The receipt of a Strategic International Partnership Travel (SIPT) award by our collaborative group allowed five investigators from the University of Washington to travel to Bangladesh in March of 2015 to develop and foster new interdisciplinary research and educational collaborations. The trip was incredibly successful and has already resulted in a visit from a team from the icddr,b to the University of Washington (during the week of April 13) to discuss a grant submission in the area of enteric diseases and growth. In addition, a number of collaborative proposals and analyses are continuing to be discussed by members of the team with colleagues at icddr,b. The investigators who participated in this trip (and their affiliations) are listed below.

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<th>Name</th>
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Four days of meetings were held at the icddr,b (International Centre for Diarrheal Disease Research, Bangladesh) with researchers from that institution and with faculty from BRAC University. As noted in the application, we focused on three main areas for collaboration:

- **Women’s, Children’s and Adolescent Health**
  1) Reproductive health, family planning.
  2) Sexually transmitted disease management.
  3) Understanding the success of South Asia in reducing child and maternal mortality.

- **Nutrition and Enteric Disease**
  1) Management of enteric pathogens to improve growth and development.
  2) The gut microbiome and growth.
  3) Nutritional interventions along the continuum of the life cycle.

- **Climate Change, Environment and Health**
  1) Diarrheal disease associations with urbanization and climate change.
  2) Modeling environmental change and chronic disease risk.
3) Nutritional risk patterns in response to environmental shifts.

A brief summary of the trip, including an overview of trip activities and initial outcomes is provided below. In addition, a copy of the schedule of activities is attached to this report.

The initial day of the visit provided an opportunity for colleagues at icddr,b and BRAC University to present an overview of institutional research priorities and activities. This was followed by a presentation on UW research activities and priorities by Dr. Judith Wasserheit, Chair of the Department of Global Health at UW. The following two days were divided into half day sessions that explored opportunities to collaborate in each of the three areas noted above. Brief presentations were made by icddr,b, BRAC and UW researchers, followed by discussion of areas for further exploration and collaboration. Interspersed into these days were tours of the clinical and laboratory research facilities available at icddr.b. Finally, a formal “Grand Rounds” type lecture was held by Professors LuAnne Thompson and Kristie L. Ebi who jointly presented a seminar entitled: The Emerging Challenges of Climate and Environmental Change to Human Health. A final wrap up session on the afternoon of the concluding days activities provided an opportunity for leaders from both institutions (Dr. John Clemens, Executive Director of icddr,b and Dr. Judith Wasserheit, Chair, Dept. of Global Health, UW (among others – see attached schedule) to highlight the very high level of mutual interest and commitment to future collaboration. In addition, a focused discussion on next steps to move the collaboration was held. A summary of next steps, divided into topic area is provided below.

1) Women’s, Children’s and Adolescent Health

Several key areas for project development were suggested, and key personnel from UW and icddr,b identified, to lead the development of grant proposals in these areas. First, the development of a proposal to evaluate the use of a clean delivery kit (Clean Kit) developed by icddr,b. In Bangladesh, 70% of women deliver at home with the aid of a community health worker (CHW). icddr,b has developed a Clean Kit to be used by CHWs to reduce morbidity and mortality during labor and delivery. The Clean Kit includes a QMat, which is a biodegradable mat that can absorb up to 450 mL of blood during labor and delivery. If a mother bleeds greater than this amount, it is no longer absorbed into the mat, as is a visual cue to expedite her transfer to a medical facility due to significant post-partum hemorrhage. Additionally, the Clean Kit includes a Tampostat. This is a simple balloon device to physically compress the uterine wall and tamponade sites of acute hemorrhage. This Clean Kit is in use in Bangladesh, and the proposed project would be to roll out its use in Kenya, where 50-70% of births occur at home, and compare improvements in morbidity and mortality during labor and delivery. Additionally, icddr,b is rolling out an augmented Clean Kit that will contain Misoprostol, an oxytocin medication that will stimulate contraction of the uterus to decrease blood loss. The proposed project would also determine additional improvements in maternal morbidity and mortality within Bangladesh using this added medication. The lead principal investigators for this project would be Dr. Anisur Rahman at icddr,b and Dr. Jennifer Unger at UW.

The second project proposed is a human papillomavirus (HPV) prevalence and vaccine rollout study. Cervical cancer is the second leading cause of cancer death in women in Bangladesh, and HPV is the causative agent of this cancer. The first prevalence study in Bangladeshi women was published by Dr. Quamrun Nahar at icddr,b in 2014, but there is no national recommendation or mandate on cervical cancer screening. Self-obtained vaginal swabs for HPV DNA is well-received among women who do not participate in national screening protocols in many countries, including the USA, and this test can be collected in low-resource
settings easily, especially where CHWs are available. Belgium is even changing its screening guidelines from Pap smear evaluation to self-obtained swabs for HPV in 2016. Our proposed study would be to determine the acceptability and feasibility of self-obtained swabs for HPV DNA among married women, to collect and determine prevalence and incidence rates for HPV infection using this collection method, and to educate women about HPV and cervical cancer. A second arm of this study would be to roll out vaccination against HPV among school-aged girls. Bangladesh is a GAVI-eligible country, and they have applied for HPV vaccines as a part of this program. However, they plan on using the bivalent vaccine that only protects against two HPV types, while there is a quadrivalent and now 9-valent HPV vaccine available for use. We propose to rollout HPV vaccination using the 9-valent HPV vaccine among school-aged girls, and to use that opportunity also to educate girls about HPV and general adolescent health. The lead principal investigators for this project would be Dr. Quamrun Nahar and Dr. Shams El Arifeen at icddr,b and Dr. Rachel Katzenellenbogen and Dr. Rachel Winer at UW.

Finally, icddr,b has recently completed data collection from a large trial involving 4000 deliveries that evaluated training of health care workers to improve outcomes related to neonatal asphyxia. A PhD student from UW (Gillian Levine) has now been in discussions with the team at icddr,b regarding assisting with the analysis of these data and nesting a component of her dissertation within this trial.

Additional areas for future collaborative projects were also discussed, including studies of improvements in family planning in adolescents, improvements in general adolescent health and sexual health education, augmentation of nutrition support at the initiation of pubertal development to maximize growth and future fertility, and male health.

2) Nutrition and Enteric Disease

This is an area where a pre-existing collaborative relationship exists between the groups and where multiple funded trials, observational studies, and projects are underway. Opportunities to engage other UW investigators, particularly in the areas of microbiology, microbiome analyses and nutrition were noted and Dr. Walson and Dr. Pavlinac are coordinating an enterics group meeting to discuss these opportunities in Seattle in June.

In addition to the existing work, several additional specific areas for collaboration were identified:

A. The development of a proposal to the Bill & Melinda Gates Foundation (BMGF) to expand a National Institutes of Health-funded (Walson-PI) randomized controlled trial of azithromycin use to prevent post-hospitalization morbidity and mortality from Kenya sites to also include Bangladesh sites where morbidity, mortality, and antimicrobial resistance rates differ substantially. Dr. Walson and Dr. Ahmed have initiated discussions with the Enteric and Diarrheal Disease (EDD) team at the Bill & Melinda Gates Foundation and are beginning to develop this proposal.

B. Plans to collaborate on secondary data analyses and associated manuscripts a) to examine the role of specific enteric infections in the risk of post-acute diarrhea morbidity and mortality and to identify plausible mechanistic pathways by which these specific bacteria increase risk, b) to determine host and clinical factors associated with specific bacterial/parasitic pathogens that merit antimicrobial treatment according to World Health Organization diarrhea management guidelines, and c) to explore associations between temporal changes in *Shigella* species and climate in the last 40 years using available data. Dr. Walson, Dr. Pavlinac, and graduate students in the departments of Epidemiology and Global Health are working closely with Dr. Tahmeed Ahmed, Dr. Qadri and Dr. Faruque on these analyses.

C. Finally, icddr,b identified a clear opportunity and need to develop epidemiology methods, biostatistics, and implementation science short-courses led by University of Washington faculty members to be conducted in Bangladesh. The next steps involve engaging with
faculties from relevant UW departments to gauge interest and availability and identify potential sources of support.

3) Climate Change, Environment and Health

There was a high level of interest in exploring further opportunities in climate change and health between the institutions. Specifically, the potential of analyzing the environmental drivers of a range of climate-sensitive diseases, using their long-term health surveillance data was discussed. The teams agreed to develop one or more pilot research activities with Dr. Streatfield and his group, focused on describing associations between specific epidemic and endemic enteric infections, particularly those caused by *Vibrio cholerae* and *Shigella* species, and environmental variables. Identifying a link between environmental changes, such as local changes in oceanographic conditions, and cholera epidemics may enable the development of early predictions of cholera outbreaks that would have significant benefits for public health and health systems. Identifying associations between weather and climate data such as temperature, rainfall, and the state of El Nino, and temporal changes in dysenteric *Shigella* species over the last 40 years may offer novel insights into mechanisms of this important pathogen’s evolution and could generate hypotheses of possible environment-level interventions. Preliminary results in either of these areas could lead to highly relevant and competitive proposals to US funding agencies, foundations, and private donors. In addition, other UW investigators, including Drs. Fassal Hossain and Rebecca Neumann (Faculty in CEE), have been identified as important potential collaborators and discussions have been initiated with both of them about additional potential opportunities for collaborations at icddr,b. For example, Professor Hossain has an active NASA sponsored research program that developed a satellite based flood forecast system in collaboration with the Government of Bangladesh. There is potential for linking that forecast system to health forecasts of outbreaks of diarrheal disease.

Leadership from both institutions were very enthusiastic about forging a strong collaborative relationship at the Institutional and Departmental level and were committed to seeing this partnership evolve beyond individual relationships between investigators. Overall, the trip was highly successful in building on existing relationships and catalyzing new peer-to-peer and institution-to-institution relationships. Opportunities for joint grant proposals are already being taken forward and a number of graduate students are in discussion with collaborators at icddr,b about potential thesis and dissertation work that could be conducted jointly.