THINKMD™ | HEALTHY LEARNERS

ZAMBIA SYNDROMIC SURVEILLANCE
Diarrheal Disease (Cholera) Outbreak 2023-2024

IDENTIFYING INCREASED RATES OF DIARRHEA IN SCHOOL BASED CHILDREN AHEAD OF THE 2023-24 ZAMBIAN CHOLERA OUTBREAK

KEY HIGHLIGHTS:

1: THINKMD's clinical intelligence platform has captured over **1,16M patient encounters via 491 schools in Zambia**, generating key clinical and disease risk data that can be leveraged for program and population health insight.

2. In October 2023, a cholera outbreak surfaced in Lusaka, Zambia. Machine learning techniques were used to investigate if THINKMD's data exhibited **syndromic signals** related to diarrheal illnesses that could have forewarned of the cholera outbreak risk.

3: Results demonstrate that meaningful syndromic clinical signals could power **early warning syndromic and disease surveillance system** for conditions conducive to facilitating outbreaks such as cholera.

4: Such an early warning system would allow public health decision makers to take **proactive measures** such as improving water and sanitation service delivery, community messaging, and ultimately, prevent the unnecessary loss of life.

BACKGROUND:

Since 2019, Healthy Learners and THINKMD in partnership with the Zambian Ministries of Health and Education, has **deployed THINKMD's clinical intelligence platform into 491 schools and into the hands of 5215 trained School Health Workers (SHWs).** During every patient assessment with THINKMDs clinical decision support and data analysis platforms, key clinical and disease risk data is captured that can be leveraged for program and population health decision makers. The THINKMD platform has captured over **1,16M patient encounters, performed 16,7M clinical risk assessments and captured 17,3M number of clinical data points - an incredibly rich data set.**

In October 2023, a cholera outbreak surfaced in Lusaka, Zambia, with over 18,000 reported cases and more than 400 fatalities by mid-February. Leveraging the THINKMD dataset, which coincided geographically with the worst-affected regions (mainly around the capital, Lusaka),

THINKMD's data science experts **utilized machine learning techniques** to investigate if the data exhibited **syndromic signals related to diarrheal illnesses** that could have forewarned of the cholera outbreak risk.

METHODS:

THINKMD's data science team began their analysis by looking at encounters with diarrhea assessments, and focused on daily positivity rates. Two separate analyses were conducted, one on data from across **Zambia (n = 327,874)** and a second specifically within the **Lusaka region (n = 83,919).** Dates with a number of daily encounters below a certain threshold (<200 encounters per day) were excluded. Missing values (due to being below the threshold) were inputted leveraging statistical inference techniques. Due to the seasonal nature of the school year, the 5-day school week, and seasonality of diarrhea incidence, key trends were first identified and then controlled for. A generalized additive model was applied, accounting for seasonality, which left remaining the true diarrhea trend as well as noise. By doing this, we are able to **discern trend changes while considering the effects of seasonal patterns.**

RESULTS & DISCUSSION:

Analyses of diarrheal syndromic data nationwide and specific to Lusaka reveal a consistent pattern even after adjusting for the three major seasonal factors: weekly, yearly, and school term-related variations. From early 2022 to mid-July 2023, there was a slight decrease in incidence. However, after this period, the trend not only halted its decline (National slope = -1.7e-5, Lusaka slope = -1.6e-5) but began to rise (National slope = 1.0e-4, Lusaka slope = 6.3e-5). These findings suggest that the **incidence of diarrhea at that particular time exceeded expectations.** This analysis in school age children presents evidence that after a stable incidence of diarrheal diseases the significant increase starting in late summer - early fall represents changes in public health risk in diarrheal diseases (e.g. changes in WASH risk, introduction of enteric pathogens) that was a prelude to the emergence of the cholera epidemic identified a few months later.
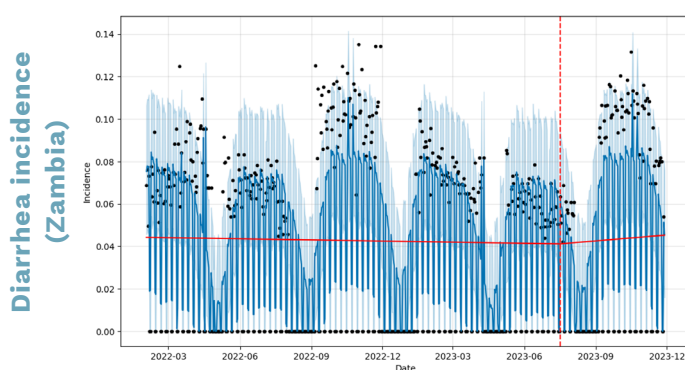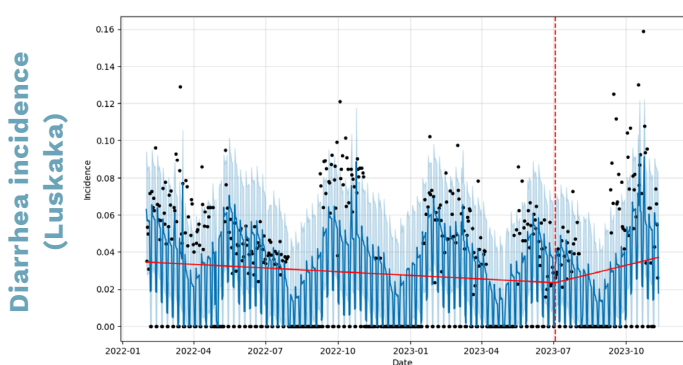
TAKEAWAY:

Though additional investigation is needed, results from this analysis demonstrate that meaningful **syndromic clinical signals are present with a school-based population** captured and identified with THINKMDs clinical decision support and data analytics platform that, in conjunction with machine learning methods, could power **early warning syndromic and disease surveillance system** for conditions conducive to facilitating outbreaks such as cholera. Such an early warning system would allow public health decision makers to take **proactive measures** such as improving water and sanitation service delivery, community messaging, and **ultimately, prevent the unnecessary loss of life.**