Republic of the Philippines

CAVITE STATE UNIVERSITY

Don Severino de las Alas Campus

Indang, Cavite

SELF-ASSESSMENT CHECKLIST

Research Proposal Making for Computer Science

Instruction: Review the self-assessment criteria provided and evaluate your CS research proposal. Please denote whether each criterion has been satisfied with either a '*Yes*' or '*No*' within the self-assessment form by putting a checkmark (✓) in the appropriate box accordingly.

Proposed Thesis Title : Understanding Pertussis Progression Dynamics in Changing Climates: Integrating Environmental Factors into Epidemiological Simulations

Area of Study : Modelling and Simulation

NO.	CRITERIA	YES	NO
1	Is your research proposal clearly defined and aligned with the research tracks and program objectives of computer science?	✓	
2	Does your research aim to address a gap in existing knowledge?	✓	
3	Does your research propose a novel/original solution to a CS-related problem?	✓	
4	Does your proposed methodology involve the creation and analysis of computer models to simulate complex systems or phenomena?	✓	
5	Are you going to (develop new **OR** modify existing) algorithms or software to imitate processes, events, or behaviors?	✓	
6	Does your methodology include hands-on experimentation, data collection, and analysis to validate hypotheses or test new ideas?	✓	
7	Are you implementing and testing your ideas in real-world scenarios or through practical applications? **NOTE:** This pertains to assessing the quality or attributes of the software through testing rather than gathering opinions from individuals regarding their perception of the software.	✓	
8	Does your thesis primarily focus on developing new concepts, frameworks, or models without extensive experimentation or implementation?		✓
9	Does your proposed methodology rely on mathematical proofs, logic, or conceptual discussions to support your research findings?	✓	
10	Will your research contribute new insights, theories, algorithms, or methodologies to the broader field of computer science?	✓	
11	Will your proposed research be considered acceptable and relevant by the academic community and potential stakeholders?	✓	
12	Does your proposal have direct client or organization who will serve as your beneficiary?		✓
13	Does your proposal will involve database and web/mobile app?	✓	
14	Does your research proposal align with accepted research areas within the field of computer science, such as artificial intelligence, data science, algorithms, computer networks, etc.?	✓	
12	Overall, is this proposal acceptable if you were the evaluator?	✓	

Submitted by:

IRESH ABBEGAIL D. SUMAYANG
Name and Signature of the Student

APRIL 05, 2024
Date

Republic of the Philippines
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COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY
Department of Information Technology

Understanding Pertussis Progression Dynamics in Changing Climates: Integrating Environmental Factors into Epidemiological Simulations

Proponents

Main Proponent: Sumayang, Iresh Abbegail D.

Group Members: Rivera, Edrei Reigne I.

Mercado,Jaimee RoseD.

Involved Sustainable Development Goals

1. SDG 3: Good Health and Well-being - This research aims to prevent the spread and impact of pertussis, a significant respiratory infection, by developing a proactive simulation framework for disease prediction. By integrating environmental factors into epidemiological simulations and providing personalized risk assessments, the study enables early intervention and control measures, contributing to reducing the burden of pertussis and promoting good health and well-being.

Involved CvSU Research Thematic Area

1. Area 1: Public Health and Welfare - This research falls under the thematic area of Public Health and Welfare as it aims to promote health and prevent disease, specifically focusing on pertussis. By developing a proactive simulation framework, the study seeks to identify individuals at risk of pertussis and implement interventions to mitigate that risk, thereby contributing to disease prevention efforts.

Rationale

Pertussis, commonly known as whooping cough, is a highly contagious respiratory illness caused by the bacterium Bordetella pertussis, primarily spread through respiratory droplets during coughing or sneezing (World Health Organization, 2024). The behavior of Bordetella pertussis is influenced by various factors, including climate and environmental conditions (Bouchez & Guiso, 2015). Research indicates that temperature, humidity, and air pressure can affect the transmission and incidence of pertussis (Wang et al., 2020). A study in Chongqing, China, found that higher temperatures were associated with increased monthly pertussis cases (Wang et al., 2020). Similarly, rises in precipitation, temperature, and wind velocity have been linked to notable increases in pertussis cases (Wang et al., 2020). Additionally, air pollution, particularly NO2 and O3, has been identified as potential contributors to pertussis resurgence (Melvin et al., 2014). Although the relationship between Bordetella pertussis and climate is complex and not fully understood, it is evident that various meteorological and environmental factors can influence pertussis transmission and incidence (Bouchez & Guiso, 2015).

According to recent reports from the Department of Health or DOH (2024), there have been 568 reported pertussis cases in the country with 40 deaths from January 1 to March 16, 2024, with Metro Manila reporting the highest number of infections at 58 cases. (Minnesota Department of Health, n.d.). However, traditional approaches to pertussis research often overlook the potential impact of environmental factors, such as climate variations, on disease dynamics. This study aims to fill this gap by integrating environmental factors, such as climate variation, into epidemiological simulations, shedding light on how changing climates influence pertussis outbreak severity, spread, and duration. By understanding these dynamics, more effective strategies for disease prevention, control, and management in diverse environmental settings can be developed.

Moreover, the proposed research seeks further knowledge on the progression dynamics of pertussis in terms of changing climates by utilizing advanced machine learning algorithms such as Logistic Regression, Decision Trees, Random Forests, Gradient Boosting Machines (GBM), Support Vector Machines (SVM), Survival Analysis, and Neural Networks. The framework aims to provide personalized risk assessments for individuals at different phases of pertussis risk by incorporating data on climate variations and other environmental factors such as geographical features and temperature fluctuations. By combining these algorithms with environmental data, the simulation framework aims to predict the likelihood and severity of pertussis outbreaks in changing climates, allowing for proactive interventions to minimize disease spread and impact. This approach considers the complex interaction of environmental factors and disease dynamics, enabling more effective public health strategies

and interventions for pertussis control and management.

Significance of the Study

The significance of this study lies in its potential to revolutionize pertussis prevention and management strategies through the development of a proactive simulation framework. By integrating environmental factors into epidemiological simulations and providing personalized risk assessments, this research offers several notable contributions:

The simulation framework offers personalized predictions for pertussis risk, allowing individuals to understand their specific risk factors and take proactive measures to prevent or mitigate the impact of pertussis outbreaks.

By predicting pertussis risk early, the simulation framework creates opportunities for early intervention. This helps in implementing control measures and reducing the spread and impact of pertussis, ultimately contributing to public health efforts in disease prevention.

Integrating environmental factors into disease prediction models enhances our understanding of how changing climates influence disease dynamics. This information can inform public health policies and interventions aimed at addressing climate-related health challenges.

The development of a comprehensive simulation framework for proactive pertussis prediction has the potential to have a broader public health impact by reducing the incidence of pertussis outbreaks and associated complications. This contributes to improved population health outcomes and enhances the quality of life for individuals affected by pertussis and the communities they reside in.

Objectives of the Study

The objective of this study is to develop and validate a comprehensive simulation framework for proactive pertussis prediction. Specifically, the study aims to achieve the following objectives:

1. Design and implement a simulation framework that integrates environmental factors, such as climate variations, and other relevant environmental factors such as geographical features and temperature fluctuations, into epidemiological simulations to predict pertussis outbreaks in changing climates.

2. Collect and incorporate longitudinal data on pertussis incidence, transmission rates, and disease progression in different geographical/climate areas to capture dynamic changes in disease dynamics associated with environmental factors.

3. Incorporate measurements of environmental factors, such as temperature, humidity, and air quality, into the simulation framework to assess their impact on pertussis transmission and severity.

4. Validate the accuracy and reliability of the simulation framework using real-world pertussis data sets and evaluate its performance in predicting pertussis outbreaks and their severity compared to traditional epidemiological models.

By achieving these objectives, the study aims to develop a novel approach to pertussis prediction that offers insights into the impact of environmental factors on disease dynamics, ultimately contributing to improved public health outcomes and the development of evidence-based strategies for pertussis prevention and control.

Expected Outputs

The primary output of this research is the development of a comprehensive simulation framework that integrates environmental factors, such as climate variations, into epidemiological simulations for proactive pertussis prediction. This framework aims to provide personalized risk assessments for individuals at different phases of pertussis risk by incorporating data on climate variations, geographical features, and temperature fluctuations. The simulation will allow for the prediction of the likelihood and severity of pertussis outbreaks in changing climates, facilitating proactive interventions to minimize disease spread and impact.

Additionally, the research seeks to enhance understanding of pertussis progression dynamics in changing climates by employing advanced machine learning algorithms including Logistic Regression, Decision Trees, Random Forests, Gradient Boosting Machines (GBM), Support Vector Machines (SVM), Survival Analysis, and Neural Networks. These algorithms,

combined with environmental data, will enable the simulation framework to predict pertussis outbreak patterns and severity accurately. The validation process will involve comparing predicted outcomes with real-world data to ensure the accuracy and reliability of the simulation framework in identifying pertussis outbreaks and assessing their impact under varying environmental conditions.

References

Wikipedia. Retrieved (April,4,2024) from https://www.who.int/news-room/fact-sheets/detail/diabetes-mellitus

Pertussis (Whooping Cough) Facts - MN Dept. of Health. (2022, October 26). Minnesota Department of Health. Retrieved April 4, 2024, from https://www.health.state.mn.us/diseases/pertussis/pfacts.html

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