National Library of Medicine

Analysis of NLM DOCLINE Interlibrary Loan system usage data during selected public health events

Fall 2019 Associate Fellowship Project

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Abstract

Objective

DOCLINE, the National Library of Medicine's interlibrary loan service for network members, aims to better understand its role in providing information access to enable evidence-based practice during a public health event (PHE). The goal of this project is to provide data-focused evidence of DOCLINE's role in supporting the public health community, which will inform DOCLINE's improvement of services.

Methods

Three case studies of public health outbreaks in the United States were selected to measure DOCLINE's capacity to reflect information seeking behaviors of the public health community. Requests during the summer 2019 measles outbreak, e-cigarette lung injury event, and the 2018-2019 influenza season were extracted from appropriate DOCLINE databases. MeSH terms were used to identify requests for literature related to PHEs. These datasets were then analyzed for trends in request volume, geographic and institutional affiliation, and content. In addition to data analysis, stakeholder interviews with public health workers and information professionals informed the team's understanding of current perspectives on information access and evidence-based practice in public health.

Results

While the number of PHE-related requests did not make up a large percentage overall, there was an identifiable increase in DOCLINE requests during some selected outbreaks. Requests came from a variety of geographic locations, with some overlap with outbreak areas. Hospitals made the most requests, and the articles were generally related to the public health issue of interest. Stakeholder interviews reflect continued and growing use of resources during events, but less recognition of mechanisms, such as DOCLINE, that enable access.

Conclusions

The data shows that the public health community are using DOCLINE as an information access tool during public health outbreaks. While there are increases in PHE-related requests, the data does not explicitly indicate DOCLINE's use for evidence-based practice. Further studies may include comparing results to other outbreak-related information such as news reports, as well as communicating with relevant user groups in the public health community. The results of this project reflect that DOCLINE data is appropriate to use in better understanding information access behaviors and can help inform further development.

Introduction

Objective

As evidence-based practice in public health pushes towards "preparedness and response…fully grounded in scientific evidence" (Carbone 2018), health science information sharing systems are important access tools for practitioners. The DOCLINE team assumes available request data reflects the system's use—therefore, its need—in response to public health events. The Associate's fall project tests this conjecture using a data-driven approach through analyzing DOCLINE interlibrary loan (ILL) request data and comparing it to available outbreak data for select public health events.

Background

DOCLINE is the National Library of Medicine's (NLM) automated ILL system used by National Network of Libraries of Medicine (NNLM) participants. Since 1993, NNLM members can create profiles to lend and borrow available materials with other members. In March 2019, DOCLINE's platform migrated from Cold Fusion to Python Django. In this report, the current iteration of DOCLINE is referred to as "DOCLINE 6," while any previous versions are referred to as "DOCLINE Legacy." The DOCLINE team maintains and supports the system as part of the Public Services Division, Collection Access Section at NLM.

Evidence Based-Practice (EBP) occurs when health professionals use evidence, often made available through literature, to make clinical decisions in providing patient care (McKibbon 1998). While the concept has been well established, continued discourse on EBP focuses on approaches to finding, assessing, and organizing appropriate information (Brownson 2018; Carbone 2018).

According to the World Health Organization, a **Public Health Event (PHE)** is "[…] any event that represents immediate threat to human health and requires prompt action, i.e. implementation of control and/or mitigation measures to protect the health of the public" (WHO 2015). We use this definition to identify potential case studies, coupled with technical parameters explained later in this report.

Methods

As PHEs vary widely in trajectory and impact, three events were selected as case studies for analysis. We developed our data collection method through an iterative approach using one case study, which was then applied to other PHEs. This section has four components—the first three focus on the formulation and implementation of our data collection and cleaning methods. The fourth section focuses on the qualitative component of our research, in which we interviewed relevant information professionals to help guide discussion and recommendations.

Part II: Select Public Health Events

Public health events vary broadly; three case studies were selected to analyze for this project. During event selection, candidate PHEs had to fit the established definition and have available corresponding data through DOCLINE. Because both DOCLINE databases collectively have available data for thirty-six months, candidate events were selected from the past three years. Vetted outbreak data also needed to be available in order to determine a time period of interest for our query. We also limited our search to public health outbreaks in the United States, which is the primary geographic audience for DOCLINE.

These parameters were considered while searching for PHE candidates. Resources from national and international health organizations, such as the Centers for Disease Control and Prevention (CDC), were also used. The CDC served as a reliable source for identifying the nature and timeline of public events, as it collects data on various outbreaks throughout the United States. Raw and analyzed outbreak data is available through their website. Once candidate public health events were identified, more information about the events was collected from online sources such as news, government, and non-profit health organizations. In order to identify relevant articles from PubMed, the Associate used the NLM MeSH Browser to determine which MeSH term(s) would be most appropriate in identifying PHE-related DOCLINE requests.

Using this evaluation method, the following three PHEs were selected:

- the summer 2019 measles outbreak,
- the outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products (EVALI, CDC), and
- the 2018-2019 influenza season.

The measles case study was selected for its concentrated timeline and geographic spread in New York. The EVALI event was selected because it is ongoing and has well documented cases. The 2018-2019 influenza season was selected for its geographic breadth and large number of cases.

The measles case study was used first as a pilot to develop and test an appropriate data collection and analysis method. Further rationale and collected data on our identified PHEs can be found in **Appendix I**.

Part II: Develop Research Questions

The DOCLINE production database, which stores records of DOCLINE requests, contains a large quantity of collected attributes both within and beyond the project's scope of interest. To curate a list of attributes, the Associate developed specific research questions to determine which attributes were necessary to collect and analyze. The following research questions were formulated and implemented in each iteration of the process, accompanied by their rationale for selection:

- **Did DOCLINE requests change during the growth, height, and decline of the public health event in the United States?** Identifying changes in requests over time for PHE-related articles will inform the conjecture that health professionals seek information using DOCLINE in response to PHEs.
- **What correlations are there between PHE-related DOCLINE requests and the geography and institutional affiliations of requests?** A correlation between the number of PHE-related requests and their geographic origin may suggest a greater likelihood of requests being made for EBP.
- **What types of information are requested from DOCLINE?** Using PMIDs to determine the most frequently requested articles, the article titles may reflect what kinds of information interest DOCLINE requestors.

Using these research questions as guidelines, the Associate then examined attributes available from DOCLINE to develop queries for data collection. Identified attributes in both DOCLINE 6 and Legacy can be found in **Appendix II.**

Part III: Prepare DOCLINE Data

After events and attributes were selected, the Associate developed SQL queries to extract DOCLINE request information during the time periods of interest. The DOCLINE team provided the request data, and the Associate used two methods to identify PHE-related requests.

The first method used legacy PubMed to identify articles with PHE-relevant MeSH terms. A list of associated PMIDs was then downloaded and cross-referenced with DOCLINE request datasets to find matches. Queries developed for both DOCLINE requests and PMIDs can be found in **Appendix II.**

Requests without PMIDs were then analyzed for relevant terms within article titles. This method was only used with DOCLINE 6 data, as aggregated data within Legacy does not save article titles. All requests relevant to the PHE of interest were then tagged for easy identification. Datasets were then analyzed using Tableau Desktop and Microsoft Excel, following the research questions as a guide. Queries, cleaning methodology, and tools used are further described in **Appendix III**.

Part IV: Interview Stakeholders

In order to better understand the implications of this project, the Associate interviewed several relevant information professionals to gain a better understanding of topics such as DOCLINE's purpose, its users' needs, and information needs of public health professionals. Interviewed individuals included Jessie Hood, ScD, MPH (CDC), Javier Crespo, MLIS (Executive Manager, National Public Health Coordination Office, NNLM), and Erin D. Latta (Coordinator, National DOCLINE Coordination Office, NNLM). Main takeaways from conversations are summarized in the results to inform discussion and recommendations.

Results

Datasets for each case study varied across timespan, total requests, and PHE-related requests (Table 1). Measles had the fewest number of PHE-related requests (n=122), as well as number of days (118). EVALI and influenza were both around six months in length; there were more than twice as many flu-related requests (n=707) as there were for EVALI (n=288). The PHE-related requests were the primary datasets used for analysis.

Table 1. Time period ranges and number of total DOCLINE requests and PHE-related requests across each case study.

	Measles	EVALI	Influenza
DOCLINE System	DOCLINE 6	DOCLINE 6	DOCLINE Legacy
Time Period	4 March to 30 June 2019	1 June to 30 November 2019	1 September 2018 to 3 March 2019
Number of Days	118	183	184
Total DOCLINE Requests[†]	269257	416771	384723
Number of Requests Related to PHE	122	288	707*

† Requests only from the United States (Regions 1-8).

*Does not include requests without PMIDs, as DOCLINE Legacy does not store information on article titles.

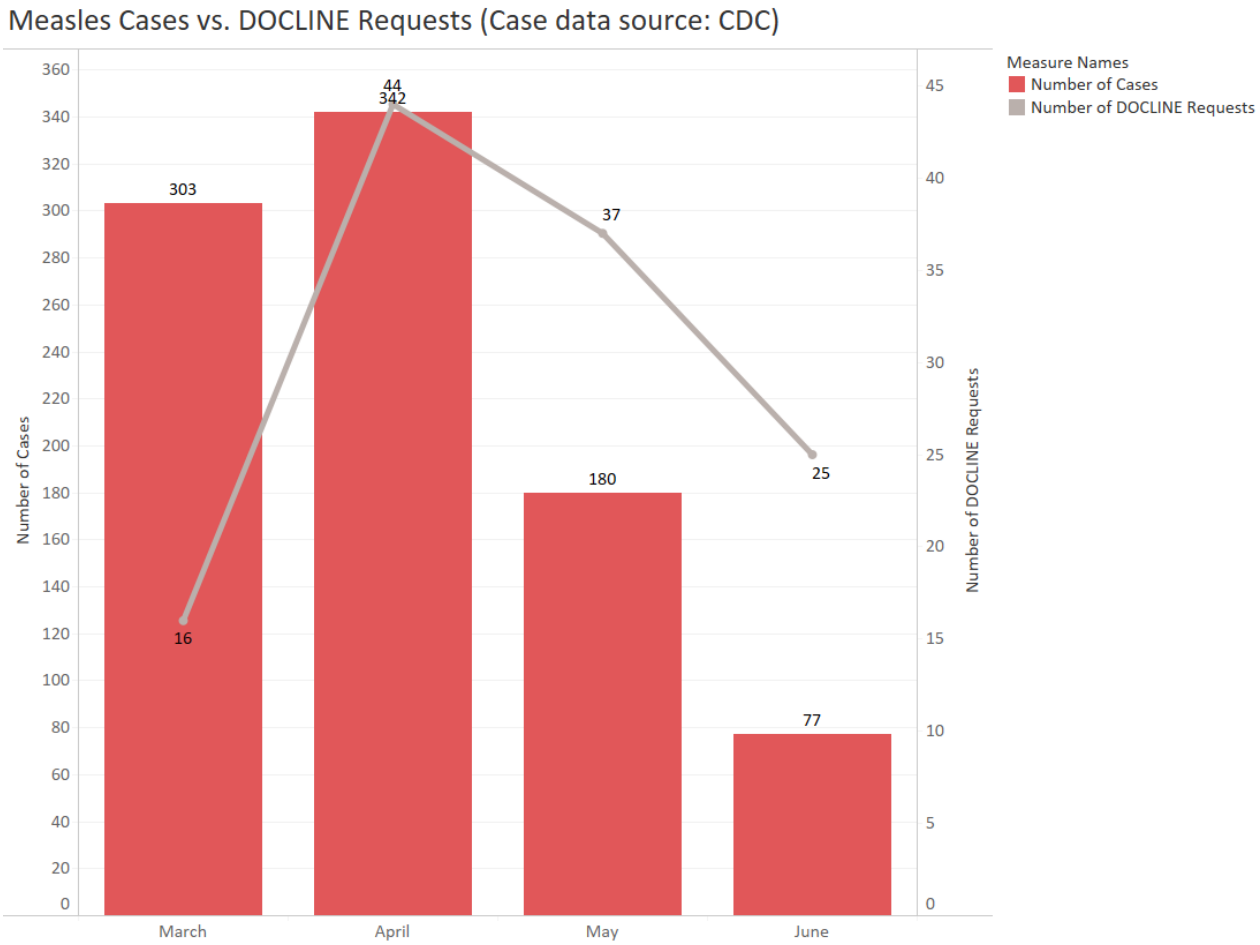
Question 1: Did DOCLINE requests change during the growth, height, and decline of the public health event in the United States?

Identified PHE-related requests comprised of <0.2% of all DOCLINE requests for each case study (Table 2). To observe trends in PHE-related requests, the number of requests were mapped over time. The trends in requests were compared to CDC outbreak data trends overall. Request and outbreak trends for measles and EVALI look similar (Figures 1-2), while trends for influenza do not (Figure 3).

Table 2. Percentage of PHE-related requests.

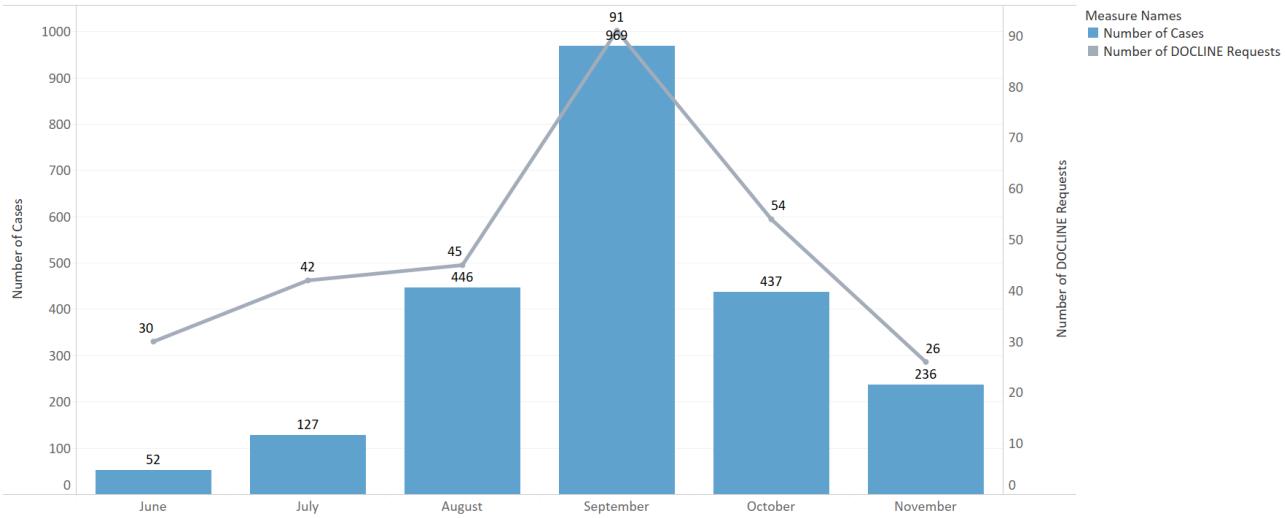
	Measles	EVALI	Influenza
Total DOCLINE Requests	269257	416771	384723
Number of Requests Related to PHE[†]	122	288	707*
Percentage of Total Requests	0.04%	0.07%	0.18%

Figure 1.



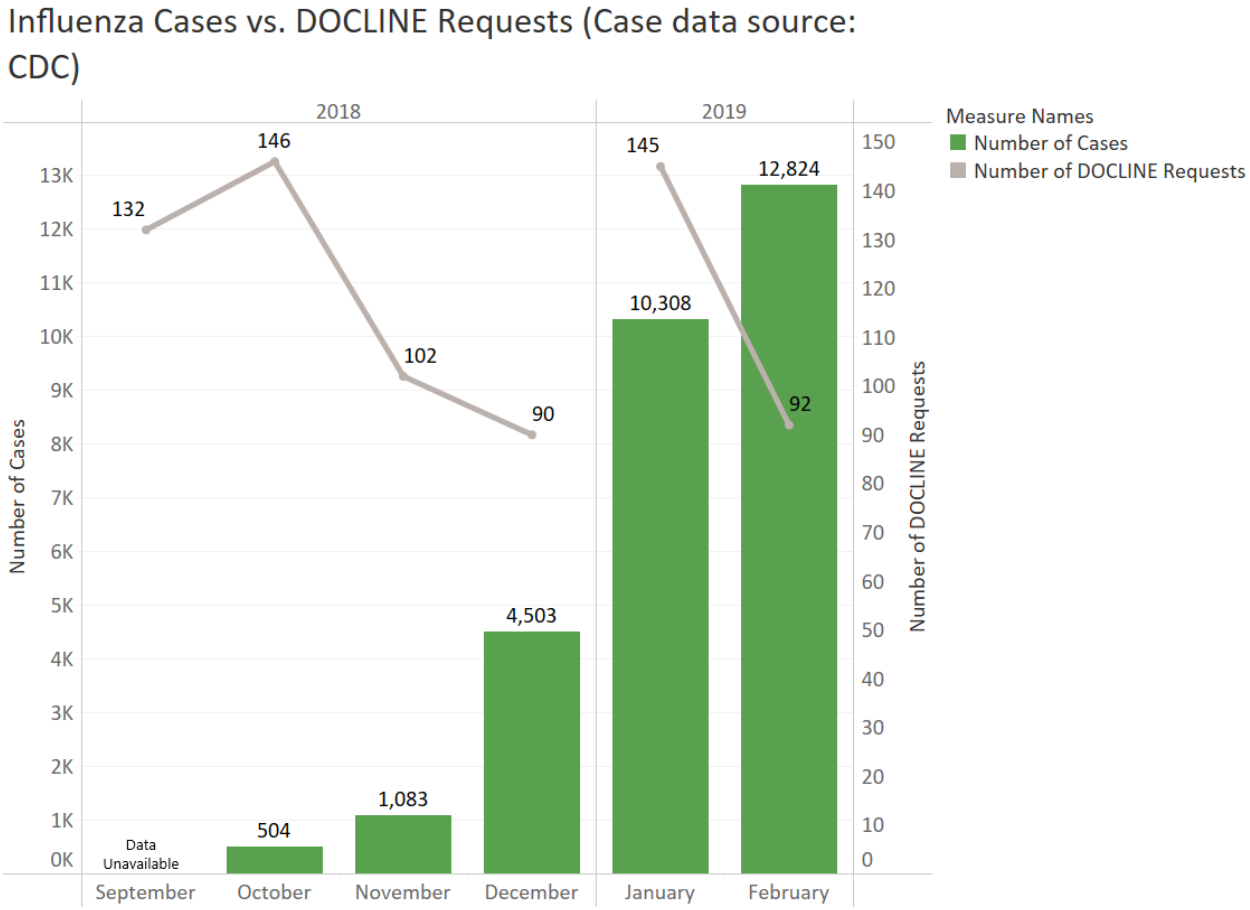
Case data from 'Measles Cases and Outbreaks.' CDC. Last accessed 23 January, 2020: https://www.cdc.gov/measles/cases-outbreaks.html.

Figure 2.



Case data from 'Outbreak of Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products.' CDC. Last accessed 23 January, 2020: https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases.

Figure 3.



Case data from 'FluView Interactive' CDC. Last accessed 23 January, 2020: https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html.

Question 2: What correlations are there between DOCLINE requests related to the public health event and the geography and institutional affiliations of the requestors?

Using PHE-related request data, the Associate identified which NNLM geographic areas had the most requests (Figure 4). These results were then compared to the geographic spread of the outbreak itself, using CDC data again as reference. Geographic correlations between PHE-related requests and the outbreaks vary. Most measles-related requests came from the Mid-Atlantic and Pacific Northwest regions (29 each), while the outbreak primarily occurred in the New York area. EVALI requests mostly came from the Greater Midwest and Southeastern Atlantic (70 and 68, respectively), whereas the largest number of cases occurred in California, Texas, and Illinois. The height of the influenza season had cases country-wide, but the majority of related requests came from the Southeastern Atlantic (233).

Frequency of requests from different institution types were also measured (Figure 5). Overall, hospitals had the largest number of PHE-related requests. Academic and Other institution types were present in each case study, but Public libraries were found only in the influenza event.

Question 3: What are the kinds of information being requested from DOCLINE?

PMIDs were used to identify articles with the most requests. Article titles of PHE-related requests were analyzed to understand the kinds of information being requested during events. As DOCLINE Legacy does not preserve article metadata, other than optional PMIDs, the influenza event was not used in this part of the analysis. During the measles event, the most frequently requested article had a total of five requests (Figure 6), whereas the top article in EVALI had thirty-one (Figure 7). The highly requested article in the EVALI case study was one of the top 20 most requested on DOCLINE overall during the time period of interest.

More data visualizations for each case study can be found on NLM's Tableau Online server (internal access only). Measles | EVALI | Influenza

Stakeholder Interviews

Interviews with relevant information professionals are summarized to highlight details from the conversations that inform the project's discussion and recommendations.

Jessie Hood, ScD, MPH

Centers for Disease Control and Prevention

Hood works as part of the CDC Library helping connect staff with library resources. There has been some interest from staff about improving access to information resources during emergency response, of which the library is mindful. Although some public health workers may use inter-library loan services, Hood notes, fewer are likely to be aware of the actual mechanisms, like DOCLINE, that enable information access. Those who are aware, however, are appreciative. Hood also notes that the CDC Library is making a proactive effort to educate staff about how to access high quality information resources using library tools.

Javier Crespo, MLIS

Executive Manager, National Public Health Coordination Office

Crespo manages NPHCO, who primarily oversee the Digital Public Health Library (DPHL). DPHL is a information resource collective of twenty-eight state/local health departments. The library also provides article delivery, which is NPHCO's analog to interlibrary loan. Crespo observed that many of these loans were done through DOCLINE using Loansome Doc until the latter product's retirement in summer 2019. NPHCO does not have data on what ILL services public health departments use currently as a result of Loansome Doc's retirement. Use of interlibrary loan varies depending on departments and local public health events. The office believes its work enables evidence-based practice, and they are looking into improving information access at the local level.

Erin D. Latta

Coordinator, National DOCLINE Coordination Office

Latta's role is to serve as the frontline contact for DOCLINE members with managing their accounts and using DOCLINE in general. User feedback comes in both email and phone calls. Hospitals usually have the most urgent issues and therefore are the bulk of phone calls, as their information requests may deal directly with patient care. Latta regularly interfaces with the DOCLINE team to hear updates and to share any persistent user-end issues. Her role is valued as a source for feedback and qualitative data for DOCLINE development.

Figure 4. PHE-related Requests by NNLM region

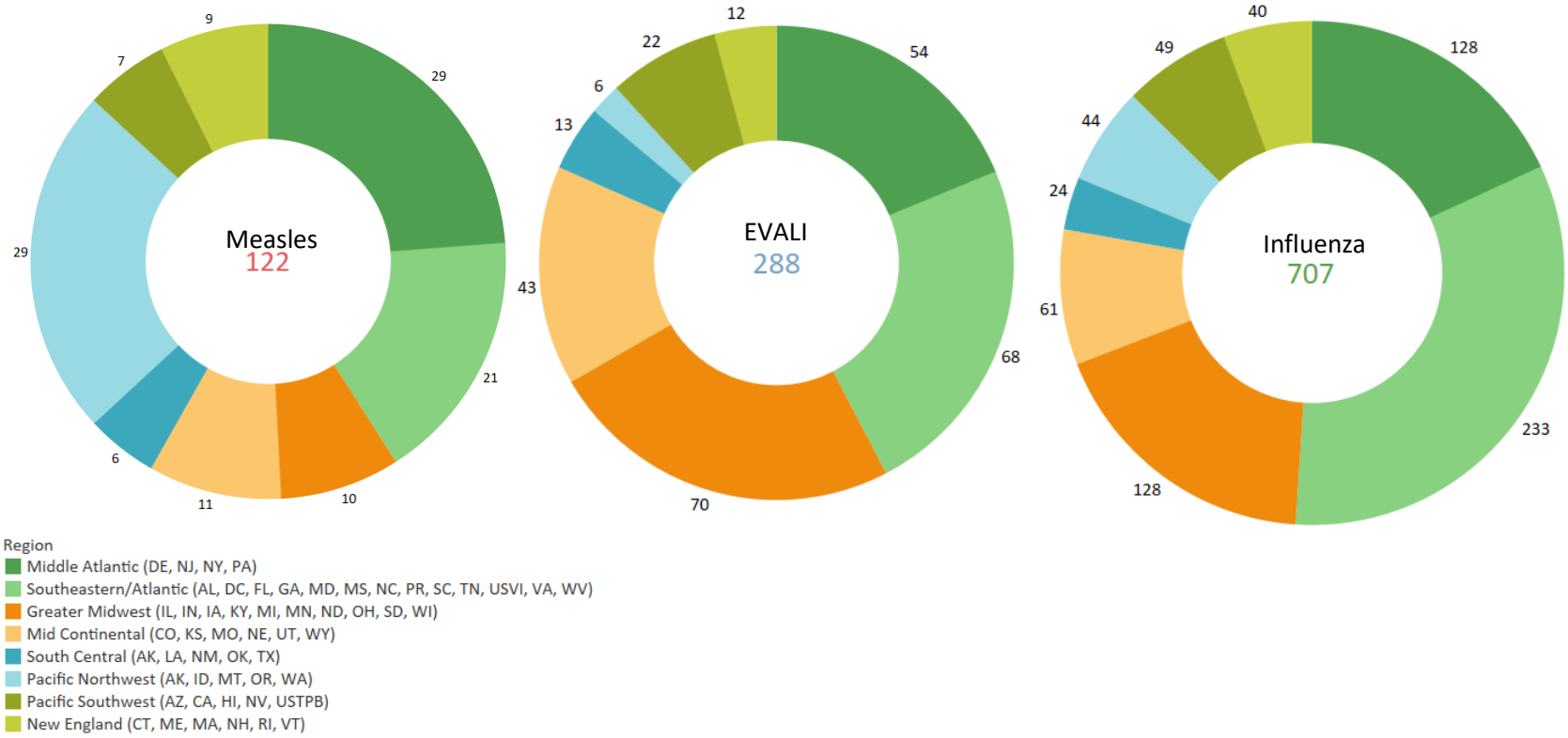


Figure 5. Requests by library type.

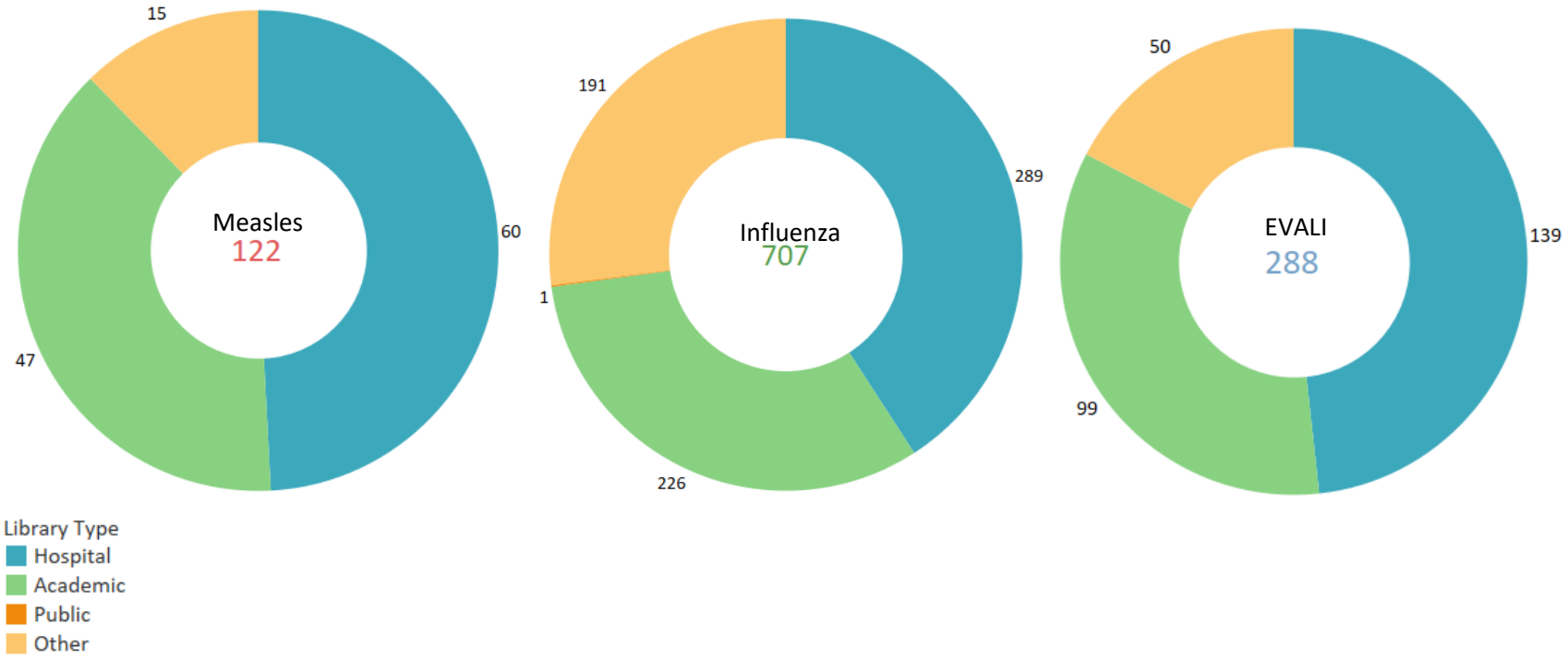


Figure 6. Measles articles with >1 requests (with PMID only)

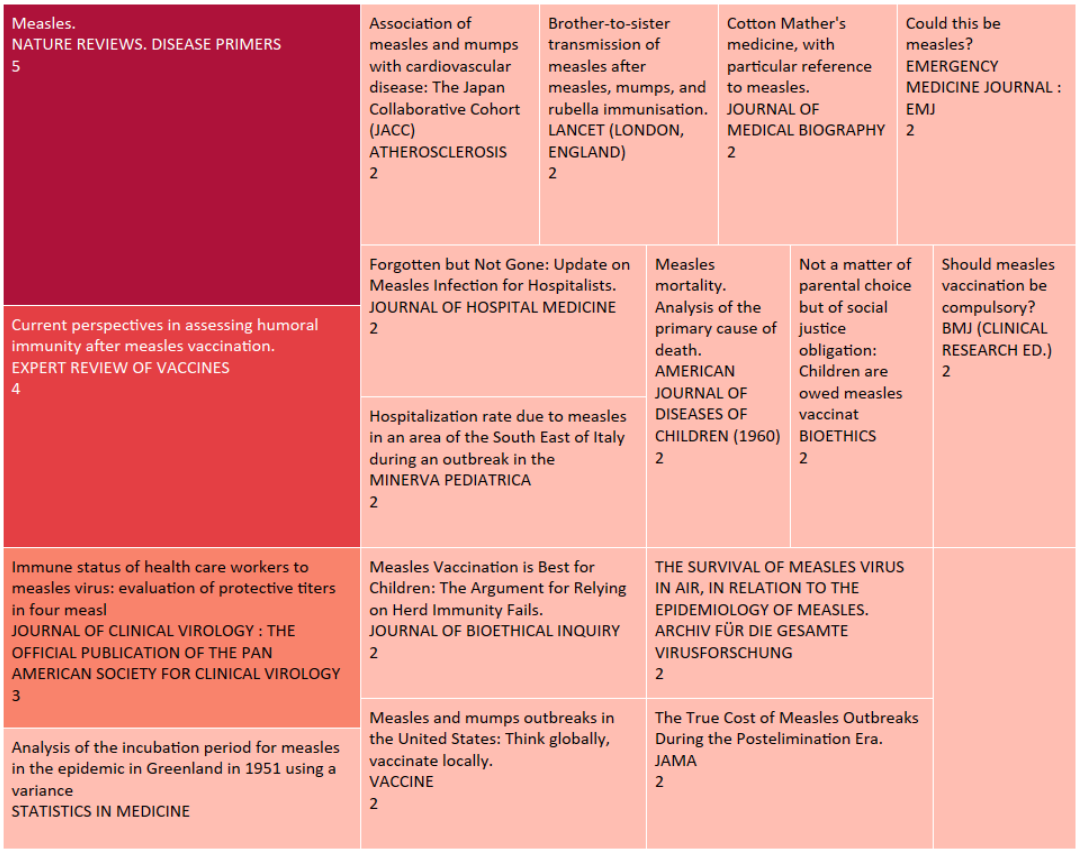
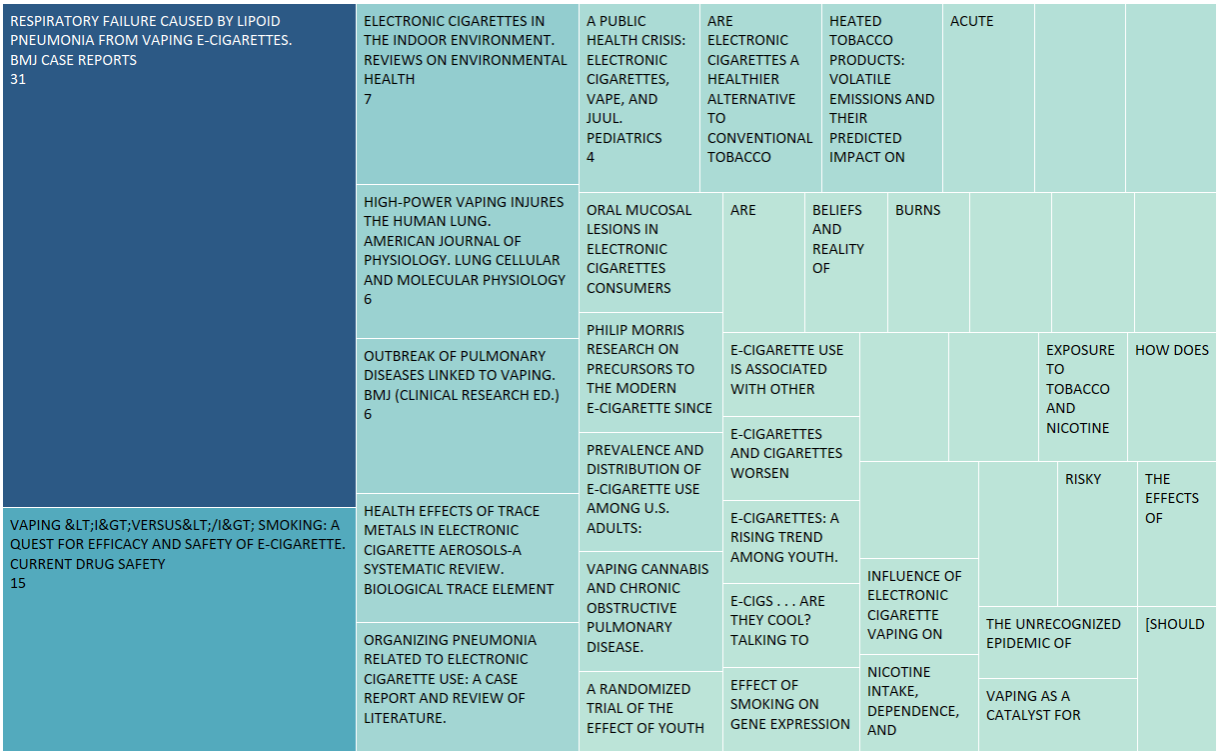


Figure 7. EVALI articles with >1 requests (with PMID only)



Discussion

Results

This project was exploratory in nature and used an observational approach. Although the n-values for each case study were low relative to the total number of DOCLINE requests, each dataset reflects the use of DOCLINE in the event of a public health outbreak. Measles and EVALI also occurred during or after the retirement of Loansome Doc, an ILL service that some public health departments without formal libraries, used to access resources. Crespo stated NPHCO does not currently have data on how many public health departments switched to DOCLINE or other ILL services after the retirement, so DOCLINE usage may have been impacted by this change.

Although the data is not comprehensive, it is sufficient to start answering the research questions. The project's results show that identification of correlations between trends in outbreaks and requests is possible, reflecting DOCLINE's continued use during public health events. Visual correlations between outbreak and request data are particularly notable in the EVALI event. This observation contrasts with the results from the influenza event. There could be several contributing factors to the ambiguity in the influenza case study, such as the variety of influenzas, the disease's lengthy history, and its commonality in public health services. As DOCLINE is used for a variety of purposes, focusing on case studies of unique issues and limited (<6 months) timespan, such as EVALI, seemed to improve the data's clarity in showing use patterns.

While the number of DOCLINE requests for PHE-related materials increased during an event, data did not reflect that most requests came from impacted areas. However, DOCLINE libraries may serve public health workers responding to events in different geographic regions, as mentioned by Hood in our interview. Therefore, the results are inconclusive regarding whether DOCLINE is used for evidence-based practice. Hospitals had the largest number of requests for each event, which suggests this information does inform clinical care. The large representation of hospitals is congruent with trends in DOCLINE membership, as a 2013 DOCLINE member survey shows 57.8% of borrowers identify as hospitals (Collins 2013).

Article titles were studied to see if they provided any indication of what kinds of information requestors sought. While the most requested article in the measles case, titled 'Measles,' provided a general overview of the disease, the most requested article for EVALI had explicit similarities with the respiratory issues found in the outbreak: 'Respiratory Failure Caused by Lipoid Pneumonia from Vaping E-cigarettes.' Other articles also pertained to specific populations and disease impact. While article titles help identify information that interest requestors, they do not fully capture users' information needs, nor the article's ultimate usefulness once in users' hands.

Because each PHE is unique, there are limitations to the project's generalizability regarding DOCLINE's role in public health response. For privacy reasons, DOCLINE does not require requestors to provide patron personal information. Therefore, the discussion cannot presume all PHE-related requests are placed on behalf of public health practitioners serving those impacted. Our ability to identify PHE-related requests is also limited due to our primary use of PMIDs in identifying relevant requests. The delay in indexing PubMed article indicates some relevant articles may not yet have metadata necessary for identification. While some articles were manually identified during data collection, there are likely other requests for PHE-related articles that were overlooked. Despite these limitations, as a first approach, this project reflects that data and methods are available to further explore DOCLINE's role in public health response. These limitations are opportunities for further research using DOCLINE data,

public health information, news articles, and/or stakeholder interviews to provide clarity for found results.

Project

The initial objective of this project was to test the conjecture that DOCLINE is used as an information tool by public health professionals in response to outbreak events. Although the results are not conclusive, such a statement could not have been tested without the resources available to us, specifically the DOCLINE production database, as well as outbreak information from CDC. Assessing available resources and technical tools at the beginning of the project was important in establishing the breadth and limitations of our research, especially because this project used data not initially collected for such a purpose. DOCLINE data, however, proved to be well-suited to the project goal because of its validity, structure, and consistency, allowing for efficient data collection and preparation.

The project's process also benefited from an iterative approach to developing an appropriate data collecting, cleaning, and analyzing workflow. This allowed for rapid adjustments to the process to better answer developed research questions, followed by productive implementation. While this process was time intensive, the resulting datasets allowed for successful data analysis and visualization Tableau, a data visualization product whose capabilities and benefits NLM continues to explore. This project benefited from Tableau's capabilities, and the Associate benefited from online learning resources and the NLM Office of Computer and Communications Systems (OCCS) to use the tool effectively. The Associate was able to find information beyond request numbers, such as geographic origins and article content, adding new depth and dimension to NLM's understanding of DOCLINE use in specific scenarios.

The project also benefited from a team-based approach, as it enabled the Associate to receive feedback from perspectives with expertise in related areas. Not only did team members provide helpful technical, historical, and logistical support, they also recommended other area experts as resources to better understand the current nature of information sharing and access within public health. In the future, similar projects should consider gathering qualitative data through stakeholder interviews earlier in the project timeline. The information gathered from these individuals can inform the development of research questions and objectives to better meet stakeholder priorities. In addition to qualitative data, more rigorous approaches to quantitative data study should also be considered in future iterations. Using additional data to create a baseline would have also helped support the strength of our findings in comparison with regular DOCLINE use. Such approaches may include defining stricter parameters for case studies and measuring for statistical significance.

Recommendations

This project seeks to inform potential next steps for DOCLINE in serving public health communities and pursuing data-driven development. Based on our stakeholder interviews, health workers like those at CDC are interested in accessing more resources during PHE response. As a tool for access, DOCLINE should consider how it can help connect health workers with quality information. Such strategies could include making articles with MeSH terms related to federally-declared public emergencies freely available. DOCLINE could also consider adding user tools, remediating the retirement of Loansome Doc, for public health workers to access information from institutions with formal libraries. Conversations amongst NLM, DOCLINE, and public health stakeholders should continue in order to identify mutual priorities and needs before DOCLINE make any informed decisions.

As DOCLINE serves its communities, DOCLINE should also use its own data to make data-driven and user-centered development decisions. The project reflects that DOCLINE data is a valuable resource, providing insight into information seeking during specific events. DOCLINE data's structure makes it suitable for this kind of analytics, which is also made possible with tools such as Tableau. DOCLINE should consider further uses of Tableau to analyze and identify use trends through informative visuals and dashboards to parse request data for specific use cases and communities.

With the growing use of quantitative data for development, DOCLINE could complement these analytics with qualitative data through user feedback. The National DOCLINE Coordination Office serves as the frontline, which means the office is a good resource for qualitative information on user priorities and needs. In the future, the DOCLINE team and the NDCO may consider collecting formalized input through online surveys from select user groups.

Next steps will depend on a variety of factors, such as development priorities, available resources, user needs, and institutional goals. This project illustrates that DOCLINE does have the resources and tools necessary to better understand user communities through a data-driven approach. Through these efforts, DOCLINE can continue to support NLM's strategic plan in improving biomedical and health information access and dissemination.

Acknowledgements

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Appendices

Appendix I: Public Health Event Selections and Data

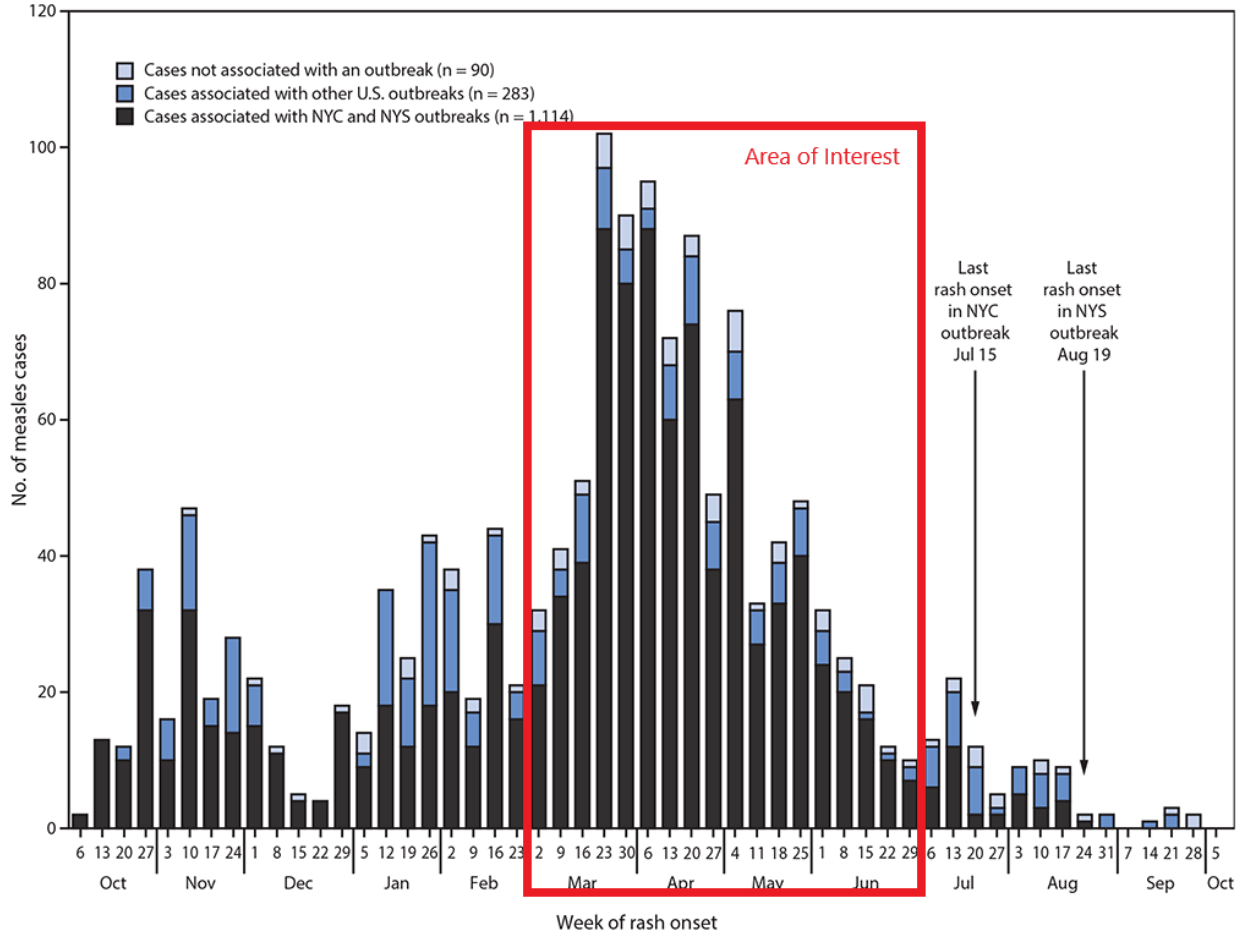
This section describes selected public health events and relevant information for data collection and cleaning purposes. Time periods were determined using outbreak data made available from CDC, with added buffer periods of 1-2 weeks before and after the event. These time ranges are identified using red outlined boxes for each event.

Event 1: Measles Outbreak of Summer 2019

Identified Peak Time Period: March 2019 to June 2019
Geographic Areas: New York
Relevant MeSH Terms: Measles (1999)

Relevant Outbreak Data

Figure 1. Number of reported measles cases (N=1487) by week of rash onset—United States, September 30, 2018-October 1, 2019. **Edited with Area of Interest outline.** Source: Patel M, Lee AD, Clemmons NS, et al. National Update on Measles Cases and Outbreaks — United States, January 1–October 1, 2019. MMWR Morb Mortal Wkly Rep 2019;68:893–896. DOI: http://dx.doi.org/10.15585/mmwr.mm6840e2

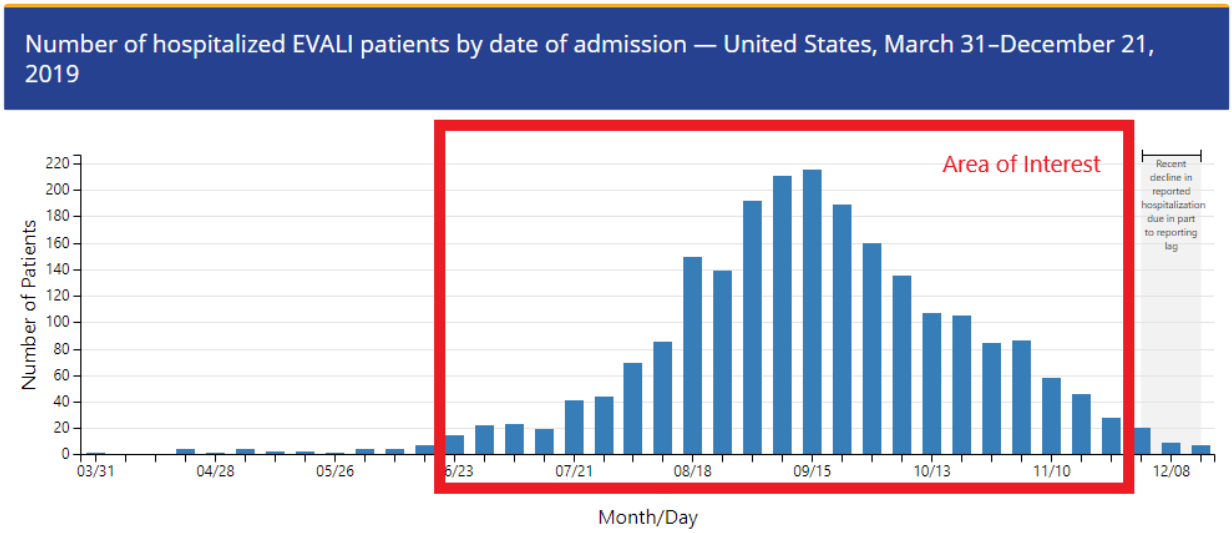


Relevant Resources

Center for Disease Control: Measles Cases and Outbreaks

Event 2: Lung Injury Associated with the Use of E-Cigarette, or Vaping, Products (EVALI)
Identified Peak Time Period: June to November 2019
Geographic Areas: Widespread; greatest number of cases in California, Illinois, and Texas
Relevant MeSH Terms: Electronic Nicotine Delivery Systems (2014), Vaping (2016)

Relevant Outbreak Data
Figure 3. Screenshot of graph recording number of hospitalized EVALI patients with area of interest outlined. Source: Center for Disease Control. Last accessed December 31, 2019.
https://www.cdc.gov/tobacco/basic_information/e-cigarettes/severe-lung-disease.html#map-cases

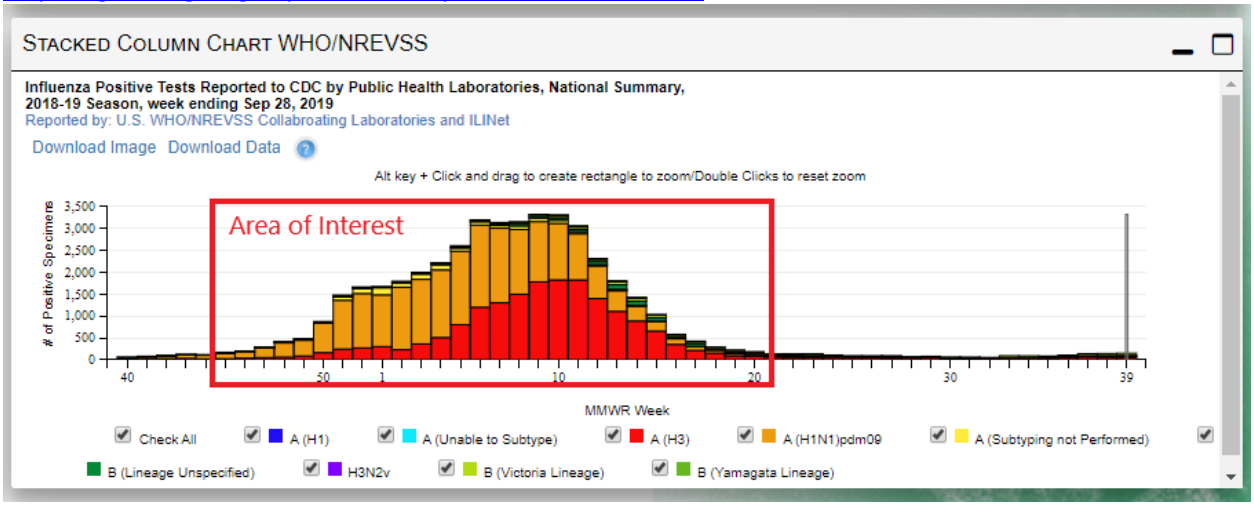


Relevant Resources
CDC: Outbreak of EVALI

Event 3: 2018-2019 Flu Season
Identified Peak Time Period: October 2018 to March 2019
Geographic Areas: Widespread at peak flu season
Relevant MeSH Terms: Influenza, Human (2006)

Relevant Outbreak Data

Figure 5. Screenshot from CDC FluView Interactive Tool—National, Regional and State Level Outpatient Illness and Viral Surveillance. Graphic from 2018-2019 Season, Viral Surveillance by Public Health Labs at the National level. Last accessed December 31, 2019.
https://gis.cdc.gov/grasp/fluview/fluportaldashboard.html



Relevant Resources
US Flu Map
FluView Dashboard

Appendix II: Data Collection

SQL queries were developed in order to access and export necessary data from the DOCLINE database using Oracle SQL Developer. Queries varied slightly in construction depending on if data was being requested from DOCLINE 6 or Legacy. DOCLINE Legacy is an aggregate of the former system, and therefore has different attributes. Between these two data sources, requested attributes were kept as similar as possible. The following DOCLINE 6 attributes (and their closest Legacy analogs) were identified to use in our query:

DOCLINE 6 Attribute	DOCLINE Legacy Attribute	Purpose
CREATED_TIMESTAMP	REQ_DATE	Request trends over time
LAST_EDIT_TIMESTAMP	--	Request trends over time
ID	--	Identification
DELIVERY_INSTITUTION_NAME	INST	Institution type; Geography
DELIVERY_LIBRARY_DEPT_NAME	DEPT	Institution type; Geography

DELIVERY_CITY	CITY	Geography
DELIVERY_STATE_PROVINCE_ID	PROVINCE and STATE_ETC_CODE	Geography
DELIVERY_ZIP	ZIP_MAIL_CODE	Geography
SERVICE_LEVEL	SERVICE_LEVEL	Request Type
NEED_BY_DATE	--	Request Type
JOURNAL_TITLE	TITLE	Content
ARTICLE_TITLE	--	Content
ARTICLE_PMID	PUB_MEDCIT	Content
LIBID	LIBID	Identification/joins
REGION	REGION_CODE	Geography
LIBRARY TYPE	LIB_TYPE_CODE	Institution type
ORGANIZATION_TYPE	FEDERAL_LIB_YN and DEMO_LIB_YN	Institution type

Queries from both databases required joins from different tables, which is reflected in the query structure. The following queries were executed by a DOCLINE team member, who then exported the results as a .csv file to share with the Associate. Some fields have been replaced with pseudonyms for clarity.

Query for Measles (DOCLINE 6)

```
select
  a.CREATED_TIMESTAMP,
  a.LAST_EDIT_TIMESTAMP,
  a.INSTITUTION_NAME,
  a.LIBRARY_DEPT_NAME,
  a.CITY,
  a.STATE_PROVINCE_ID,
  a.ZIP,
  a.SERVICE_LEVEL,
  a.NEED_BY_DATE,
  a.JOURNAL_TITLE,
  a.ARTICLE_TITLE,
  a.ARTICLE_PMID,
  b.LIBID,
  b.REGION,
  b.LIBRARY_TYPE,
  b.ORGANIZATION_TYPE
from.requests a
join.library b
on a.requesting_library_id = b.id
where a.created_timestamp between '04-MAR-19’ and ’30-JUN-19’;
```

Query for Vaping (DOCLINE 6)

```
select
  a.CREATED_TIMESTAMP,
  a.LAST_EDIT_TIMESTAMP,
  a.INSTITUTION_NAME,
  a.LIBRARY_DEPT_NAME,
```

```
  a.CITY,
  a.STATE_PROVINCE_ID,
  a.ZIP,
  a.SERVICE_LEVEL,
  a.NEED_BY_DATE,
  a.JOURNAL_TITLE,
  a.ARTICLE_TITLE,
  a.ARTICLE_PMID,
  b.LIBID,
  b.REGION,
  b.LIBRARY_TYPE,
  b.ORGANIZATION_TYPE
from.requests a
join.library b
on a.requesting_library_id = b.id
where a.created_timestamp between '01-JUN-19' and '30-NOV-19';

Query for Flu (DOCLINE Legacy)
          select
  a. REQ_DATE,
  a. SERVICE_LEVEL,
  a. PUB_MEDCIT,
  a. REQ_LIBID,
  b.INST,
  b.DEPT,
  b. CITY,
  b.PROVINCE,
  b.STATE_ETC_CODE,
  b.ZIP_MAIL_CODE,
  b. REGION_CODE,
  b. LIB_TYPE_CODE,
  b. FEDERAL_LIB_YN,
  b. DEMO_LIB_YN
from.requests a
join.library b
on a.REQ_LIBID = b.LIBID
where a.REQ_DATE between '01-SEP-2018' and '03-MAR-19';
```

To identify which of the resulting requests were related to the PHE of interest, a list of PMIDs, unique number identifiers of all Pub Med articles, with related MeSH term(s) was collected through PubMed legacy. The following PubMed searches were made for each event:

Measles
"measles"[MeSH Term]
15,190 results on 1/2/2020

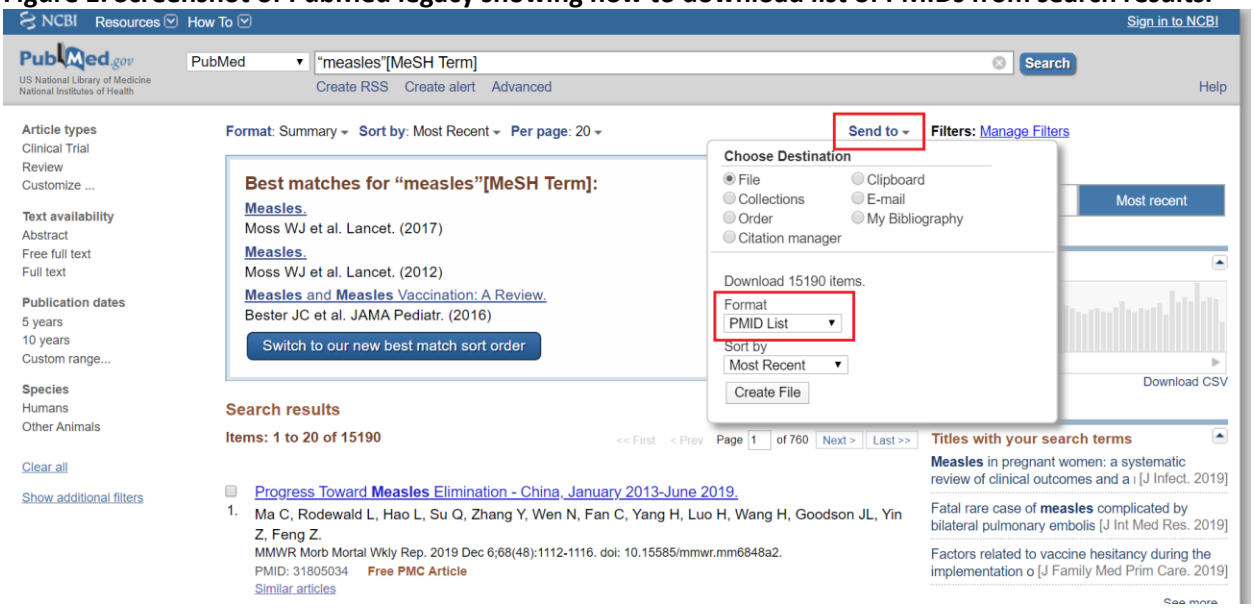
EVALI
("vaping"[MeSH Terms]) OR "electronic nicotine delivery systems"[MeSH Terms]

2,925 results on 12/16/2019

Influenza
"influenza, human"[MeSH Terms]
47,762 results on 12/31/2019

Once search results were available, a .txt file of PMIDs was downloaded using Send To>File. It is noted that the Associate used PubMed legacy instead of the newest version of PubMed, as the latter only enables downloads of up to 10,000 records at a time. Once the .txt file was downloaded, the contents were copied into an Excel spreadsheet to join with the DOCLINE query dataset (further explained in **Appendix III**).

Figure 1. Screenshot of PubMed legacy showing how to download list of PMIDs from search results.



Appendix III. Data Cleaning

Data cleaning, like data collection, was done for each case study. The overall process was kept consistent, with the exception of minor adjustments depending on the DOCLINE database used. Once the query results were made available, the Associate cleaned the data to enable analysis based on developed research questions. Microsoft Excel (Office 365 ProPlus version 1902) and Tableau Prep Builder (version 2019.3) were both used in order to process the data, when necessary, as follows:

1. Microsoft Excel (Part 1)
    a. In **DOCLINE 6**, separate date and time within the 'CREATED_TIMESTAMP' attribute
        i. Data>Text to Columns>Delimited>Space
    b. Changed some attribute names for easier comprehension during data analysis

DOCLINE 6	Legacy	New Name
CREATED_TIMESTAMP	REQ_DATE	REQUEST_SUBMITTED
DELIVERY_INSTITUTION_NAME	INST	REQUESTING_INST_NAME
DELIVERY_LIBRARY_DEPT_NAME	DEPT	REQUESTING_INST_DEPT_NAME
DELIVERY_CITY	CITY	REQUESTING_INST_CITY
DELIVERY_STATE_PROVINCE_ID	PROVINCE and STATE_ETC_CODE	REQUESTING_INST_STATE
DELIVERY_ZIP	ZIP_MAIL_CODE	REQUESTING_INST_ZIP
	PUB_MEDCIT	ARTICLE_PMID

2. Tableau Prep Builder
    a. Cleaned values for REQUESTING_INST_NAME, REQUESTING_INST_CITY, REQUESTING_INST_STATE, JOURNAL_TITLE, ARTICLE_TITLE, and ARTICLE_PMID for easier searching and parsing in later steps.
        i. Clean>Make Uppercase
        ii. Clean>Remove Extra Spaces
    b. Removed requests that were made as tests
        i. Used text filter for 'test' within REQUESTING_INST_NAME
        ii. Excluded values from final dataset
    c. Removed requests from international institutions
        i. Region Code 00
        ii. Filtered REGION attribute for only '00'>Exclude
        iii. Also excluded Canada (Region 20) and Mexico (Region 21), as identified PHEs were only within the United States (Regions 1-8)
    d. Added PMIDs from PubMed MeSH Term searches to appropriate requests
        i. Left Join using ARTICLE_PMID from DOCLINE request dataset
    e. Tagged requests who matched with PMID list
        i. Added new column to add tag—tag named after PHE of interest
            1. Ex. Measles tag = MEASLES; EVALI tag = VAPING
        ii. Done through 'Calculated Field' for PMID
            1. IF [PMID]>0 THEN '*TAG*' END
    f. Exported resulting data into .csv
3. Microsoft Excel (part 2)
    a. Converted .csv .xlsx
    b. Created table (Insert>Table) to filter records for PMIDs with *null* values (no PMIDs submitted)
    c. Used Text Filter to search for relevant MeSH terms within ARTICLE_TITLE attribute
        i. If non-PMID article titles had MeSH term(s) present, then added tag
        ii. Also searched for related words
            1. Measles: rubeola, MMR, vaccine
            2. EVALI: electronic cigarettes, vape
            3. Influenza: flu
    d. Saved results for use as data source in Tableau Desktop

Appendix IV. Project Proposal

Analysis of NLM Interlibrary Loan usage data during selected public health events

Project Details	Over the last decade, significant resources have been utilized during public health crises. The National Institutes of Health posits that decisions and actions related to such events should be based on scientific evidence and include the "application of principles of scientific reasoning, including systematic uses of data and information systems…." (https://nihlibrary.nih.gov/resources/subject-guides/evidence-based-public-health) Health information professionals play an important role in such Evidence Based Practice (EBP), including in identifying and retrieving appropriate literature from various sources for use in making health care decisions. To that end, the National Library of Medicine established the Emergency Access Initiative for use during certain health crises (https://www.nlm.nih.gov/news/NLMActivatesEmergencyAccessInitiativeforHarvey_Irma.html). However, despite such approaches and programs, "the ideal of a preparedness and response field fully grounded in scientific evidence has not yet been realized." (https://ajph.aphapublications.org/doi/10.2105/AJPH.2018.304702) Although it is expected that inter-library loans increase during notable public health events, related DOCLINE use patterns have not been documented. The Associate will track one or several recent **public health incidents** of her choosing and utilize applicable DOCLINE data to display and analyze possible usage trends and patterns that may assist NLM in developing related recommendations. Creating a simple Tableau Storyboard should be considered.
Project Sponsor	Hochstein, Colette (NIH/NLM) [E] Takamaru, Gillian (NIH/NLM) [E] Unger, Elisabeth (NIH/NLM) [E]
Associate Approver	Dunn, Kathel (NIH/NLM) [E]
Project Length	2 months
Skills Needed	Some experience with data manipulation/munging and with identifying and preparing data for analysis; proficiency with Excel. (**Optional:** basic graphics capability; willingness to explore visualization software such as Tableau.)
Project Keywords	Data Analysis; Data Science; Documentation; Evaluation;
Sponsor Unit	LO: Public Services
Expected Benefits to NLM	Improve methodology in decision-making; Improve process, product/service; Research
Open for	Associate; Intern/Volunteer
Departmental Approver	
Assigned To	
Resource People (NLM)	
Project Availability	Applied
Resource People (NLM, NIH)	
Status	Active
Hours per week	8 hours/week; 6-8 weeks duration