BRisk and GREAT: Rapid Risk Assessment for Transfusion-Transmitted Infectious Diseases on AWS (Amazon Web Services)

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Introduction

A challenge for the FDA Center for Biologics Evaluation and Research (CBER) Office of Biostatistics and Epidemiology (OBE) is evaluating and responding quickly to emerging diseases that may impact the blood supply. When a new transfusion transmitted disease emerges, detailed information and knowledge about the disease is often limited, scattered across myriad sources, which complicates risk assessment for regulatory decision-making. Geographic Risk Evaluation and Assessment Tool (GREAT) and Blood Risk (BRisk) Tool were developed to help address this challenge.

GREAT and BRisk Expedite Risk Analysis

GREAT assists modelers and decision-makers in evaluating the latest public health data from the perspective of geographic risk. The tool provides a rapid overview of changes in emerging infectious diseases using data from the U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) and identifies the regions with the most risk (e.g. ranked by risk contribution that takes into account the potential number of U.S. donors exposed in the region) for further analysis.
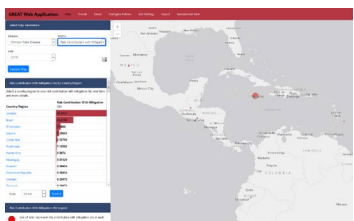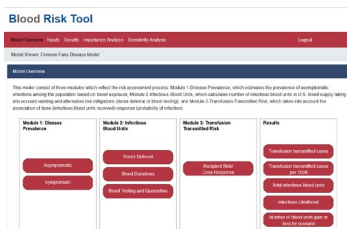

Figure 1: Risk contribution in GREAT

Figure 2: Model overview in BRisk

Once the regions of interest have been identified, BRisk performs risk assessment using probabilistic algorithms in predetermined models. Three model templates, which model different exposure mechanisms (travel, behavior, or residence), are used to create models for emerging infectious diseases using Lumina's Analytica. These models contain thousands of interconnected nodes but only a small subset of these nodes need to be changed to model a new disease. BRisk assists users in modifying a template to model an emerging disease by only exposing the nodes that need to be updated for editing in a user interface.

BRisk
and
GREAT

Modeling and simulation tools for **risk assessment** and **policy evaluation** on **AWS** to assist CBER in responding to **emerging infectious diseases** that may impact the **safety of U.S. blood supply.**

Developing BRisk and GREAT for AWS

- The FDA developed BRisk and GREAT on the OIMT Innovation Lab sandbox, which allows for experimentation with technologies not current on the MAT (Master Approved Technology) List.
- The applications use Lambda serverless functions to keep costs down. Traditional application architectures have servers running all the time, while Lambda functions run only when needed.
- To keep the Lambda functions responsive, EventBridge programmatically calls the applications' functions every 15 minutes to keep them warm.
- API gateway is used to call the Lambda functions from GREAT and will time out if the functions take more than 30 seconds to run.

AWS Costs

- OIMT required some specific resources be included which impacted costs.
- For example, a VPC interface endpoint and a transit gateway are required to connect applications to the FDA network and an elastic load balancer is required to allow users to access front-end applications from the FDA network.
- Additionally, only certain virtual servers are supported by OIMT.
- Since costs are variable, we monitor them closely.

Conclusions

- The tools provide decision-makers with important information concerning identified threats and possible mitigations and assist in the development and evaluation of emerging donor deferral and blood screening policies.
- Both tools are currently on AWS in the development enclave and will be available for testing soon.

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