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Detection of Outbreak Signals Using R

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Objective

Go to:

Develop a statistically rigorous automated process for weekly communicable disease report analysis to improve the speed and accuracy of outbreak detection in Missouri.

Introduction

Go to:

The goal of adequate biosurveillance is to signal that an outbreak may be occurring and through subsequent work is confirmed or refuted. Such a system should be equally able to detect outbreaks of diseases of extremely low reporting frequency, or those with high seasonality.

Methods of detecting increases in notifiable communicable diseases reported to the Missouri Department of Health and Senior Services (MDHSS) were based on quartile comparisons to 5-year historical disease reports for the report week and resulted in frequent detection of statistically significant increases that were, in fact, not indicative of disease outbreaks. Frequently generated alerts led to "alarm fatigue" in epidemiologists.

Methods

Go to:

MDHSS's 10-year communicable diseases database (2002-2011) was used to establish the background frequency of selected diseases: E. coli O157:H7 (a predominantly foodborne disease with strong outbreak potential, EC), erhlichiosis (a highly seasonal tickborne infection, ERH), Q fever (low incidence disease, Q), and pertussis (high incidence disease, P).

Seasonality was modeled by fitting a first- or second-order trigonometric model1 to the average reported cases in each week of the year. Assuming a Poisson distribution for the number of cases per week, we can get an estimate of the mean (or expected) count for each week. Since the mean and variance of the Poisson are equal, we are able to estimate the variance, and therefore the standard deviation, of the count from this

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