribution) to the book entitled “Ecological Health: Society, Ecology and Health,” *Advances in Medical Sociology*, Vol. 15, pp. 217-239.
- A peer-reviewed journal article, entitled “Community Perspectives of Dengue transmission in Dhaka, Bangladesh: An Integrative Methodological Approach”, by Dhar Chowdhury, P., Haque, C. E., Driedger, M. and Hossain, S. has been accepted for its publication by *International Health* (in press).
- A paper (poster) entitled “Understanding Dengue Transmission in Dhaka, Bangladesh” was presented at the American Society of Tropical Medicine and Hygiene 62nd Annual Meeting, Washington D.C., U.S.A. November 13-17, 2013, by Parnali Dhar Chowdhury, C. Emdad Haque, Michael Drebot and Robbin Lindsay.

- A paper entitled “Dengue Transmission and Risk Factors in Dhaka, Bangladesh” was presented at the Global Risk Forum (GRF) Davos One Health Summit 2013, Davos, Switzerland, November 17-20, 2013 by Parnali Dhar Chowdhury, C. Emdad Haque, Michael Drebot and Robbin Lindsay.
- A paper (poster) entitled “Is it a bad mosquito, a defective virus, or filthy environment? It is an Ecohealth approach to understand dengue transmission” was presented at the Graduate Poster Competition by C.H. R. Faculty of Environment, Earth, and Resources, University of Manitoba, September 23, 2013, by Parnali Dhar Chowdhury, C. Emdad Haque, and Robbin Lindsay.
- A paper entitled “Role of primary care providers in dengue prevention and control in the community: practitioners’ and local laypersons’ perspectives in Dhaka, Bangladesh” was presented at the European Forum of Primary Care (EFPC 2013), Istanbul, Turkey, September 8-10, 2013, by Parnali Dhar Chowdhury, C. Emdad Haque, and Sumon Meyur.
- A paper (poster) entitled “Understanding dengue transmission through Ecohealth Approach” was presented at the Canadian Student Health Research Forum (CSHRF) – Manitoba Provincial Competition, on “Big Science, Informatics and Biomedicine”, University of Manitoba, Winnipeg, Canada, June 4, 2013, by Parnali Dhar Chowdhury, C. Emdad Haque, Michael Drebot and Robbin Lindsay.
- A paper (poster) entitled “Understanding dengue transmission through Ecohealth Approach” was presented at the Canadian Student Health Research Forum (CSHRF) – CIHR National Competition, on "Big Science, Informatics and Biomedicine", University of Manitoba, Winnipeg, Canada, June 5, 2013 by Parnali Dhar Chowdhury, C. Emdad Haque, Michael Drebot and Robbin Lindsay.

IN-KIND CONTRIBUTION MADE BY THE UNIVERSITY OF MANITOBA

- The Clayton H. Riddell Faculty of Environment, Earth and Resources of the University of Manitoba has been providing administrative and logistical support to the project since its inception. An Office Assistant at the Natural Resources Institute was assigned to look after the project financial and bookkeeping matters.
- The University of Manitoba has also contributed to the infrastructural needs of the project, particularly through providing computer hardware and software, and computer time.

IN-KIND CONTRIBUTIONS OF THE NATIONAL MICROBIOLOGIY LABORATORY

- The National Microbiology Laboratory (PHAC) has been providing the necessary laboratory infrastructure and logistical supports to test the serological samples. A substantial portion of the cost of supplies is being borne by the NML.

LESSONS LEARNED AND CHALLENGES AHEAD: A REFLECTION AND PROJECTION

- Institutional barriers often create serious obstacles to partnership and collaboration. Such barriers might have stemmed from variations in disciplinary orientation, professions, knowledge and administrative culture. To overcome such barriers in our project, coordination among the field research pursuits being carried out by NSU and PSTC (the vector and community development components), ICDDR,B (serological component), UM, NSU and Jahangirnagar University (climate, ecology) is critical. Keeping the goal of the transdisciplinary research orientation of the project in mind, the North South University (NSU), University of Manitoba (UM), ICDDR,B and PSTC are working together to establish international as well as national institutional linkages in Bangladesh. In this connection, a close coordination with the Directorate of Public Health Services, Ministry of Health and Family Welfare, Government of Bangladesh is being maintained.
- The local research team in Bangladesh has attempted to make up the time loss in research due to political unrest during the early months of 2013. The political situation has stabilized following a national parliamentary election in early 2014 and project personnel in Bangladesh are presently taking full opportunity to catch up with research outputs.
- The research and administrative activities of NSU, PSTC, UM, and PHAC during 2013 and early 2014 laid the ground for very reliable, authentic, transdisciplinary, participatory research on dengue in Bangladesh. The teams developed further confidence that this challenging research work will be able to achieve its goals and objectives with the dedication of the local communities, students, researchers and other stakeholders. For instance, the four entomological surveys, the first KAP field work, and three serological surveys helped enormously in building field research capacity among entomologists (who are the employees of the Government of the People's Republic of Bangladesh), NSU graduate students, nurses, and field epidemiologists in Bangladesh. These human resource capacity-building efforts will have a far reaching positive impact upon the health and community-participatory research capacity in the country.