



July 10th, 2019

Via Email

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N.C. Department of Environmental Quality
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Dear Renee Kramer & NC Department of Environmental Quality,

I am writing to provide feedback on the “DEQ North Carolina Community Mapping System,” as requested at <https://deq.nc.gov/outreach-education/environmental-justice/deq-north-carolina-community-mapping-system>.

My Background

I have worked as a temp contractor with the NC Department of Health and Human Services (DHHS) for around seven years, providing informatics, dashboard development, epidemiology, and disparities expert support. After my undergrad in Computer Science (Duke '03) and a Masters in Social Work (UNC '09) focusing on non-profit management, I began public health work with the Orange County Health Department in 2010 – first with their Community Health Assessment then becoming their first Public Health Epidemiology & Informatics Manager. After collaborations with North Carolina Department of Health and Human Services I became a part-time contractor assisting in the epidemiology and informatics space. I completed a second Masters, Masters of Professional Science in Biomedical and Health Informatics, focusing on Public Health Informatics in 2018, and defended my Epidemiology PhD in 2019 (Dissertation on Racial Disparities in Traffic Stops).

Most recently I have built two interactive dashboards for NC DHHS. First, I was the main designer and architect of the North Carolina Opioid Action Plan data dashboard website (<http://bit.ly/NCOpioidDashboard>), which I'm currently in the process of transitioning to Tableau. That site is widely used, over 20,000 hits in the last 15 months. Second, I have released an Alcohol Outlet dashboard (<http://bit.ly/NCAlcoholDashboard>) that has received around 2,000 hits since its release earlier this spring. I have around a decade of static and interactive dashboard development.

I would like to share some suggestions and critiques for the prototype. I will also offer my help if DEQ decides to design a version more in keeping with these principles and ideas. Perhaps we could collaborate with the Environmental Health Branch (with more content knowledge of the health mechanisms), the Chronic Disease Branch (where I'm at, where we have a lot of dashboard development experience), and DEQ. Perhaps the Office of Minority Health could also play a role.

Suggestions

1) Be explicit about environmental justice and other core concepts - orient the user to them.

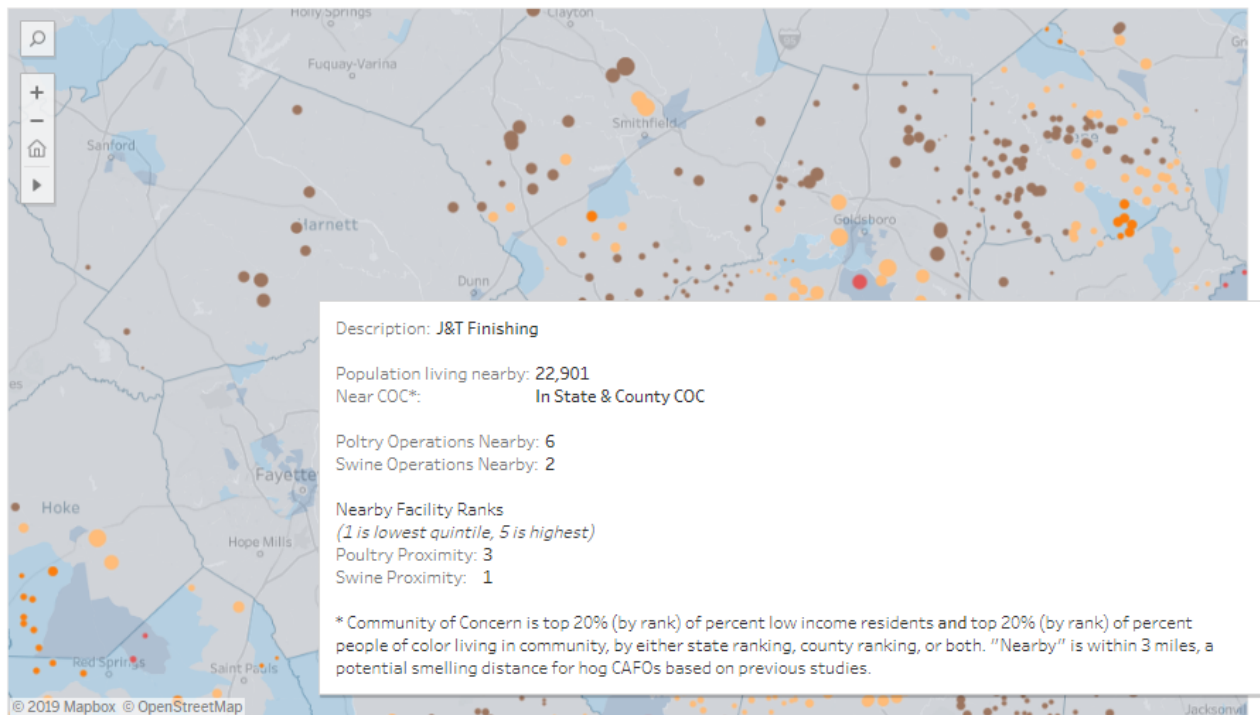
I would like to see the tool start with a very clear orientation to core concepts like environmental justice, environmental racism, and disparities. Other state departments (e.g. DHHS) do this very clearly. For reference, consider the celebrated “Racial and Ethnic Health Disparities in North Carolina: North Carolina Health Equity Report 2018” by the NC Department of Health and Human Services Office of Minority Health and Health Disparities (https://schs.dph.ncdhhs.gov/SCHS/pdf/MinorityHealthReport_Web_2018.pdf) . Perhaps you could collaborate with that office, or DHHS in general, to define disparate exposure to sites of environmental concern. I think it’s important that DEQ put its definition out there, so it can hold itself accountable to it and communities can assist in that process. We have taken to recording an orientation to the core concepts and use of our dashboards in Youtube and embedding those as videos on the dashboard landing page. We’ve received very positive feedback for that practice, and I recommend it.

2) Prioritize EJ related measures first, then health and population measures later

Though defining Communities of Concern may be nuanced, and defining what a disparity in environmental exposures / proximity is similarly nuanced, these are the most important concepts for a tool designed to speak to questions of environmental justice and racism. I am surprised that these concepts weren’t included more directly in the prototype in a more usable fashion. I and other community members with some expertise in developing risk scores and indices for spatial areas would be happy to assist you in this. Other tools (e.g. California’s CalEnviroScreen tool, <https://oehha.ca.gov/calenviroscreen/>) are very explicit about their definitions, which could be taken as is, for starters.

As an example, as a test, I created a measure of “community of concern” (though there are many ways to do this, I prototyped with top 20% (by rank) minority and low-income residents). I then overlaid swine and poultry CAFOs, with points representing their relative size (of head), and flagged them whether they were in or near a county or state (again, by county or state rank) community of concern. This prototype (not a complete dashboard, just an example interactive map) was built entirely in Tableau, after spatial math completed in R (though it could be done in ArcGIS, for example). See next page.

Swine CAFOs and Communities of Concern



Mike's Notes:

Pan and zoom the map around to explore using the tools at the upper left of the map, or pan by holding CTRL or ALT and dragging your mouse and zoom with your mousewheel. Click on or mouse over a community or CAFO for more information.

This is Just a draft/test. There's other math to identify communities of concern (e.g. could use the rank of who's exposed to the most swine already). And certainly the labels ("community of concern") may need work. I have no positive things on this map - Tableau has some serious limitations on layers - though I could also put things like churches and schools and parks on maps on another page. I could include other exposure types besides swine (and a count of nearby poultry), etc. But this demonstrates some way to prioritize intervention. Could also rank by the number of people around the CAFO (currently size of dot), or the number of head or SSLW of hogs (not currently included as variables, but could be). This isn't meant to be a solution, but often discussion is easier when looking at something real.

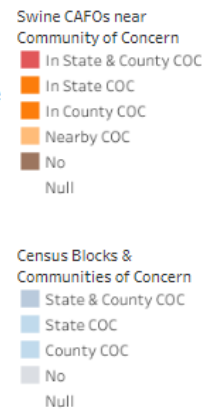
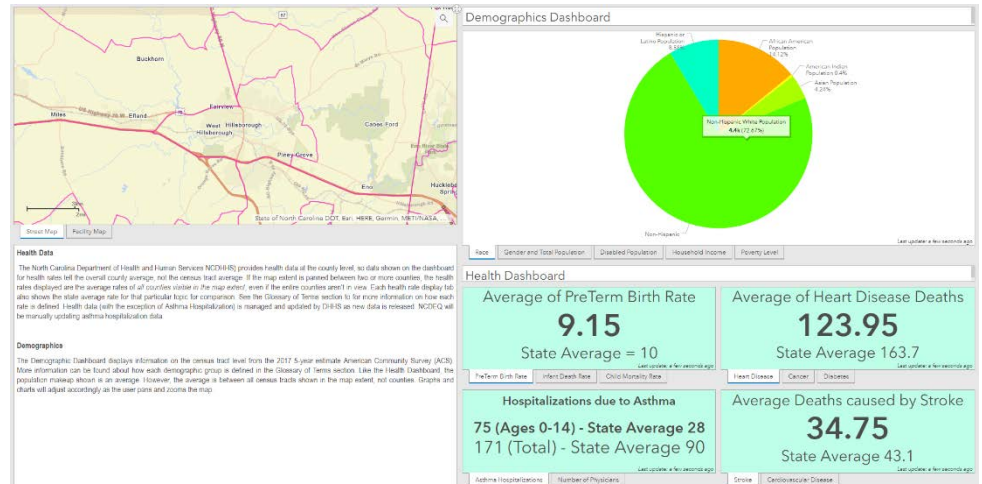


Figure: Screenshot of prototype dashboard element – Swine CAFOs and Communities of Concern. Developed by Mike Dolan Fliss (author) in Spring 2019.

3) Follow best practices for usability.

As it's currently designed, the site does not follow most modern principles of data visualization and dashboard development. This will reduce the public's ability to use it at all, and use it correctly. Edward Tufte and Stephen Few are thought leaders in this space. I recommend Few's "Information Dashboard Design" as a starter. Usability should be paramount. I understand the ArcGIS online platform has limitations (see later point) but think that there should be some effort to follow modern data visualization principles to maximize usability. A whiteboard / story board may help with the design here, as would specific user experience "tasks" and a demonstration of how a user might complete them. As is, the site strikes me as a less-usable version than the EPA EJ SCREEN tool, not one that's particularly known

Figure: Screenshot of ArcMaps dashboard. Data is buried behind many different tabs, and largely un-visualized. Though there are comparisons to state average, readers will not be able to tell whether higher or lower metrics are significantly higher or lower (no z-scores, percentiles, etc.).



4) Use a more data-visualization-friendly different platform.

Though I appreciate this tool took real staff time to build (and is no small feat I'm sure), I believe DEQ may be severely limited by the ArcGIS platform. ArcGIS online does not have robust data visualization and graph types, even while it has a good mapping basis. Even the Story Maps feature (used by the NC State Center for Health Statistics for Social Determinants, here <https://schs.dph.ncdhhs.gov/data/hsa/>) would do a better job in conveying a narrative.

Dozens of state employees are now using Tableau, a relatively low- to no-cost tool for presenting data, including map data. I recommend that. I've also built highly customized dashboards in R Shiny, though this is more nuanced.

All tools have limitations. Tableau may not do as good of a job with map data (though I've had good success with it, actually). But given you'll have to compromise somewhere, I highly recommend moving away from ArcGIS, which will have some major limitations in behind-the-scenes math on the metrics (like appropriate population-weighted averages) and more usable graphs.

5) Ensure health data presented is correct; automate where possible.

I work daily with health data – death and ED records in particular. I am concerned the aggregation methods for the health data as presented in the tool are very incorrect and will lead to more confusion than not. Per the health notes (and thanks for these!):

The North Carolina Department of Health and Human Services (NCDHHS) provides health data at the county level, so data shown on the dashboard for health rates tell the overall county average, not the census tract average. If the map extent is panned between two or more counties, the health rates displayed are the average rates of all counties visible in the map extent, even if the entire counties aren't in view. Each health rate display tab also shows the state average rate for that particular topic for comparison. See the Glossary of Terms section for more information on how each rate is defined. Health data (with the exception of Asthma Hospitalization) is managed and updated by DHHS as new data is released. NCDEQ will be manually updating asthma hospitalization data.

“NCDHHS provides data at the county level” is not true, for one, and two, average rates of all counties visible produces categorically incorrect measures of health. On point one, I (and the State Center for Health Statistics) can provide DEQ with health data below the county level. Death data for mortalities are available as low as the block group, ED data is available at the zip code, and birth data is likewise available sub-county – I have worked with all of these datasets personally. I believe (though am not sure) hospitalization discharge data is also available sub-county, though I have not worked with that data set below the county level. Still population weighted averages would be a better attempt at combining these measures. Averaging whatever is on the map is so wrong as to be better to NOT do it. We find journalists write articles based on our dashboard data. If they were to compare the DEQ tool to DHHS tools, it should be reasonable similar. As is, I am concerned you are putting out data that may be very incorrect. Lastly, I have been working on automation of data flows from many health systems. I am happy to be a resource in this area so DEQ does not have to manually update as much data. I'd recommend a processing step (which I or others can help you write in R or another language), then visualization building.

6) Be explicit about disparities in health

The DHHS office of minority office mentioned previously is very explicit about demonstrating what a health disparity looks like. Likewise, the State Center for Health Statistics Healthy NC 2020 objectives also includes measures of disparities. I'd like to see this tool incorporate very clear measures of disparate proximity exposure to environmental hazards, as well as health disparities by race and income. As is there is little health disparity information – just aggregate comparison of an entire area to the state, in a way that makes it challenging to know what is a meaningful difference, and no measures of disparate proximity.

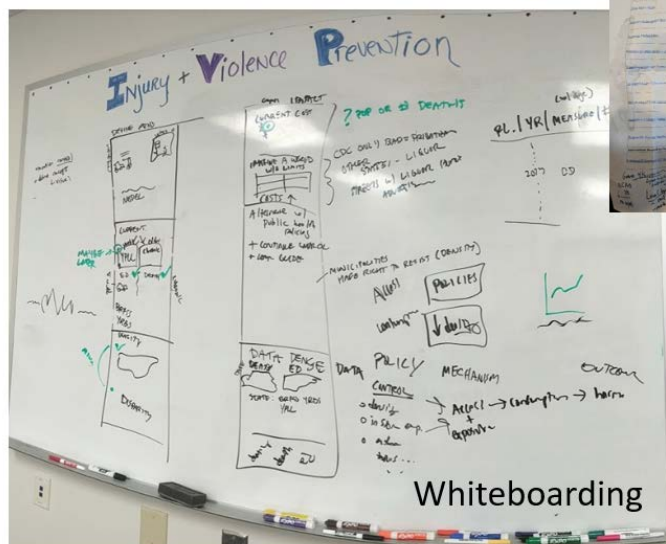
7) Start dashboard design from story-boards. Incorporate community meeting feedback.

Before offering a prototype this far into the process, I recommend whiteboarding, and getting feedback from anticipated users. When I presented the Alcohol dashboard to a national group of epidemiologists (below), I shared that it's a common best practice to design user interfaces using a technique sometimes called white-boarding, story-boarding, or wire-framing. In short: draw out what it should look like, and what should it do. Identify how a user can answer their questions with the tool. As is, if a user wanted to answer a question like “is my area exposed to more release locations than others? Are the health metrics in this area worse for some people than others?” The data to answer these questions is too spread out to readily answer it quickly.

Relatedly, I am curious what feedback from the community meetings DEQ hosted was used in this process. Was those community meeting processes too vague to be useful in the design? I only attended one community meeting, but per my notes, little of what we talked about it is represented at all in this dashboard. It might increase community trust to document how feedback on initial design requirements was incorporated into this design. If it was, my apologies: again, I only attended the meeting I was invited to. But if those community meetings were not so useful for the design process, perhaps starting over and focusing on dashboard design user elements would be useful. If I can help with that process, I am willing. We've gone through this dashboard design process a few times now, even we're still, always, learning and receiving good, critical feedback.

Figure, Right: Slide from presentation at national conference on development of alcohol dashboard on whiteboarding. Presentation given at Council of State and Territorial Epidemiologists (CSTE) June 2019 meeting.

Alcohol Dashboard: How we design:



SOURCE:

NCDHHS, Division of Public Health : Injury & Violence Prevention Branch | Measuring alcohol outlet density | Tuesday June 4, 2019

8) Include more environmental location data, especially poultry locations

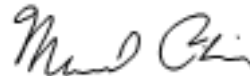
I understand that for whatever reason other state departments are not sharing the location of poultry CAFOs. However, this is a very common emission type in NC. Though I understand the state may have limitations in sharing data captured from other mechanisms (like EWG's estimated poultry locations), it seems to me that DEQ could post data from others with the clear limitation that it may not be right. It's not like the location data is perfect for the state data, either. But providing no layer for such incident locations seems wrong to me. Ideally I'd like to see DEQ take the lead here and post something, even if it's imperfect – whether based on the EWG dataset, Department of Emergency Management footprint information, collaborate with a spatial researchers to get some data... but nothing for poultry doesn't seem right, in our state.

9) Innovate

Building a tool like this is an opportunity to be a national leader. For instance, there are phone apps that provide anonymous complaint submission for public safety interactions (e.g. Mr. Checkpoint for law enforcement interactions). Though I recognize staff time and funding are limited, some of these tools could be built using open source free or low-cost products, like google forms, or survey monkey. I think the community members interested in this tool are looking for different, improved functionality as compared to EJ SCREEN – and not just very similar functionality with one or two more layers.

In conclusion, you have my genuine sympathies for how difficult it is to build a strong tool for community mapping and environmental justice. I've built my share of tools, and the process is not easy. There are best practices, but no magic techniques that solve all the very real issues of clear story-telling, data visualization, platform selection, co-design, government data silos, and working across different content areas (e.g. including health and disparity data in DEQ tools). This is far from easy. That said, I think collaboration – with community groups who would be users, and data partners like DHHS - can help make what may be otherwise impossible, possible. I'd hope DEQ aspires to have a nationally recognized community mapper / environmental justice tool. And I'd like to help us get there, even if it takes a while. Please reach out if I can be of service – I am willing to help co-lead a design process, assist in uptraining of other tools (e.g. Tableau), help in data processing, etc.

Signed,



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