Building information visualizations with PubMed

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Why PubMed?

It’s big enough to tell us something about the biomedical literature as a whole

It’s free!

It’s easy to develop against

PubMed and MEDLINE

MEDLINE is the carefully organized database from the National Library of Medicine that provides access to “journal articles in life sciences with a concentration on biomedicine”

- Curated list of more than 5,600 journals
- Citations indexed with MeSH controlled vocabulary
- Almost 24 million indexed citations

PubMed is that and in-process stuff, publisher-supplied records, books, etc. – a little more than 27 million records

Both are searched through the same interface

Why visualizations?

Hard (at least for some of us) to form mental pictures without them

They’re pretty!

If they are *interactive,* they can give one a new way of interfacing with data

Basic Pattern

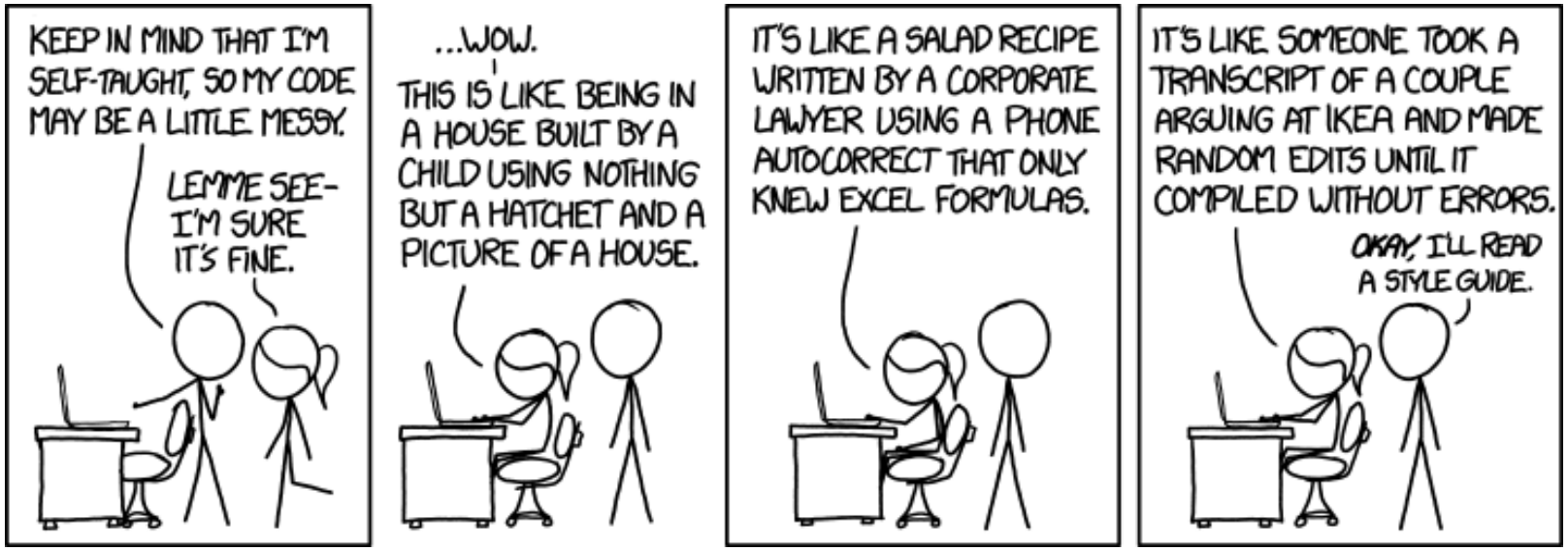
1. Send search to PubMed
2. Retrieve counts
3. Compare them to a baseline of some kind
4. Graph the difference
5. ???
6. Profit

Design Principles: Fast, Cheap and Out of Control

Use existing libraries whenever possible

Push as much out to the browser as possible

Working code will work just fine…



https://xkcd.com/1513/

E-Utilities

API to NCBI databases

Maintained by NLM

Simple syntax for calls – easy to implement in many environments

https://eutils.ncbi.nlm.nih.gov/entrez/eutils/esearch.fcgi?db=pubmed&term=diabetes&retmode=json&rettype=count

Brand-new documentation at https://dataguide.nlm.nih.gov/

Google Charts

Free

Simple

Works across browsers and probably(?) will be supported for a while

Lots of different iterations on the same theme

- Once you figure out one, easier to do another

Case one: Distribution by MeSH category or Subheading

MeSH headings are classes under 16 main branches

"Anatomy", "Humanities", etc

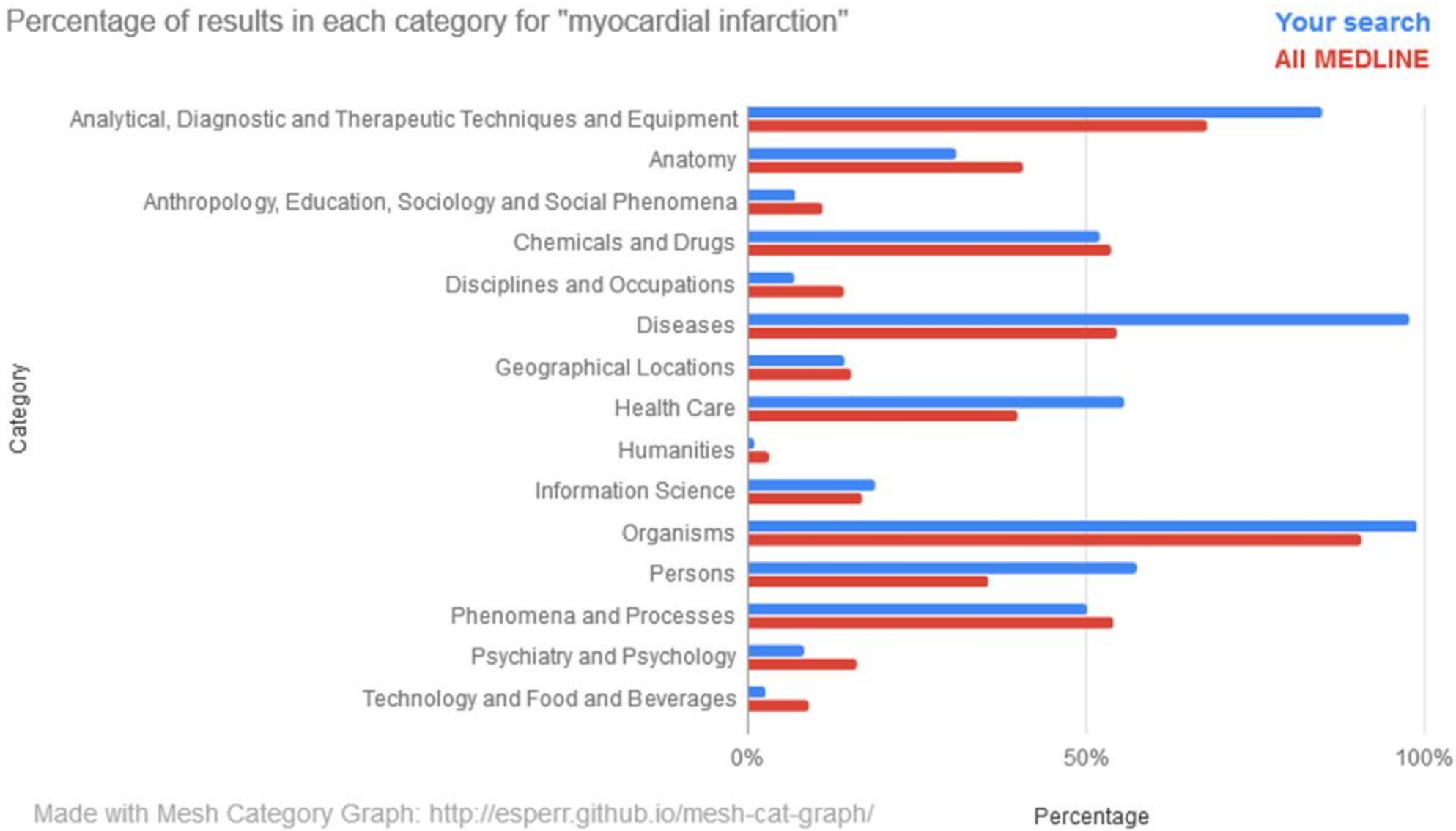
Many times MeSH headings will be further qualified with a subheading

"Analysis", "Diagnosis", "Psychology", etc.

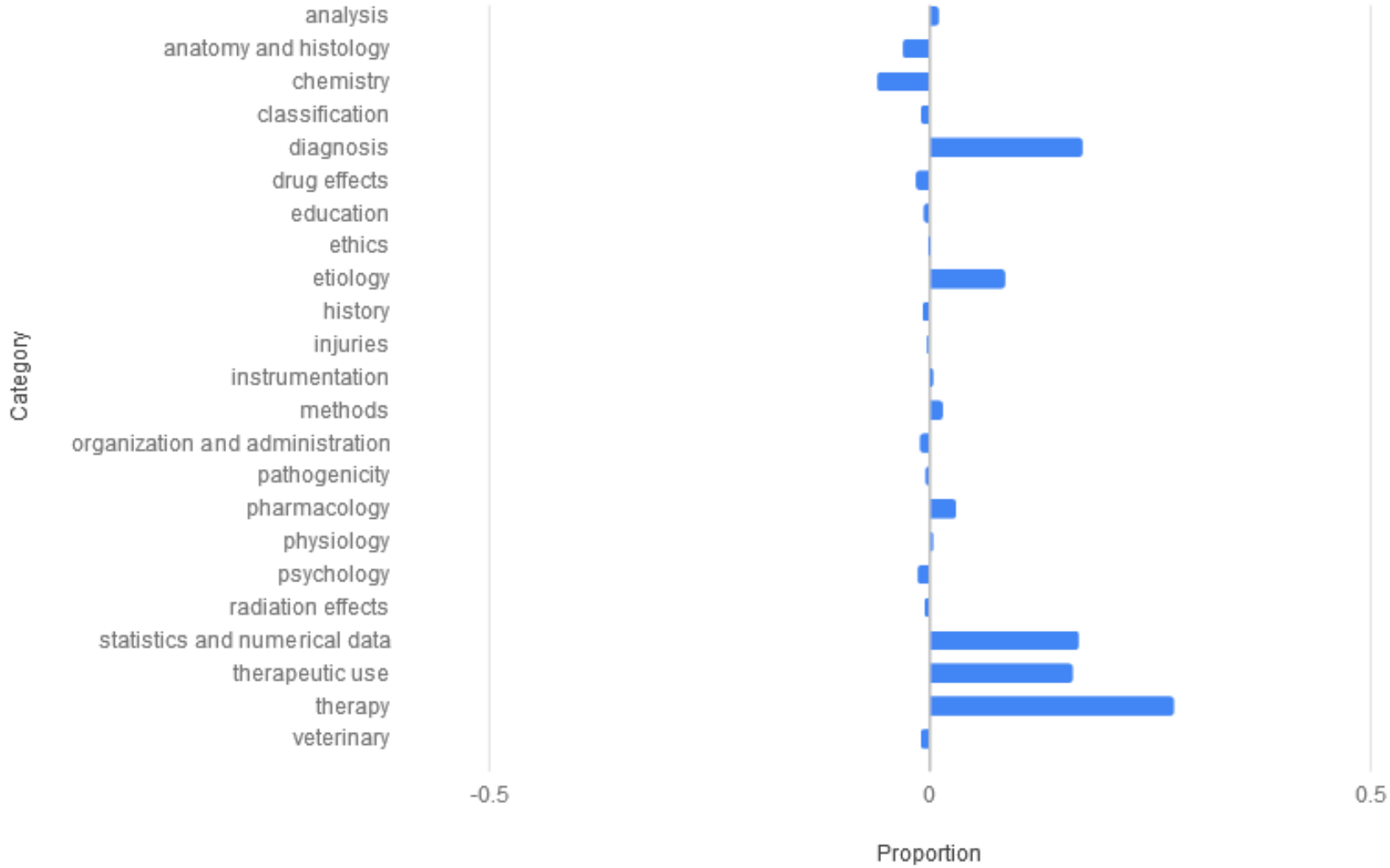
Do the *proportions* of headings under each tell us something about our search?

https://esperr.github.io/mesh-cat-graph/ and

https://esperr.github.io/mesh-subhead-graph/


Percentage of results in each category for "myocardial infarction"
Your search
All MEDLINE
Analytical, Diagnostic and Therapeutic Techniques and Equipment
Anatomy
Anthropology, Education, Sociology and Social Phenomena
Chemicals and Drugs
Disciplines and Occupations
Diseases
Geographical Locations
Health Care
Humanities
Information Science
Organisms
Persons
Phenomena and Processes
Psychiatry and Psychology
Technology and Food and Beverages
Category
0%
50%
100%
Percentage
Made with Mesh Category Graph: http://esperr.github.io/mesh-cat-graph/

Proportion of subheadings for "myocardial infarction" compared to baseline



Made with Mesh Subheading Graph: http://esperr.github.io/mesh-subhead-graph/

Difference between proportions of results for "cancer" and "heart disease" in each category

Made with Mesh Category Graph: http://esperr.github.io/mesh-cat-graph/

Case two: citations on a choropleth

MeSH headings include not only topic areas but *geographic regions*

- Around 15% of all indexed records are tagged with the name of a continent, country or city

For real coverage, probably want to throw in some text search as well

Too slow to do everything at once, so we split up the work

https://esperr.github.io/mapping-medline/

Mapping MEDLINE

Search

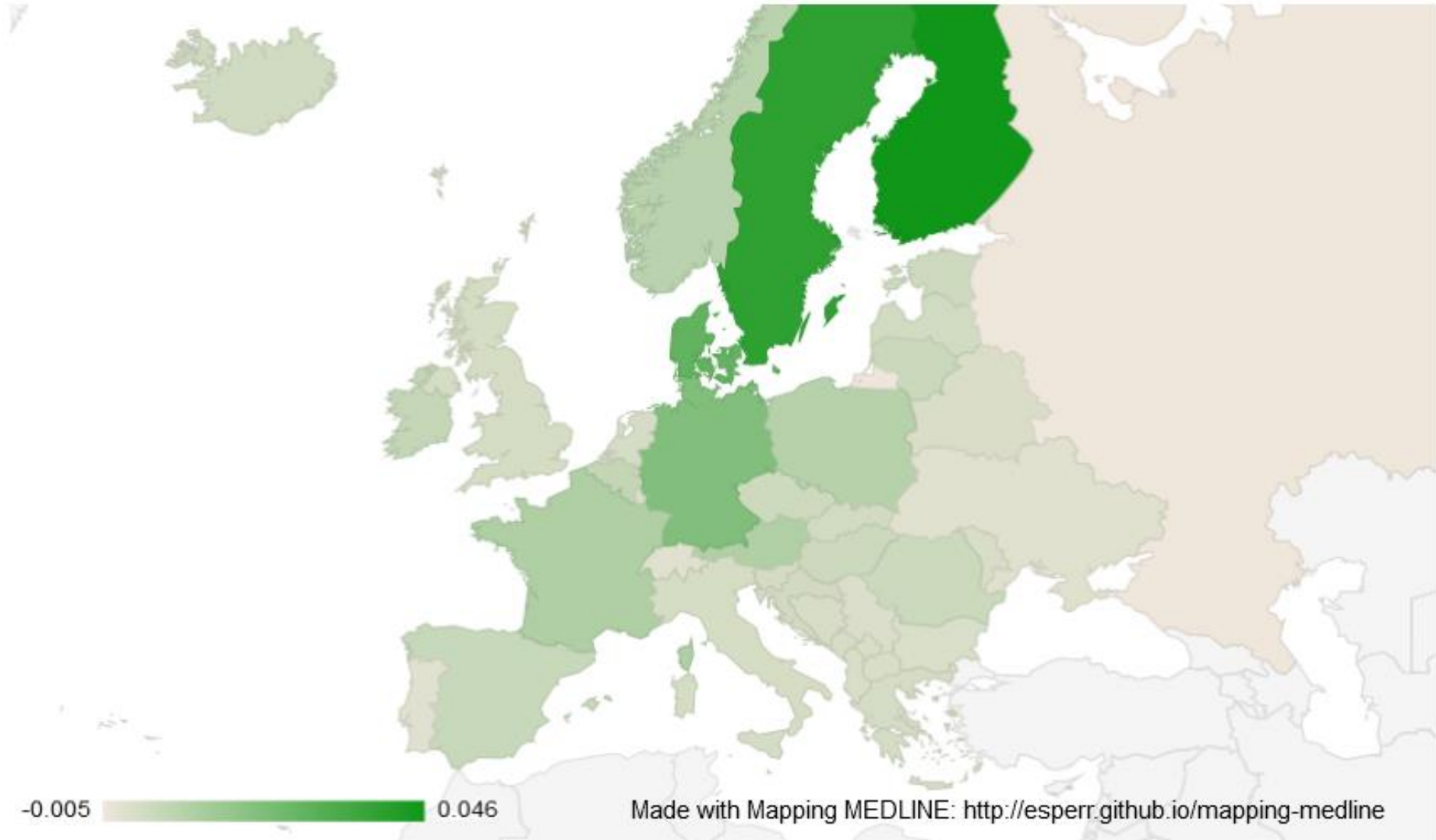
10,335 geographically tagged results for 'Diabetes Mellitus, Type 1'

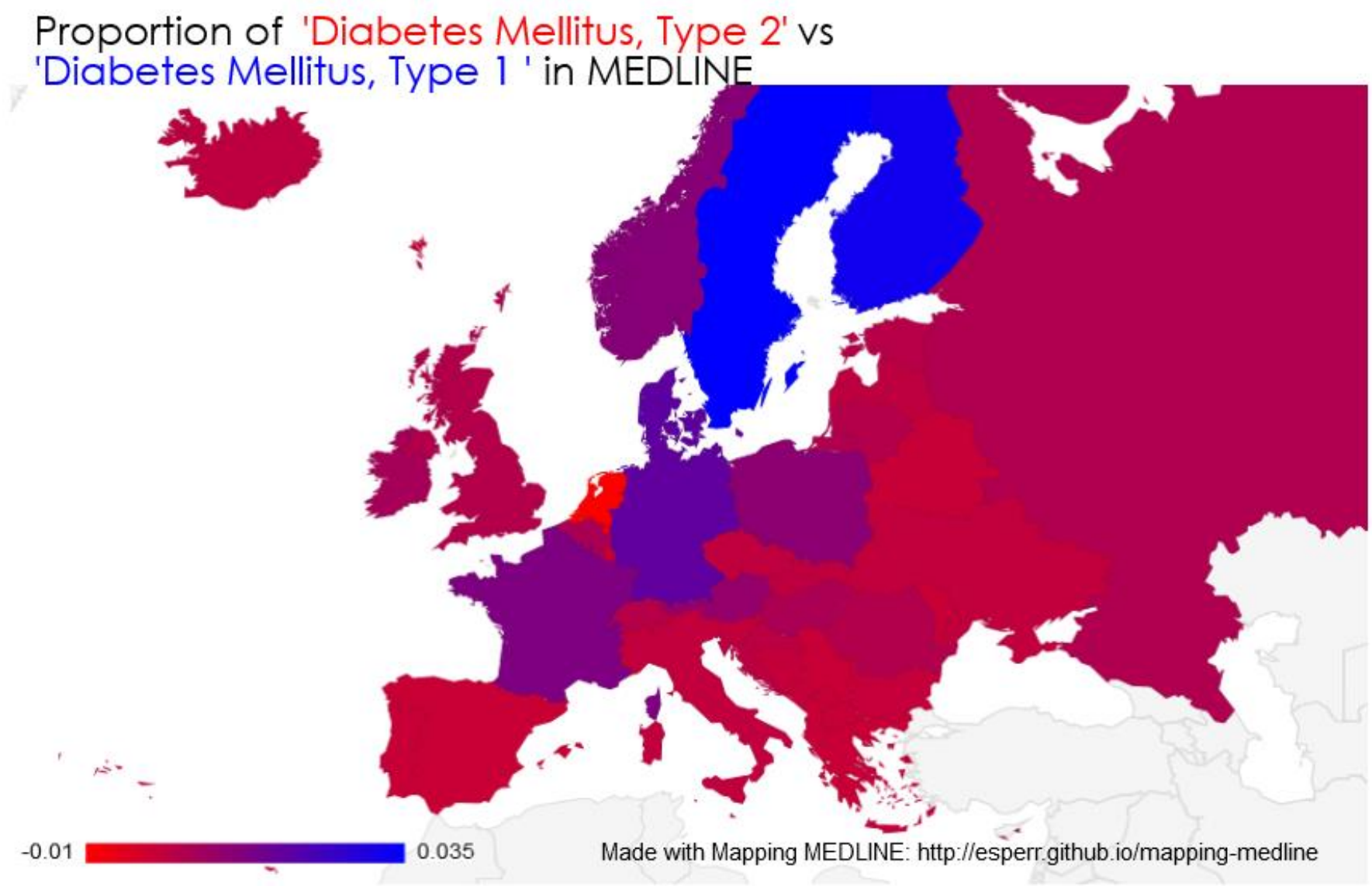
(Select a region below to see the map)

Africa	540	**Asia**	1,790
Caribbean Region	72	**Central America**	4
Europe	5,348	**North America**	2,462
Oceania	445	**South America**	301

Note: Use the 'Back to region list' link to return to this list

Proportion of MEDLINE citations for 'Diabetes Mellitus, Type 1 ' in Europe




Proportion of 'Diabetes Mellitus, Type 2' vs
'Diabetes Mellitus, Type 1 ' in MEDLINE
-0.01
0.035
Made with Mapping MEDLINE: http://esperr.github.io/mapping-medline

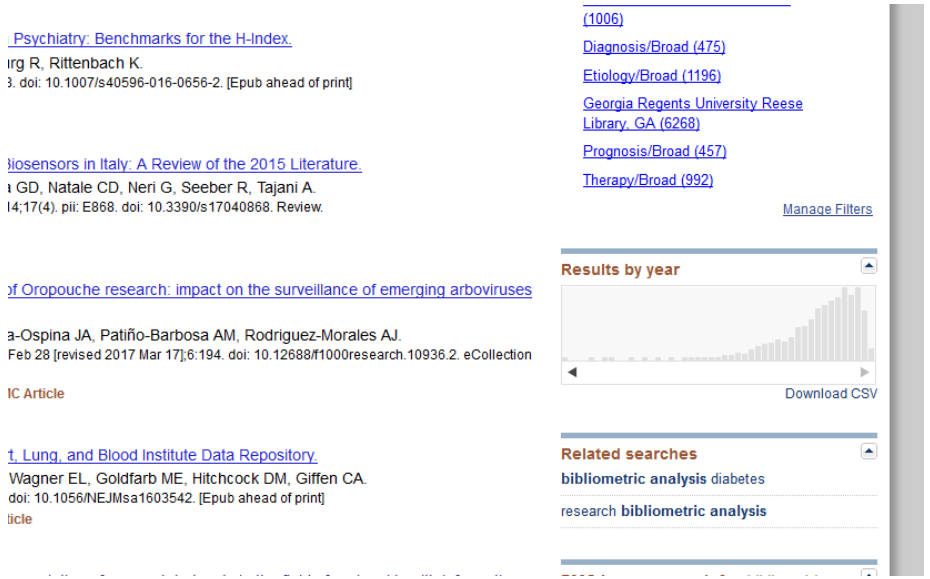
Case three: Citations over time

We *could* search each year individually, but that would take forever

Is there something else we could do?

Urlfetch and regex to the rescue!

https://esperr.github.io/pubmed-by-year/



Proportion of citations in PubMed

proportion for each search by year, 1945 to 2017

Made with PubMed by Year: http://esperr.github.io/pubmed-by-year

Case four: Venn diagrams

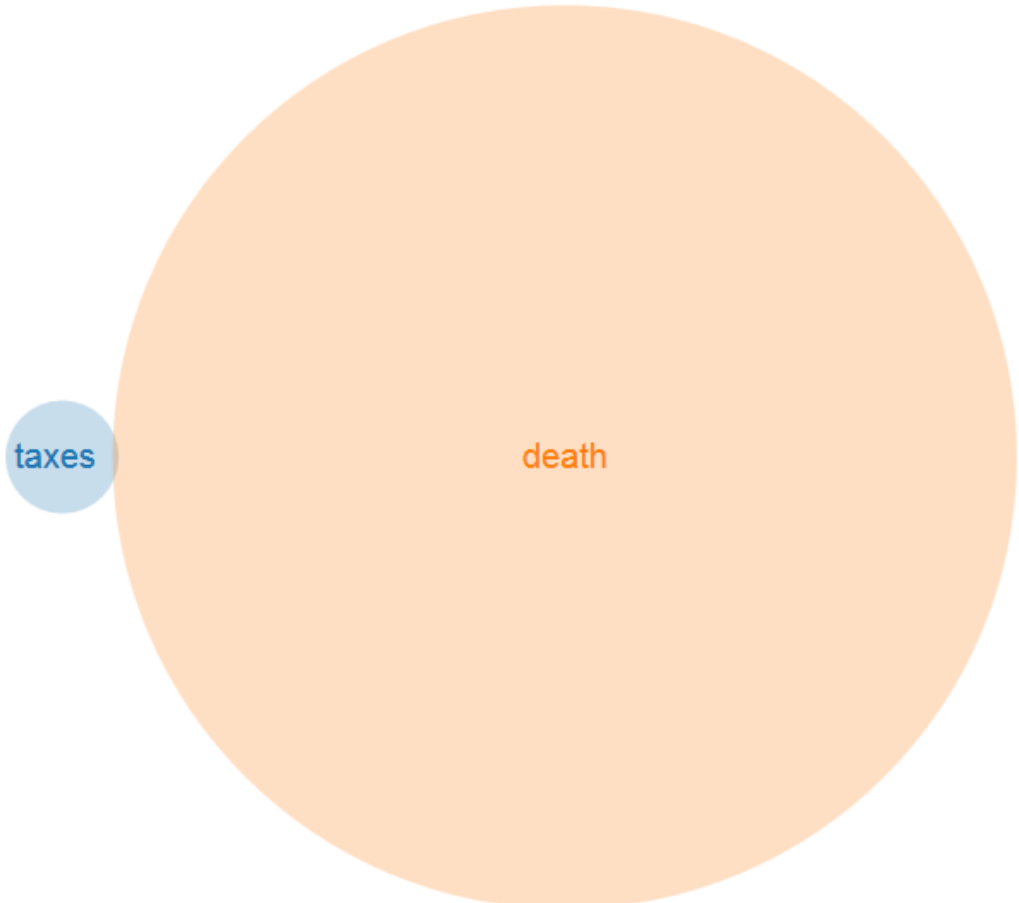
Librarians love Venn diagrams!

Another way of seeing beyond numbers

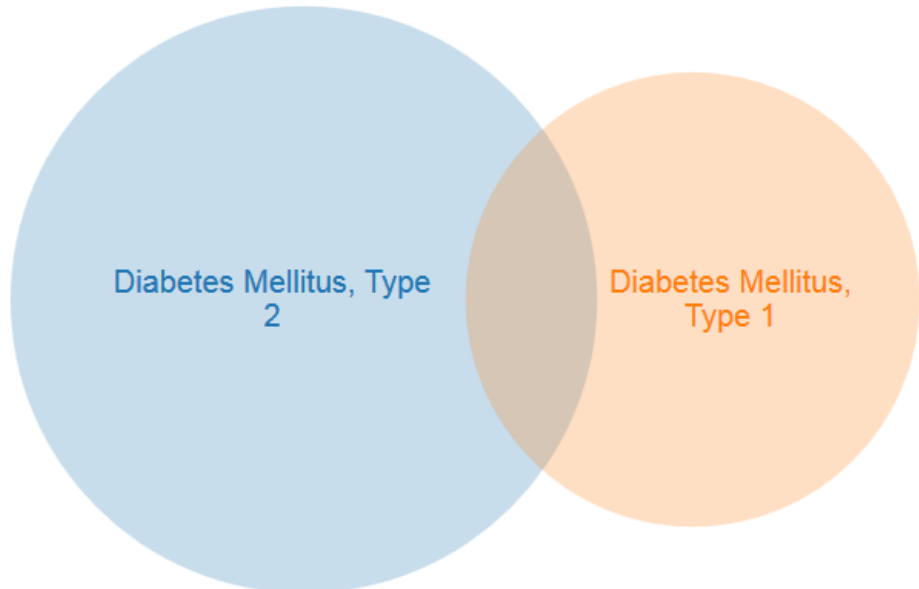
Does require a little d3 (with the help of venn.js)

https://pubvenn.appspot.com/

death and taxes



Diabetes Mellitus, Type 2 AND Diabetes Mellitus, Type 1



Questions?

https://esperr.github.io/visualizingpubmed/

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