

10TH GRADER USES MATH TO HELP SQUASH MOSQUITO-BORNE, DEADLY DENGUE VIRUS

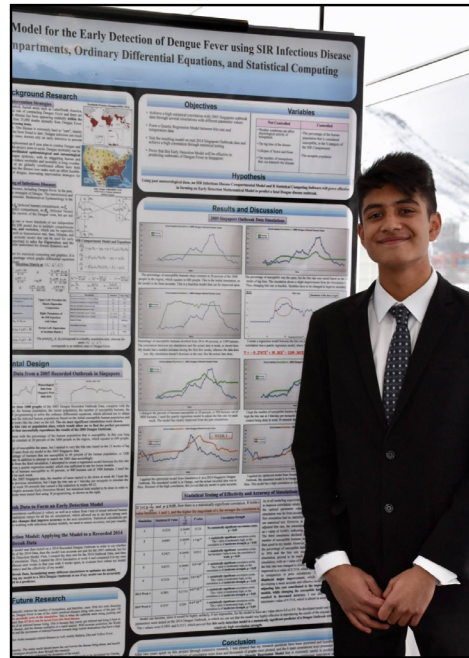
Tarun Martheswaran, a Utah STEM Ambassador currently studying epidemiology as a summer school student at Harvard ahead of entering his junior year at The Waterford School, is proof positive that math-based approaches to real world problems make a difference.

His 2018 Intel ISEF award-winning research, "Exploring the Transmission and Strategic Intervention of Dengue Fever Using SIR Compartment Mathematical Modeling and Ordinary Differential Equations," was also merited with the US Air Force Award for an Outstanding Science and Engineering Fair Project, and the Mu Alpha Theta Award for the most challenging, original, thorough, and creative investigation of a problem involving Mathematics.

But for Tarun, it was never about the awards, or having his work published by the Society for Public Science – it was about standing up to a disease that had claimed the lives of loved ones living in Southeast Asia.

"I became interested in studying Dengue as all members of my extended family currently reside in Malaysia, a country that has a high prevalence of Dengue Fever," Tarun said. "Some have been infected with these disease in the past, and close friends of my parents have passed away from severe forms of the fever."

Dengue Fever is a debilitating viral disease of the tropics, transmitted by female mosquitoes, causing sudden fever, acute joint pain and internal hemorrhaging. The World Health



Organization (WHO) estimates more than 25,000 deaths annually.

To date, no vaccine has been developed for Dengue Fever due four virus serotypes, or strains, that are extremely difficult to develop an immunity against. Early detection of Dengue is proving to be the only viable option of mitigating its transmission and potentially containing it.

So, Tarun figured out a way to apply differential equations in detecting Dengue early. His math-based model was so accurate that the Malaysian Ministry of Health has been applying it in their work against the deadly disease. Ultimately, many lives could be saved if this early detection model were to be employed in the real world.

"I set out to innovate a novel approach to detect the outbreak of Dengue disease," he explained. "With this research, I hope to achieve a more strategic way to detect Dengue Fever, so that vector control strategies can be put into place ahead of time to reduce outbreaks drastically."

Excerpted from his study abstract:

"Using actual 2005 Dengue disease outbreak data from Singapore, as well as 10 years' worth of Singaporean climate data, the average temperature and vector-human population were calculated. Thousands of simulations with varying susceptible human populations and mosquito bite rates were done to produce a quartic function relationship between the climate and bite rate. Statistical testing using Pearson's values showed a significant correlation between the test data and actual Dengue outbreaks, with 2013 R-value of 0.74, 2014 R-value of 0.53 and 2015 R-value of 0.61. These positive results indicate that we can use this novel model to accurately predict Dengue disease outbreaks and as a tool for early detection with proactive vector control measures in place, which ultimately reduces the number of deaths associated with this disease. This tool will be the only viable measure until a promising vaccine is developed to control and curb Dengue diseases that, to date, have killed more than 5 million humans worldwide."

See Tarun's study:

<https://abstracts.societyforscience.org/Home/FullAbstract?ProjectId=17890>