Modeling Malaria Disease Spread Using Location-Specific Internet Data

Publisher: IEEE

Gbenga Adegbite; Sunday Edeki; Itunuoluwa Isewon; Jelili Oyelade; Ezekiel Adebiyi
All Authors

17
Full

-

V.

Discussion

Show Full Outline
Authors
References
Keywords
Metrics
Abstract:
Malaria importation is one of the hypothetical drivers of malaria transmission dynamics across the globe. Existing studies that focused on malaria importation used mobile phone data to study human mobility trends in relation to malaria incidences but did not capture the mobility patterns of those in the human population who do not use a mobile phone based on institutional restriction policy. Hence, the purpose of this study is to assess the impact of human mobility on malaria transmission dynamics using Covenant University Undergraduate Students in Nigeria who are restricted from mobile phone usage as the pilot population study group. One of the core objectives of this study was to develop a novel location-specific Internet Data Model (IDM) to conceptually express travel rates among the pilot population study group of interest. Furthermore, this work statistically modeled the association between IDM-derived travel and hospital-reported malaria incidences.
Published in: 2023 27th International Conference on Circuits, Systems, Communications and Computers (CSCC)
Date of Conference: 19-22 July 2023
Date Added to IEEE *Xplore*: 25 December 2023
ISBN Information:
DOI: 10.1109/CSCC58962.2023.00033
Publisher: IEEE
Conference Location: Rhodes (Rodos) Island, Greece
I. Introduction
Malaria is a consistent health-care problem in Sub-Saharan Africa, particularly in Nigeria, [1], [2]. Malaria is transmitted based on contact of a Plasmodium-infected mosquito with an unprotected human host that does not use the World Health Organization-approved malaria preventive measures, [1]–[3]. Furthermore, malaria transmission dynamics may be influenced by both climatic and human factors, [2], [4]. The climatic factors influencing the transmission dynamics of malaria include rainfall, relative humidity, wind, and temperature whereas the human factors include age, gender, and travel, [2], [4]. The aforementioned climatic factors mainly affect the population dynamics of the malaria vector which will in turn have an impact on malaria transmission within the human host, [2]. Hence, different existing studies have developed mathematical, statistical, and computational models for predicting the metapopulation dynamics of the Plasmodium-carrying mosquito, [2], [5]. However, most of these malaria vector studies focused on how the transitioning of the mosquitoes at various life-cycle stages, affects its population dynamics, [5]. In malaria-endemic regions of the World, the main malaria vector species of study interest were often “Anopheles gambiae

sensu lato, Anopheles gambiae sensu stricto, Anopheles arabiensis and Anopheles funestus", [5], [6]. Malaria importation is a key human factor that influences malaria transmission dynamics globally, [7]. Malaria importation occurs as a result of human mobility from one transmission zone to another transmission zone similar to other infectious diseases, [7]–[9]. However, most studies focused on studying malaria importation into a low transmission zone, [7]. Human mobility patterns useful for studying malaria importation are often based on mobile phone data such as "Call Detail Record (CDR)", [7]–[9]. However, the acquisition of the aforementioned mobile phone data is costly, time-consuming, and laborious for epidemiologists working in a low-resource setting with less access to funding and collaboration, [7]. Furthermore, there is limited mobile phone usage in some environments in Sub-Saharan Africa which will make mobile phone data unavailable. Hence, to gather human mobility information needed to study imported malaria in an environment where there is a restricted mobile phone usage policy, this work implemented a new cost-effective and non-laborious internet location-specific data model to represent travel rates among the Undergraduate Students within the academic environment of Covenant University in Nigeria.

Authors
Gbenga Adegbite
Department of Computer and Information Sciences, Covenant University, Ota, Nigeria
Sunday Edeki
Department of Mathematics, Covenant University, Ota, Nigeria
Itunuoluwa Isewon
Department of Computer and Information Sciences, Covenant University, Ota, Nigeria
Jelili Oyelade
Department of Computer and Information Sciences, Covenant University, Ota, Nigeria
Ezekiel Adebiyi
Department of Computer and Information Sciences, Covenant University, Ota, Nigeria

References
Keywords
Metrics