



Surveillance Data Dashboards

And Other Solutions for Local Public Health

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MPH Applied Practice Experience Report, abridged
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Abstract

Introduction

Public health informatics aims to enhance health outcomes using a combination of IT, data science, and business intelligence. This report uses a case-study to illustrate the use-case of a data modernization initiative at the local public health level in Michigan.

Background

The communicable disease surveillance data sharing at Kent County, Michigan, has historically been inefficient. Numerous strenuous manual data management steps were necessary to generate monthly Notifiable Disease Reports. This project produced two deliverables to address these issues

Methodology

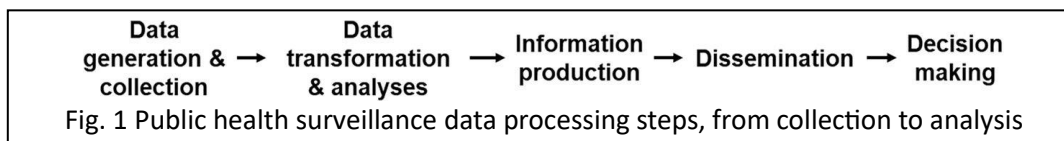
Power BI was utilized to build an intuitive, interactive data dashboard to display surveillance data. Python was used to create a novel automation tool to simplify and streamline MDSS data extraction.

Results

The time and effort associated with the monthly notifiable disease reports was reduced from 10 hours per month to 20 minutes per month, or, by 94%. Kent County may save an estimated \$4,615 annually in personnel time alone, in addition to higher employee satisfaction and faster public health response in the community.

Introduction

Public Health Informatics (PHI) is a branch of health informatics that merges concepts from IT, data science, and business intelligence to improve health outcomes (Magnuson & Dixon, 2020). The Data Modernization Initiative (DMI) within CDC uses PHI solutions to update public health data infrastructure and optimize surveillance systems to support real-time responses to public health issues (*Opening up Health Data for All | 2022 DMI Snapshot | CDC, 2022*). The Michigan Disease Surveillance System (MDSS) embodies DMI concepts within PHI (*Michigan Disease Surveillance System Background, n.d.*). MDSS was put into place nearly 20 years ago and has advanced significantly in that time. The system still has end-point data delivery gaps, however, and this report discusses a case-study of how implementing DMI at the local level may bridge those gaps.



Kent County Health Department serves nearly 700,000 citizens in West Michigan (United States Census Bureau QuickFacts, n.d.). The Communicable Disease (CD) Division serves Kent County's communicable disease case investigation and data reporting needs. The data sharing process has numerous inefficiencies, however, that limit the divisions output capacity. The process includes multiple MDSS logins, manual data querying and formatting, and other menial tasks to create their monthly Notifiable Disease Reports.

This report presents an innovative solution to modernize Kent County’s surveillance data reporting. A novel data management software solution provides support for MDSS user queries, an automated pipeline handles data cleaning and formatting, and a dashboard shares the data via effective visualizations.

Methodology

Deliverable 1: Notifiable Disease Report Dashboard

Guided projects on Coursera were utilized for basic familiarization with Power BI. Next, a sample dataset was exported from MDSS, following the county’s standard protocol. Power Query and DAX were initially used for data cleaning and processing; we switch to python after encountering challenges. An initial dashboard prototype was developed; it went through multiple iterations of improvement based on feedback received.

Deliverable 2: Epi_Helper: An Automated Data Management Pipeline

Kent County’s monthly disease report process involved manually extracting data from 15 MDSS exported files. Many of those exports were redundant and unnecessary. An automated software tool called Epi_Helper was built from the ground up to streamline and simplify data transport to end stakeholders. A public GitHub repository for the tool was created, alongside a guidebook with how-to demo videos.

Case & Investigation Status Settings	Current Month	YTD	5-Year History
CaseStatus: ['Confirmed'], InvestigationStatus: ['Active', 'Completed', 'Completed-FollowUp']	+	+	+
CaseStatus: ['Confirmed'], InvestigationStatus: ['Active', 'Completed', 'Completed-FollowUp', 'Review']	+	+	+
CaseStatus: ['Confirmed', 'Probable'], InvestigationStatus: ['Active', 'Completed', 'Completed-FollowUp']	+	+	+
CaseStatus: ['Confirmed', 'Probable', 'Suspect'], InvestigationStatus: ['Active', 'Completed', 'Completed-FollowUp', 'Review']	+	+	+
CaseStatus: ['Confirmed', 'Probable', 'Suspect', 'Unknown'], InvestigationStatus: ['Active', 'Completed', 'Completed-FollowUp', 'New', 'Review']	+	+	+

Fig 2. Kent County’s old process required 3 MDSS exports per unique Case & Investigation Status setting, for a total of 15 exports per monthly disease report.

Findings

Deliverable 1: Notifiable Disease Report Dashboard (Appendix A)

The Notifiable Disease Report dashboard was completed 22 days ahead of schedule. The dashboard uses color to intuitively display monthly case count data and 5-year median values. While a feedback form was not developed, oral feedback was received during prototype presentations. A snapshot is viewable in the Appendix, with a live version accessible via a QR code. Feedback confirmed the dashboards intuitiveness, and suggestions were made to enhance the interactivity.

Deliverable 2: Epi_Helper: An Automated Data Management Pipeline (Appendix B)

Epi_Helper became a critical component of the project. The tool supports the MDSS data extraction process and automates the data management workflow, piping formatted data directly into the Notifiable Disease Report Dashboard. The cost-savings potential of the tool is significant, saving Kent County approximately \$4,615 annually. Other, less quantifiable benefits include higher employee satisfaction, as well as timelier public health responses and subsequently better health outcomes in the community.

Discussion

This project achieved its goal of enhancing the efficiency, accuracy, and usefulness of Kent County's surveillance data sharing, which previously consumed significant resources and hindered timely public health data usage.

- Notifiable Disease Dashboard: This high-quality dashboard will soon be on Kent County's website. It provides timely information for stakeholder decisions but could benefit from enhanced interactivity and a shift from case counts to incidence based on user feedback.
- Epi_Helper: Tailored for CD, this data management tool integrates well into their workflow. Future development should focus on its graphical user interface, potentially broadening its use to other health departments.

Implications

This project presented a novel informatics solution to modernize data management at a local public health department. In this particular case, the LHD will save an estimated \$4,615 annually in labor alone. Beyond cost-savings, the solution may boost employee morale and significantly reduce errors in disease reporting. Moreover, timelier data sharing may prompt faster public health responses, leading to better health outcomes in the community. The project may inform local public health adoption of data modernization initiatives.

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References

- Baker, E. L., Brand, W., Davidson, A. J., LaVenture, M., Singletary, V., & Smith, P. F. (2016). Building the business case for public health information systems. *Journal of Public Health Management and Practice*. <https://doi.org/10.1097/phh.0000000000000495>
- Centers for Disease Control and Prevention. (2018). *Public Health Surveillance: Preparing for the Future* [Online].
- Chiolero, A., & Buckeridge, D. L. (2020). Glossary for public health surveillance in the age of data science. *Journal of Epidemiology and Community Health*, jech-211654. <https://doi.org/10.1136/jech-2018-211654>
- Concannon, D., Herbst, K., & Manley, E. (2019). Developing a data dashboard framework for population health surveillance: widening access to clinical trial findings. *JMIR Formative Research*, 3(2), e11342. <https://doi.org/10.2196/11342>
- Junker, S., Damerow, S., Walther, L., & Mauz, E. (2023). Development of a prototype for high-frequency mental health surveillance in Germany: data infrastructure and statistical methods. *Frontiers in Public Health*, 11. <https://doi.org/10.3389/fpubh.2023.1208515>
- Magnuson, J., & Dixon, B. E. (2020). *Public Health informatics and information systems*. Springer Nature.
- Malik, S. (2005). *Enterprise Dashboards: Design and Best Practices for IT*. Wiley.
- Malkani, D., Malkani, M., Singh, N., & Madan, E. (2023). Best Practices for the Design of COVID-19 Dashboards. *Perspectives in Health Information Management*, 20(1). <https://perspectives.ahima.org/page/best-practices-for-the-design-of-covid-19-dashboards>
- Michigan Disease surveillance System background*. (n.d.). <https://www.michigan.gov/mdhhs/keep-mi-healthy/communicablediseases/mdss/michigan-disease-surveillance-system-background>
- Opening Up Health Data for All | 2022 DMI Snapshot | CDC*. (2022). <https://www.cdc.gov/surveillance/data-modernization/snapshot/2022-snapshot/stories/opening-up-health-data.html>
- Public Health Informatics Institute. (2019). Data Modernization Initiative: Case-based surveillance capabilities and technology recommendations. In *phii.org*.
- United States Census Bureau QuickFacts. (n.d.). U.S. Census Bureau QuickFacts: Kent County, Michigan. Census Bureau QuickFacts. <https://www.census.gov/quickfacts/fact/table/kentcountymichigan/PST045222>

Appendix A



Notifiable Disease Report

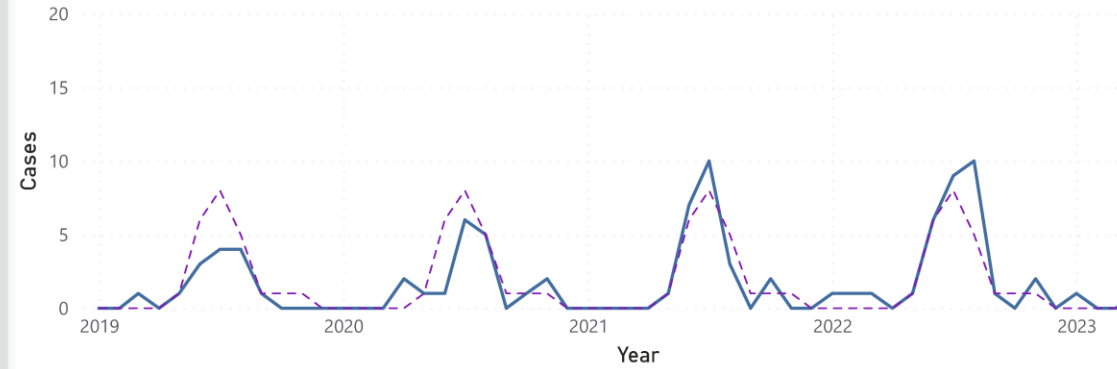
Diseases by Disease Group

- AIDS/HIV
- COVID19/MIS
- Foodborne
 - Campylobacter
 - Giardiasis
 - Salmonellosis
 - Shiga toxin-producing Escherichia coli (STEC)
 - Shigellosis
- Influenza
- Influenza-Like Illness

Lyme Disease

By Month

● Cases ● 5-Year Median



Time Period

Last Select

No filters applied

Apply all slicers

Clear all slicers

Time	Disease	Cases	Cases Median	YTD	YTD Median
1/1/2019	Lyme Disease	0	0	0	0
1/1/2020	Lyme Disease	0	0	0	0
1/1/2021	Lyme Disease	0	0	0	0

Lyme Disease

YTD

25!

5-Year YTD Median: 8

a. Chickenpox cases are reported primarily from schools. Confirmed and probable cases are included. b. Includes "Influenza-Like Illness (ILI)" and lab-confirmed influenza. ILI cases have flu-like symptoms and are reported primarily by schools. These numbers are currently under a health department review process c. "Meningitis, Bacterial, Other" includes meningitis and bacteremia caused by bacteria OTHER THAN H. influenzae, N. meningitidis, or S. pneumoniae. Except for Chickenpox, Campylobacter, Coronavirus, Cryptosporidiosis, Shiga-Toxin Producing E. Coli, Salmonellosis, Shigellosis & Influenza-Like Illness, only confirmed cases (as defined by National Surveillance Case Definitions) are included. Reports are considered provisional and subject to updating when more specific information becomes available.



Appendix B

```
PowerShell
Epi_Helper main ~3 91
24.441s ljens > python .\src\epi_helper\__main__.py

-----
Welcome to Epi_Helper, your MDSS data management assistant!
-----

First, let's check the disease group settings from last time.

-----
Last month's settings:

Diseases: ['AIDS, Aggregate', 'Novel Coronavirus COVID-19', 'Giardiasis', 'H.
influenzae Disease - Inv.', 'Hepatitis A', 'Hepatitis B, Acute', 'Hepatitis C,
Acute', 'Hepatitis C, Chronic', 'Hepatitis C, Unknown*', 'Legionellosis', 'Me
ningitis - Aseptic', 'Meningitis - Bacterial Other', 'Meningococcal Disease',
'Mumps', 'Pertussis', 'Streptococcal Dis, Inv, Grp A', 'Streptococcus pneumoni
ae, Drug Resistant', 'Streptococcus pneumoniae, Inv', 'West Nile Virus', 'CP-C
RE', 'Coccidioidomycosis', 'Cyclosporiasis', 'Guillain-Barre Syndrome', 'Hemol
ytic Uremic Syndrome', 'Malaria', 'Multisystem Inflammatory Syndrome', 'Strept
ococcal Toxic Shock', 'Toxic Shock', 'Vibriosis - Non Cholera', 'Histoplasmosi
s', 'Kawasaki', 'Listeriosis', 'Shingles', 'Respiratory Syncytial Virus']


Case Status: ['Confirmed']

Investigation Status: ['Active', 'Completed', 'Completed - Follow Up']

Do you need to make any changes? y/n: n
-----
Done!
```



README.md



Epi_Helper

Version: 0.1.0 (Alpha)

Alpha Version This pipeline is currently in Alpha testing and issues could appear during data processing, use at your own risk. Feedback and suggestions are welcome!

Overview

Epi_Helper was created to help local health departments in MI quickly and easily create communicable disease surveillance reports from MDSS output csv data files. The tool includes two parts:

1. Query Assistant - remembers the case status and investigation status settings for groups of reportable diseases of interest. Guides the user through MDSS report queries
2. Automated Pipeline - intakes MDSS-generated csv files, extracts relevant disease data, cleans & preprocesses, then inputs data into a master dataset.csv

The pipeline is dynamic in that the user creates a config file to select case and investigation status settings for groups of reportable diseases. The Query Assistant checks MDSS output csv files case and investigation status metadata against the config file, and rejects csv files that do not match the config settings for that particular group of diseases.

The output dataset.csv is optimized for use in PowerBI. Once PowerBI is configured to generate surveillance reports from output Epi_Helper data, the user only has to refresh PowerBI after generating dataset.csv for each new surveillance data period moving forward

Epi_helper is designed for 5-year MDSS surveillance reports, and has only been tested on Kent County data.