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Developing a Meaningful Social Determinants of Health (SDOH) Neighborhood Index

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EPI CORNER

Neighborhoods constitute the social and physical context surrounding children and their families. Neighborhood characteristics (AKA social determinants of health, SDOH) have the potential to mediate family -and individual- risk (on the positive side), or introduce risk (on the negative side). Obtaining meaningful neighborhood-level SDOH measures can be challenging, however. This article describes one method for developing a Neighborhood SDOH index for Kalamazoo County, as part of a study examining the impact of neighborhood upon pediatric primary care access. "Neighborhood" was defined by census tract, an administrative unit used by the federal government's Census Bureau, and typically including 4,000 individuals. As a census bureau unit, census tract has the advantage of massive amounts of publicly available data, and is often used by researchers and policy makers alike to assess community context.

Step 1. Conduct a scan of publicly available data sources for census tract level data, including:
- Census Bureau
- ISCPR (Inter-university Consortium for Political & Social Research)
- Healthy People 2020
- Raj Chetty's Opportunity Atlas
- Dartmouth Atlas of Healthcare

Step 2. Select measures that captured meaningful economic and social characteristics, including structural equity. The table below lists the measures (and their source) that we selected for our study:

SDOH dimension	Variable	Source (website)
Economic	**Median HH income**	**Census Data, https://www.census.gov/data.html**
	Employment rate	**Opportunity Atlas, https://opportunityatlas.org/**
	College grad	**Census Data, https://www.census.gov/data.html**
	Privately Ins-birth	**Vital Records (geocoded, aggregated)**
Social	**Married parents**	**Census Data, https://www.census.gov/data.html**
	Jail rate *	**Opportunity Atlas, https://opportunityatlas.org/**
	Structural Equity**	**Census Data, https://www.census.gov/data.html**

* % of cohort (born 1975-1983 to parents in the bottom 25th income bracket) in jail on 4-1-2010
** Structural Equity Measure: ratio of White median HH income to Black median HH income

Step 3. Identify a meaningful health measure (census-tract level). Because we had access to geocoded individual-level vital records, we selected the health outcome of "prematurity." We aggregated this up to the census tract to generate a prematurity prevalence figure for each of the 57 tracts in the county. From there, we calculated prevalence quintiles:

Quintiles
5 (worst)	=	16.0%-23.1%
4	=	11.5%-15.6%
3	=	9.4%-11.1%
2	=	6.7%- 8.8%
1 (best)	=	0.0%- 6.3%

Step 4. Generate SDOH thresholds using the best and worst prematurity-quintile tracts:

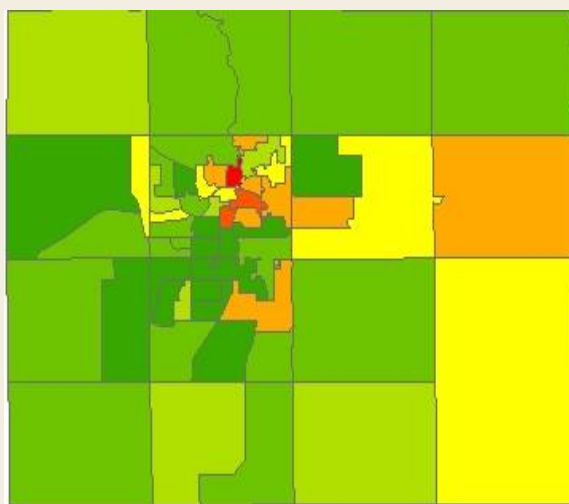| THRESHHOLDS		
Variables	**BEST (11 census tracts with prematurity between 0-6.5%)**	**WORST. (11 census tracts with prematurity between 15.9-23.1%)**
Median HH income	$48,429	$40,997
Employment rate	62.3% (age 16+ in workforce)	62.9% (age 16+ in workforce)
College grad	31.6% (age 25+)	23.7% (age 25+)
Privately Ins-birth	60.5% (39.5%)	47.5 (52.5% Medicaid)
Married parents	63.2 (36.8%) (of child <18)	60.6 (39.4%) (of child <18)
Jail rate	7.0%	14.1%
Structural Equity	(6) 1.52 Whites higher HH $	(9) 2.28 Wh higher HH $

Step 5. Calculate relative rates, and select <u>meaningful</u> variables, those with relative rates >= 1.2 or <= 0.8

Variables	**BEST (11 census tracts with prematurity between 0-6.5%)**	**WORST. (11 census tracts with prematurity between 15.9-23.1%)**	**Relative Rates**
Median HH income	$48,429	$40,997	1.2
Employment rate	62.3% (age 16+ in workforce)	62.9% (age 16+ in workforce)	1.0
College grad	31.6% (age 25+)	23.7% (age 25+)	1.3
Privately Ins-birth	60.5% (39.5%)	47.5 (52.5% Medicaid)	1.3
Married parents	63.2 (36.8%) (of child <18)	60.6 (39.4%) (of child <18)	1.0
Jail rate	7.0%	14.1%	0.50
Structural Equity	(6) 1.52 Whites higher HH $	(9) 2.28 Wh higher HH $	0.67

Step 6. Generate SDOH Index, using the highlighted variables above and their WORST threshold level. Census tracts were given a point for each threshold reached, for a range of 0-6 possible points. The higher the points, the worse the SDOH risk:

> SDOH Index thresholds:
> (1) HH income<$41,000,
> (2) College grad<24%,
> (3) Medicaid ins>52%,
> (4) Jail rate>14%,
> (5) racial SES equity>2.3,
> (6) prematurity >15%.

Step 7. Map the neighborhoods using the SDOH index. Neighborhood risk varied widely across Kalamazoo County, from 0 risks (light yellow) to 6 risks (red).

This method, using publicly available data and applying risk-threshholds based upon an identified health outcome, generated a meaningful index capturing neighborhood level SDOH risk.

Powering a Study with Paired Data

By: Alyssa Woodwyk, MS

When performing power analysis for a research study, it is important to consider whether the data are correlated. A common example of correlated data are pre/post survey responses from the same individuals. The nature of collecting data from the same individual at two or more time points necessitates the use of statistical methods which account for the inherent correlation. Two use cases of power analysis for correlated data are paired means and paired frequencies.

When we have quantitative data collected at two time points for the same subjects, we can perform a paired means power analysis. This requires either the group means, standard deviations, and the correlation, or the mean difference to detect and its standard deviation, and the total number of pairs for which data were collected. When we are collecting pre/post data on the same subjects, the total number of pairs is equal to the total number of subjects. However, when we match subjects for two treatment groups, the total number of pairs is the number of subject pairs.

If categorical data are correlated between two time points, we can perform a paired frequencies power analysis. This analysis requires either the discordant proportions or the difference to detect in the two discordant proportions, the reference proportion, and the total number of pairs. Discordant proportions are those of paired responses that differ between the two data collection time points. For example, survey respondents who responded 'yes' then 'no' to the same question on a survey administered at two different time points, or conversely those who responded 'no' then 'yes'. These proportions are often notated as p_{10} and p_{01}.

Given the information necessary, it is possible to determine whether an analysis utilizing paired data is adequately powered. While correlation is inherent in paired data, knowing the proper techniques to power such a study will ensure analytical findings the researcher can be confident in.

Data Bytes

REDCap Messenger

By: Anita Bell, BS

What is REDCap Messenger?
Messenger is a fairly new communication tool that has been added to the REDCap platform. Similar to a chat client, it allows users to exchange information via direct and group messages, as well as the ability to upload and share data files and other documents. Consider exploring Messenger functionality if you use REDCap and participate in study teams.

Benefits of REDCap Messenger

Security: Messenger can be used for all communications within a study. Because it is hosted on REDCap servers, it shares the HIPAA-compliant security protections built into the REDCap application. A major advantage of using Messenger is that communication for an entire study can be created, shared and stored in a central location - the "conversation" that you create. Conversations can consist of any number of messages, with optional file attachments and embedded images. Study data and PHI, among other information, can be uploaded and discussed freely, without data breach concerns. Data can be transferred securely without the obligation of creating OneDrive or similar shares for secured access.

Archiving/backup: It's worth noting that past conversations are not deleted and remain accessible after ending a REDCap session. You can download and save Messenger conversations in Excel .csv format. You can also archive conversations within Messenger, if desired. To remain compliant with HIPAA and to ensure data safety, files downloaded from Messenger must be saved to a secured HIPAA compliant storage location.

How to use REDCap Messenger

Open Messenger by clicking on the "REDCap Messenger" link on the REDCap navigation pane, if you have a project open. (If you're in "My Projects" view, the link is located along the top tabs.) Select "Create new conversation". Add study participants to the project by selecting names from the "Users List" or search for users with the "Search Users" box. Enter a title for the conversation; a study name or related keyword is a good choice. Optionally, you can link the conversation to a project. Projects are selected from a dropdown list populated with each project that the user has access to.

Messages entered will be displayed in each user's Messenger viewing pane. If a user is not logged into REDCap, he can receive "general" notifications via WMed's Outlook email when messages have been posted to a conversation. (Outlook notifies the user that a message has been added, but does not display the message, for security purposes.) Users also receive "system" notifications from REDCap administrators. An example would be a notification listing new features in REDCap; a recent message revealed that reports could be organized into "Report Folders" in any project. Notifications are optional and user-customizable in REDCap settings.

An estimated 85% of medical research is a waste, due to inadequate study design, weak research questions, or poor reporting of the results[1]. To be part of the 15% of studies that are making meaningful contributions, a carefully crafted research question is essential.

Research questions are questions that cannot be easily answered and require some effort (or research) to solve. They start with a problem that needs to be addressed. Research questions often start with 'how' or 'why', and are written in a very clear and focused manner to address a specific problem. Research questions may be exploratory, descriptive, or explanatory. Exploratory questions connect ideas and ask 'why" type questions, they provide information to define relationships between variables. Descriptive questions are observational in nature, and describe conditions and characteristics that exist. Explanatory questions attempt to explain causal relationships and describe the effect that one variable has on another. Regardless of the type of question, there are five key features of a good research question, described by the acronym FINER.

Feasible: Good research questions need to be answerable and attainable with the available resources including finances, expertise, study population, time, and equipment. The question also needs to be focused enough to answer; questions that are too broad will not be easily addressed in a research project and may require an entire career to answer.

Interesting: The question should be both interesting to the research team and to the public. It should also address a problem that is important to solve. For example, answering the question "will humans swim faster through syrup or water" is probably not that important (yes, this was a real project that was awarded an IgNobel award)[2].

Novel: A good research question should provide new knowledge that adds to the current state of the field. In order to ask a novel question a solid understanding of the current knowledge in the field is needed, this defines where the line between known and unknown exists.
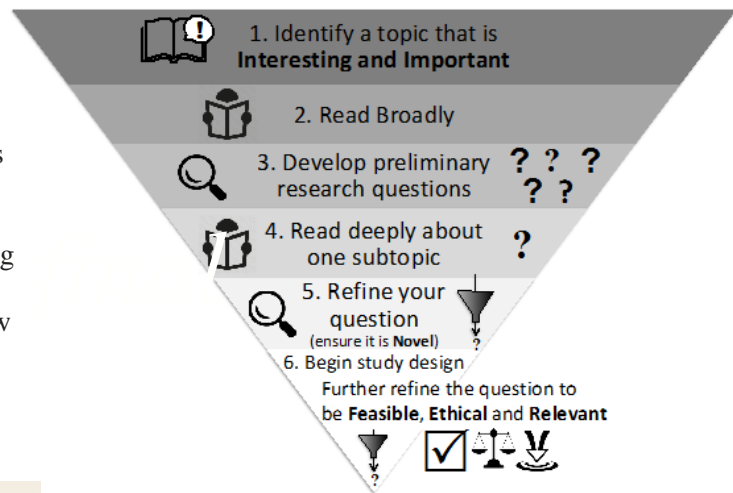
Ethical: Any good research project should be ethically designed, held to the highest of scientific standards, and have appropriate regulatory oversight. Ethical studies have social and clinical value, respect for subjects, and appropriate research methods. The study should be designed to eliminate bias; consultation with biostatisticians can help to ensure appropriate study design.

Relevant: The question and answer should matter. The results should provide useable information that has a significant and demonstrable impact on the problem.

A good research question will guide and structure the research project. The answer to your research question becomes your hypothesis that can be tested to determine its accuracy. Thus, the research becomes focused towards addressing or testing the hypothesis.

Developing a good research question takes time. Spending time planning and designing the project upfront ensures that the process and outcomes are worth the effort. Follow the steps indicated (figure to the right) to develop and focus a good research question.

1. Identify a topic that is **Interesting and Important**
2. Read Broadly
3. Develop preliminary research questions
4. Read deeply about one subtopic
5. Refine your question (ensure it is **Novel**)
6. Begin study design
Further refine the question to be **Feasible, Ethical** and **Relevant**

1. Chalmers I, Glasziou P. Avoidable waste in the production and reporting of research evidence. Lancet 2009;374:86-9.
2. Gettelfinger B, Cussler EL. Will humans swim faster or slower in syrup? American Institute of Chemical Engineers Journal 2004;50:2646-7.