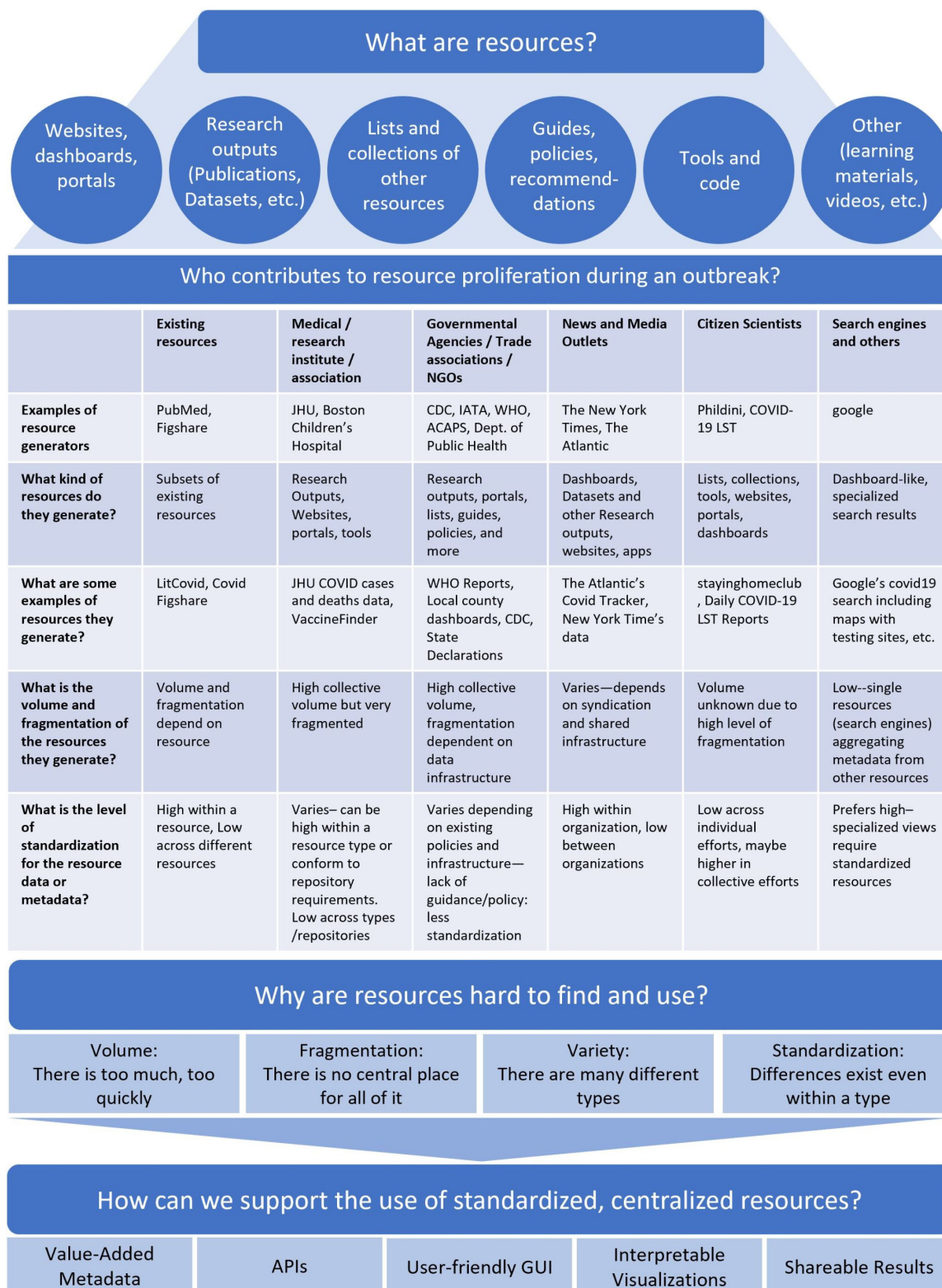


Outbreak.info Research Library: a standardized, searchable platform to discover and explore COVID-19 resources

In the format provided by the
authors and unedited



Supplemental Figure 1. What are resources, who contributes to the proliferation of resources, why are resources difficult to find and use, and how can we support their use?

Usability Studies and Protocols

A. Usability Study Results

Date	n	Task Number	SCR	EFR	TPT	EOU	LTR
Nov 23-25, 2020	5	1	100%	60%	~1 min	96%	Highly likely
		2	100%	0%	~1 min	100%	Highly likely
Mar 4 - Apr 2 , 2021	5	3	100%	100%	40 sec	100%	Highly likely

SCR- Average Successful Completion Rate for the task, EFR - Average Error-Free Rate, TPT- Average Time Per Task, EoU- Average Ease of Use Rating, LTR - Average Likelihood To Return Rate

B. Usability Study Protocol

Audience: Biomedical researchers

Purpose: Test the ease by which biomedical researchers could use outbreak.info to access or visualize data and find up-to-date publications.

Format: Moderated usability study conducted via Zoom. Users were asked to perform one or more of the following tasks:

1. Please use the Research Library to find new datasets related to the COVID-19 reproduction number in the United States.
2. Please use the Research Library to find publications related to cytokine response storm in COVID-19 patients.
3. Please find all publications related to B.1.1.7.

Post-test questions asked:

- Overall, please rate how easy or difficult it is to use outbreak.info on a scale of 1-5, where 1 is very difficult and 5 is very easy.
- How likely are you to continue using outbreak.info to regularly access data or resources, on a scale of 1-5 where 1 is very unlikely and 5 is very likely?
- What do you like most about the outbreak.info app?
- What would you improve about the app? Or what would you add to the app?
- How would you compare outbreak.info to other sites you've used to access data & resources?

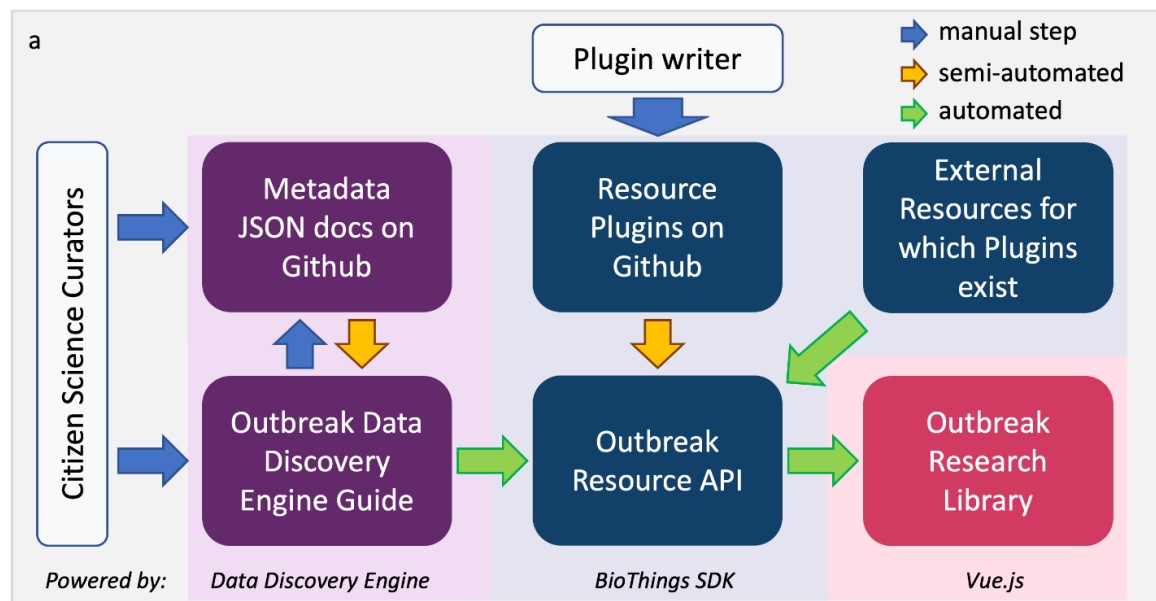
Metrics/Measurements recorded:

- Ease and satisfaction about each task (5-point Likert scale),
- Time on each task,
- Number of successful task completions and errors,
- Overall ease and satisfaction (5-point Likert scale),
- Likelihood to use (5-point Likert scale),
- Suggestions for improvement (likes, dislikes, recommendations),
- Error-free rate,
- And noted observations about the users' process.

C. Changes ensure usability of Research Library

Usability Study	Changes Implemented
Nov 23-25, 2020	<ul style="list-style-type: none"> • Redesigned homepage to present outbreak.info's main features as three actionable categories near the top • Added an introductory video • Revised how other pages are linked from the homepage • Collapsed many of the site's details into expandable cards • Renamed "Resources" to "Research Library."
Mar 4 - Apr 2 , 2021	<ul style="list-style-type: none"> • No changes were made to the Research Library

Supplemental Figure 2. Usability studies for iterative design improvements of the Outbreak.info Research Library. **A.** Remote moderated usability test of outbreak.info was conducted between November 23-25, 2020 and between March 4, 2021 and April 2, 2021 over Zoom. Five biomedical researchers participated in each round of tests which consisted of asking users to perform the tasks (and recording metrics) in accordance with protocol (**B**). There was a successful completion rate of 100% for both tasks and zero critical errors, but some non-critical errors resulted in an error-free rate of 60% for the first task and 0% for the second task. The average amount of time spent on each task was around 1 minute. **C.** Improvements to the site and Research Library were made with accordance to the results of the usability studies in November of 2020, but follow-up usability studies in March-April of 2021, indicated no additional changes were needed in order to improve the user performance on the tested tasks.



b

The screenshot shows a web interface for a dataset titled 'NYT list of how virus was contracted'. The record is displayed in a structured format with various tabs and filters.

Dataset: NYT list of how virus was contracted

Authors: Sarah Almukhtar, Aliza Aufrichtig, Matthew Bloch, Julia Calderone, Keith Collins, Amy Harmon, Rich Harris, Adeel Hassan, Jon Huang, Danielle Ivory, Rebecca Lai, Allison McCann, Richard Oppel, K. Patel, Julie Shaver, Anjali Singhvi, Charlie Smart, Mitch Smith, Derek Watkins, Timothy Williams, Jin Wu, Karen Yourish, Jordan Allen, Jeff Arnold, Ian Austen, Mike Baker, Ellen Barry, Samone Blair, Nicholas Bogel-Burroughs, Aurelien Breeden, Emma Bubola, Maddie Burakoff, Christopher Calabrese, Sarah Cahalan, Robert Chiarito, Matt Craig, Brandon Dupré, Melissa Eddy, John Eligon, Timmy Facciola, Matt Furber, Robert Gebeloff, Matthew Goldstein, Rebecca Griesbach, Lauryn Higgins, Jake Holland, Jon Huang, Danya Issawi, Anna Joyce, Hinga Klein, Jacob LaGesse, Alex Lemonides, Patricia Mazzei, Jesse McKinley, Miles McKinley, Sarah Mervosh, Lauren Messman, Andrea Michelson, Steven Moity, Thomas Gibbons-Neff, Azi Paybarah, Elian Peltier, Sean Plambeck, Elisabetta Povoledo, Scott Reinhard, Thomas Rivas, Alison Saldanha, Alex Schwartz, Emily Schwing, Libby Seline, Anjali Singhvi, Alex Traub, Maura Turcotte, Tracey Tully, Waananen Jones, Schoenfeld Walker, Jeremy White, Will Houpp, Andrew Chavez, Michael Strickland, Tiff Fehr, Miles Watkins, Josh Williams, Albert Sun, Shelly Seroussi, Nina Pavlich, Carmen Cincotti, Ben Smithgall, Andrew Fischer, Rachel Shorey, Blacki Migliozi, Alastair Coote, Steven Speicher, Hugh Mandeville, Robin Berjon, Thu Trinh, Carolyn Price, Michael Robles, and [view affiliations](#)

Filters: RISK FACTORS, TESTING PREVALENCE, PUBLIC HEALTH INTERVENTIONS, MECHANISM OF TRANSMISSION, PREVENTION, TRANSMISSION, VIRAL SHEDDING / PERSISTENCE, TREATMENT, REPURPOSING

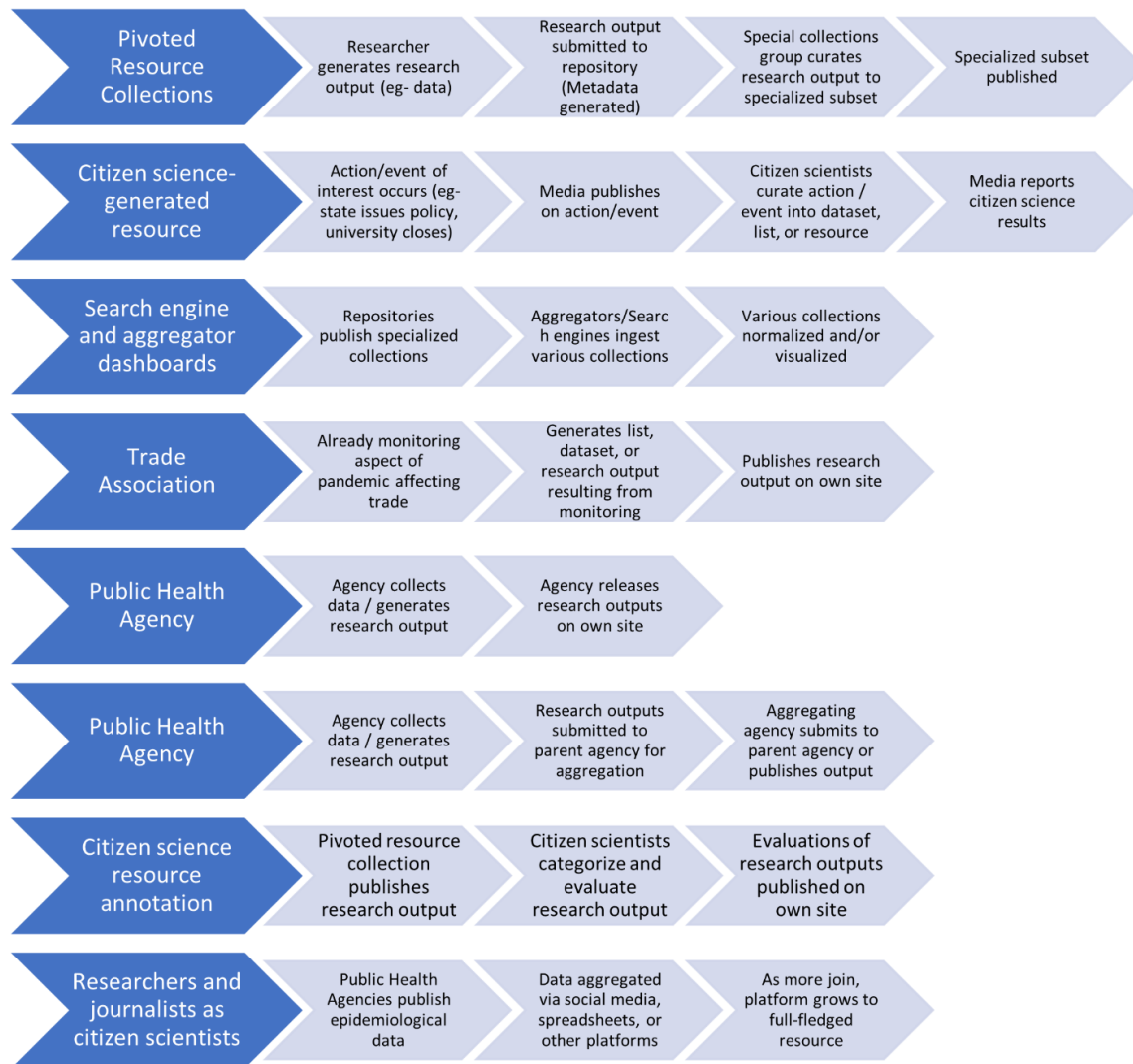
Classical Epidemiology: Reported cases in the United States, Where new cases are increasing, Where new cases are mostly the same, Where new cases are decreasing

Other filters: Cases and deaths by state and county, New reported cases by day in the United States, New reported deaths by day in the United States, Hot spots: Counties with the highest number of cases per resident, Cases in select prison populations, What You Can Do, Coronavirus Tips: Frequently Asked Questions and Advice

Record provided by: Data Discovery Engine [Learn more](#)

Coronavirus in the U.S.: Latest Map and Case Count. Coronavirus in the U.S.: Latest Map and Case Count. Note: Data are based on reports by states and counties at the time of publication. Local governments may revise reported numbers as they get new information. Some deaths may be reported by officials in two different jurisdictions. When possible, deaths have been reported here in the jurisdiction where the death occurred. While the first known case in the United States was announced on Jan. 21, charts show cases since Feb. 26, when American public health officials first identified community transmission of the virus.

Supplemental Figure 3. Aggregating resource metadata by leveraging community contributions. **a**, The community contribution pipeline and technology stack for outbreak.info's Research Library. Curators may submit dataset metadata using the DDE built-in guide or from GitHub via the DDE/BioThings SDK. Python-savvy contributors can create parsers to contribute even more metadata via the BioThings SDK plugin architecture. A resource plugin allows the site to automatically ingest and update metadata from the corresponding external resource. Blue arrows indicate manual steps, yellow arrows indicate automatable steps after an initial set up, green arrows indicate completely automated steps. **b**, An example of a detailed metadata record manually-curated by volunteers as it appears in the Research Library.



Supplemental Figure 4. Example resource-generation pipelines observed within the first month of the pandemic, resulting in a highly fragmented, non-standardized resource landscape that is difficult to search, centralize and leverage.

a Filter search results by topicCategory

You searched for transmission AND cats 159 results

Topic

- Host/Intermediate Reservoirs (41)
- Transmission (39)
- Viral Shedding/Persistence (36)
- Mechanism of Transmission (34)
- Mechanism (31)

b

Evidence of neutralizing antibodies against SARS-CoV-2 in domestic cats living with owners with a history of COVID-19 in Lima, Peru

Luis M. Jara, Cusi Ferradas, Francesca Schiaffino, Camila Sanchez-Carrion, Ana Martinez, Alexandra Ulloa, Gisela Isasi-Rivas, Angelia Montalvan, Luis Guervara Sarmiento, Manolo Clemente Fernandez Diaz, and Mirko Zimic

bioRxiv

published 28 May 2021 • accession 28 June 2022

Recent provided by bioRxiv

Topics: Rapid Diagnostics, Host/Intermediate Reservoirs, Mechanism of Transmission, Diagnosis, Mechanism, Viral Shedding/Persistence, Antibody Detection, Transmission

SARS-CoV-2 can infect a variety of wild and domestic animals worldwide. Of these, domestic cats are highly susceptible species and potential viral reservoirs. As such, it is important to investigate disease exposure in areas with active community transmission and high disease prevalence. In this report we demonstrate the presence of serum neutralizing antibodies against the receptor binding domain (RBD) of the SARS-CoV-2 in cats whose owners had been infected with SARS-CoV-2 in Lima, Peru, using a commercial competitive ELISA SARS-CoV-2 Surrogate Virus Neutralization Test. Out of 41 samples, 17/41 (74%) and 31/74 (134%) were positive, using the cut-off inhibition value of 30% and 20%, respectively. Not all cats living in a single house had detectable neutralizing antibodies showing that heterogeneous exposure and immune among cohabiting animals. This is the first report of SARS-CoV-2 exposure of domestic cats in Lima, Peru. Further studies are required to ascertain the prevalence of SARS-CoV-2 exposure among domestic cats of Lima, Peru.

Funder: not specified

Corrections: Peer-reviewed version: PMID34462726

c Links from Genomics Reports

Omicron Publications & Resources 1,484 results

Clinical Trial Safety and Immunogenicity Study on Omicron Inactivated COVID-19 Vaccine and Prototype Inactivated COVID-19 Vaccine in Population Aged 18 Years Old and Above Vaccinated the Prototype Inactivated COVID-19 Vaccine Junshi Zhao, Master 1 June 2022

Publication Immunity response against mild-to-moderate breakthrough COVID-19 Pichanun Mongkolsucharitkul et al. medRxiv 31 May 2022

Publication Safety and superior immunogenicity of heterologous boosting with an RBD-based SARS-CoV-2 mRNA vaccine in Chinese adults Xiaoqiang Liu et al. medRxiv 31 May 2022

Publication Lineage BA.2 dominated the Omicron SARS-CoV-2 epidemic wave in the Philippines Yao-Tsun Li et al. medRxiv 31 May 2022

Publication SARS-CoV-2 Delta and Omicron community transmission networks John Murray et al. medRxiv 31 May 2022

Publication Potent and pan-neutralization of SARS-CoV-2 variants of concern by DARPin Vikas Kariyappa Chonira et al. bioRxiv 31 May 2022

Links to search by topicCategory

Topics: Rapid Diagnostics, Host/Intermediate Reservoirs, Mechanism of Transmission, Diagnosis, Mechanism, Viral Shedding/Persistence, Antibody Detection, Transmission

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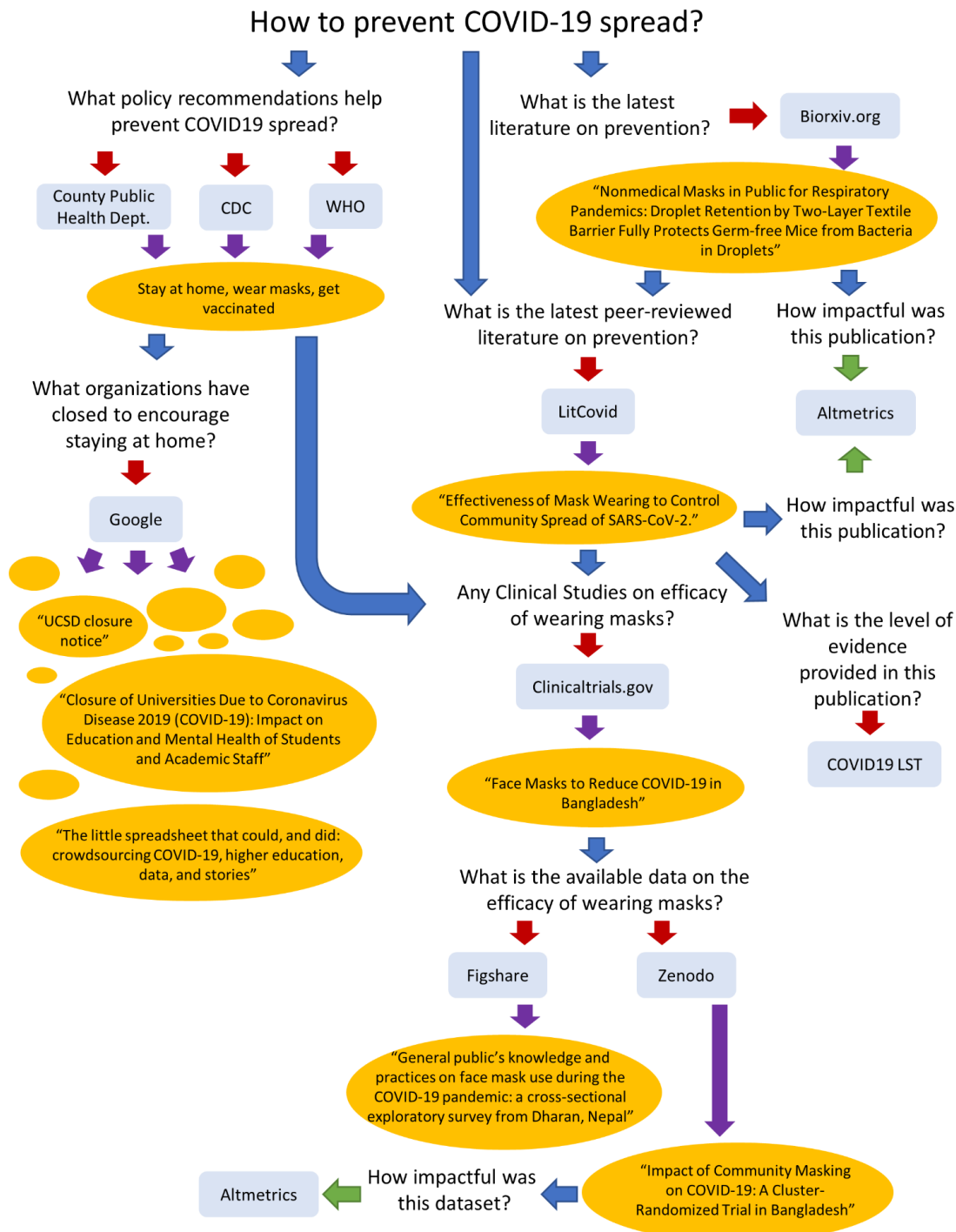
Links to related records

Corrections: Peer-reviewed version: PMID34462726

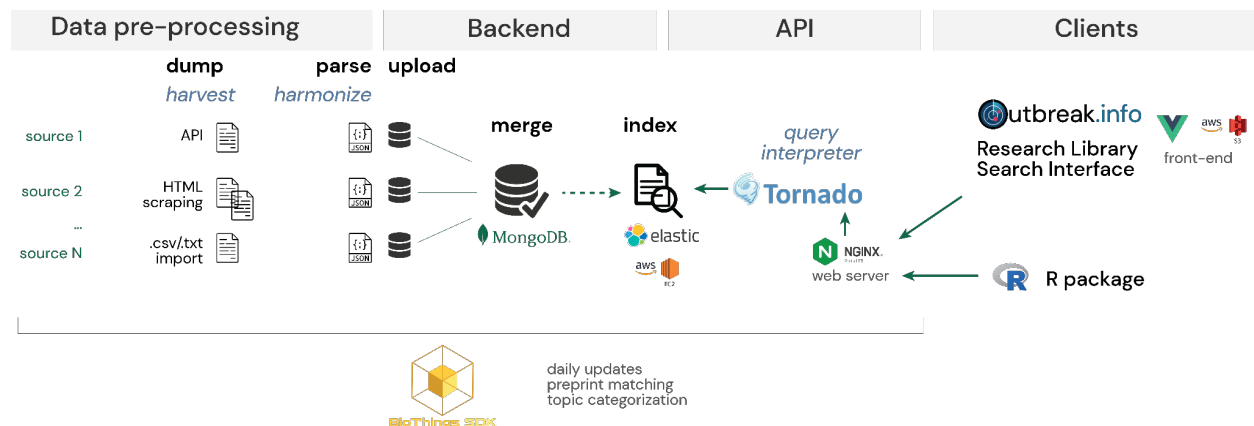
VIEW RECORD ON OUTBREAK.INFO

VIEW RECORD ON SOURCE

Supplemental Figure 5. Enabling exploration of the resources. **a**, Selectable options for filtering results by topic category or other facets enhance searchability and exploration from the search results view. **b**, Links to other records or to additional potential searches of interest enabling further exploration from a record view. **c**, Links from the Omicron Variant report to related resources.



Supplemental Figure 6. Example resource exploration pathway for addressing the question, "How to prevent COVID-19 spread" early on in the pandemic. The question leads to an iterative process of refining the question (unbound text), searching a resource/website (blue rounded box), finding a result of interest (orange oval). Blue arrows indicate a question refinement step. Purple arrows indicate a result review step (*i.e.*- identifying a potential result of interest). Red arrows indicate a manual search and filter step. Green arrows indicate linked search (*i.e.*- manual input to a resource not needed for result).



Supplemental Figure 7. Systems architecture for the outbreak.info Research Library metadata infrastructure. Individual data sources are harvested either through API-based calls, reading a tabular file or scraping-based HTML crawling, harmonized to our schemas through custom parser scripts, and uploaded, merged, and indexed to an Elasticsearch index using BioThings SDK. Since each source is harvested and harmonized independently, errors in a given data source do not affect updates in the other sources or the overall status of the API. Queries from the Research Library front-end or the R package are routed through a Tornado-based interpreter which accesses the underlying Elasticsearch index to return results from the API call.

