ACTIVITY REPORTING FORM
FOR CDC GRANTS PROGRAM
IMU Simons African Fellowship Program

(Deadline for completion: four (4) week after the end of the research visit)

Please note that at least four pictures of the supported activity should be included/ attached to this report. (by email).
After consideration by CDC, the intention is that this activity report and pictures will be made publicly available on the CDC website.

Dates spend at the centre/host institution: 1st September 2019-29th December 2019

The progress report should a brief (one page) activity report:

1. Summary statement (1-2 sentences) of major outcome of your visit:
   - Two articles in preparation on *Modeling the interplay between human and adaptive mosquito behaviour, decay in bed-net efficacy on malaria prevalence*
   - I learnt more on how to analyse nonlinear dynamical systems with Maple and MATLAB, how to estimate parameter and partial identifiability
   - I also learnt how to Canvas online class management platform, and how to prepare an online course

2. Brief description of your research activities during your research visit:
   - During the four months of my visit to the University of Florida, I made big strides in my research on modelling the interplay between human and mosquito behaviour and malaria control strategies. The resources in the Mathematics Department and University in general were modern and of high quality. The internet was extremely fast and readily available. I could easily access almost any research resources I needed. I had excellent support from the IT Department in setting up my online account and profile that gave me access to all I needed online.
   - The first month was spent discussing and reviewing literature to re-formulate malaria models to capture our targeted challenges to control measures. We were able to identify two areas to include in our research; bed-net efficacy and the emerging mosquito resistance to pyrethroids, and the interplay between human choice to use or misuse treated bed-nets using a game theory approach. We are working on both model hoping to complete the analysis and proofs in the month of February for publication.
   - My days were spent learning new theories and their application to the models, updating the models, reviewing relevant literature, doing mathematical analysis and writing the manuscript using LaTeX.
   - We had joint discussions with my host, Dr. Ngonghala, his two graduate students, Jesse Adamski and Hardik Desai, and other departmental faculty working in Bio-mathematics. I got a chance to meet and mentor one of his masters’ student, Tabou from Benin who visited the department to complete his master’s thesis. He was able to reformulate the model for his project with our help and successfully defended his thesis and graduated in December.
   - On Thursdays, we had Bio-math Seminars. They were very helpful to me as I learnt what the other researchers were doing and got useful tips to enhance the quality of my research. I got a chance to present my work the Bio-math. Seminar on 31st October 2019. I also attended Jesse’s PhD oral exam.
   - The last month of my visit was involving as we worked used MAPLE to carry out and/or check some of the analysis of the two models and agreed to complete and submit the first paper by end of January and the second paper by end of February, since there was not enough time to finish up and submit the manuscripts before my departure.
   - The International office was very helpful to my visit, they facilitated my settling down, getting health insurance, and organised many social activities for the international visitors. During the Thanksgiving week, had a party where we prepared our local food dishes for sharing. We had a rare chance of attending the homecoming in Gainesville during the month...
of October. The event was amazing with exciting cultural activities. They organised parties and events for us and made us feel at home and learn more of the American culture.

3. Students and post-doctoral fellows advised:
   I did not advice any student per se, but I got a chance to hold discussion of my work, work on the projects together with three of Dr. Ngonghala’s students, Jesse, Hardik, and Tabou.

4. Joint activities with your host:
   Two research articles in preparation, presentation of my work during the Bio-math seminar, discussions centred on career development, mentorship of graduate students and grant proposal writing.

5. Research in progress (as a result from the visit): Three papers in preparation. One of the papers titled: Modeling adaptive mosquito behavior and decay in bed-net efficacy on malaria prevalence is in collaboration with Dr. Ngonghala and two of his graduate students (Jesse and Hardik). The first paper should be ready for submission by end of February 2020. The second titled: Impact of individual strategy in using bed-nets on the pattern of malaria transmission: a game-theoretic approach was done in collaboration with Prof. Samit Bhattacharyya, from the University of Antwerp, Germany, and an expert in Game theory, myself and Dr. Ngonghala. We expect to finish up by end of March 2020. The third paper titled; Partial Identifiablity- Estimating malaria prevalence from data is being done in collaboration with Prof. Singer Burton, from the Emerging Pathogens Institute, University of Florida, using data from the Garki project. This paper should be ready by end of April.

6. Papers in preparation resulting from the research visit:
   2. Wairimu, J., Ngonghala, C. N., and Bhattacharyya, S. Impact of individual strategy in using bed-nets on the pattern of malaria transmission: a game-theoretic

7. Planned future activities as a result of your research visit:
   - First, we want to complete the papers and get them published in high impact journals.
   - Then we start and continue working on a third paper.
   - We plan on recruiting and co-advising two masters and possibly two undergraduate students from the University of Nairobi to benefit from the mentorship program and facilitated the application process for admissions into a Ph.D. program at the University of Florida for one student from Kenya that we will co-advice.
   - We have applied for a (alumni) follow up CARNEGIE African Diaspora Fellowship to support Dr. Ngonghala’s next three-months (May-July, 2020) visit to the University of Nairobi. If successful, we will concentrate on research activities involving both graduate and undergraduate students, student-mentorship, and curriculum review.
   - The work I had planned to do turned up to be more than I expected, so we were unable to model a combination of the mosquito and human behaviour, neither did we integrate social economic factors due to time limitation. Our plan is to apply for more funding, to support a full year’s visit starting from August 2020, which will serve as my sabbatical leave. If successful, we will be able to mentor more students, publish more papers and apply for more grants to do more investigation on malaria control.
   - Since we were not able to work on mosquito behaviour, once the Game theory paper is done, we will embark on another project to include mosquito foraging and stochastic behaviour. This will also be a collaboration with Prof. Samit, Dr. Ngonghala and myself.

With my signature I agree that my Activity Report and pictures can be published on the CDC website.

Date: 30th January 2020

Signature Grantee: