

How We Measure Food Insecurity: Existing Models and Proximity as a Potential Factor for Future Models

ANTONIO RAMIREZ

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Abstract

Models for measuring food insecurity in our world account for factors such as quantity and quality of the foods that come into a household along with financial situation. In researching existing models for measuring food insecurity, proximity wasn't a common factor and that struck me as odd because food deserts exist which is a spatial issue, not a quantity, quality, or financial issue. This begs the question, what is the effect of proximity (i.e. to grocery stores) on measures of food insecurity for people in the United States? This paper proposes a non-probability convenience-purposive sampling strategy for Tacoma, WA residents in order to determine the reliability and validity of proximity as a factor in food insecurity. Being on the ground and surveying people would accrue first hand anecdotes and data regarding the effects of space on people's food insecurity. The survey consists of 8 questions (see Appendix page 14), 6 of which directly deal with the variables this proposal is aimed at measuring with 2 optional questions that are for gathering qualitative, anecdotal data to provide context to the food insecurity narrative. The variables of interest are proximity to grocery stores, money spent on food, common grocery store locations that individuals visit, mode of transportation, and monthly income (see Appendix for questions).

Intellectual Benefits

As will be explained later in the paper, there are flaws in the existing models for measuring food insecurity. Not to say that they haven't been working for their intended purposes in the past, there are factors, in this case proximity, that are being left out and I believe that these models could benefit from including spatial factors. Bringing proximity into the conversation means that there is a new lens with which to observe these phenomena.

Practical/Policy Benefits

Knowing the effects of proximity on people's food insecurity would allow for businesses to establish new locations in areas that are prime for business, or for cities to build housing based on how many food services are within a given distance to the potential housing area (or some combination thereof). I believe that understanding food proximity would allow for future urban development to be conscious of people being able to have adequate spatial access to food.

Introduction

Food insecurity is a prominent issue in the United States, affecting one in eight people. This means that all of those individuals fall into one or more of the following categories (including but not limited to): not knowing where your next meal will come from, not knowing when your next meal will come, not receiving adequate nutrition, and/or not receiving quality products. Throughout the years, many researchers have developed ways of measuring food insecurity so as to overcome the binary of categorizing people as ‘food insecure’ and ‘not food insecure’ and instead describe food insecurity as a spectrum. This way, we can attempt to ask why people are food insecure and what are the effects thereof. This paper is going to dive into different methods of measuring food insecurity, comparing them in order to determine commonalities, differences, and importantly the gaps that are missed.

Background

Components of food insecurity Coates (2013, p.188) deconstructed the term ‘food security’ into five dimensions: food sufficiency, nutrient adequacy, cultural acceptability, safety, and certainty and stability. Swindale and Bilinsky (2006, p.1450S) describe the experience of food insecurity in the form of domains. These domains deal with anxiety and uncertainty around household food supplies, the quality of one’s food (which they include “variety, preferences, and social acceptability” into), the effects of insufficient food intake, and coping strategies. In an earlier paper from Coates, Frongillo, Rogers, Webb, Wilde, and Houser (2006, p.1439S) they brought up that researchers at Cornell developed their own set of domains to observe U.S. households with; “1) *Uncertainty* or worry over food; 2) Food is of inadequate *quality*; 3) Food is of inadequate *quantity*; or

4) Food was acquired through *socially unacceptable* means”. Thus, we can extract the notions of uncertainty, quality, quantity, and socially unacceptable acquisition. Cafiero, Viviani, and Nord (2018, p.146) really hone in on the notion of access when it comes to food security. Barret (2010, p.825) notes how food security revolves around three main ideas: “availability, access, and utilization”. They go on to describe how these three ideas are inherently hierarchical, “... with availability necessary but not sufficient to ensure access, which is in turn, necessary but not sufficient for effective utilization” (Barret, 2010, p.825).

This provides a good starting point to compare and describe the facets of food insecurity since there are bound to be endless lenses through which researchers choose to observe food insecurity. Common themes that are present among these researchers is the idea of access, which boils down to quantity and quality of food. First people need to be able to get their hands on food at all, and from that point they need to be able to acquire enough food to sustain themselves and have the quality of food to not still be in a situation where their health declines.

Problems with prior/other models Maxwell (1996, p.292) brings up two common methods for measuring food security as well where they fall short in the grand scheme of things. The first method that Maxwell describes feels very algorithmic per se because it involves estimating a household’s food purchases over time, estimating the amount of food a household has on hand over time, and estimating what foods the household has consumed. The second method they bring up is something that has popped up in a few sources during my research and it’s the method that I will refer to as the ‘24-hour recall method’. Essentially, households will be asked to recall their last 24 hours of food consumption for each individual in said household, this way that data can be analyzed

for caloric intake and possibly other macro/micro nutrients. This method, Maxwell (1996, p.292) writes, provides more detailed and reliable data, but at the cost of several potential faults including but not limited to:

memory lapses, observer bias, respondent fatigue, a short and possibly unrepresentative recall period, and high data collection costs that resources often constrain analysis to relatively small samples (Maxwell, 1996, p.293)

They note that neither of these models “measures vulnerability or sustainability”

(Maxwell, 1996, p.293), which seems to be a common theme that models used by the other researchers mentioned in this paper attempt to incorporate, but instead “mostly only capture the sufficiency element... neither method has been accepted as a ‘gold standard’ for an analysis of household food security” (Maxwell, 1996, p.293)

Argument(s)

Quantity and quality of food definitely seem to be the umbrella that encapsulates the common notions of food insecurity among the researchers mentioned prior. Time and time again the idea of access is portrayed as the end-all be-all of food insecurity, combining ideas from both quantity and quality. However, when comparing the different literature access is only ever described financially which makes sense for the most part, but the common gap among the existing research is that there is a spatial aspect to access.

Spatial access has a few different facets that stick out in my mind. First off is the correlation of different foods to different regions of the world. Grocery stores here in Washington won’t have the same groceries as, say, Texas or Minnesota let alone in a different country. On the same note of regional differences, even growing your own food in gardens will differ because different climates will prevent certain crops from growing (or be more beneficial to others) not to mention how some places are more fertile than

others to garden/farm. The second facet of spatial access that I would like to point out is the notion of proximity. We understand that there is a key financial aspect to food insecurity, but I believe that with that comes a spatial issue of proximity to food sources.

Having money for food does not necessarily guarantee a given quantity or quality of food. People that live in food deserts are a perfect example because they face the direct impact of not having the spatial access to quality foods:

One such area is East Palo Alto, California. While the region hasn't had a supermarket in almost 40 years, it has two McDonalds, a Pizza hut, and a Taco bell. To obtain fresh fruits and veggies, residents must travel outside the city; thus, they often rely on fast food for their meals. (Getz, 2008, p.48)

Getz's (2008, p.48) article goes on to describe the detrimental effects of not having nutritional choices available, quoting a Jillian Davis, RD on how "fruits and vegetables play a role in disease management...".

Let's look at a different example where we are not in a food desert since that situation is not necessarily representative of the population in the United States. Not all grocery stores are created equal because each of them fall along different places on the supply chain. I'm pulling names from stores in my hometown of Tacoma, WA (but I'm sure there are similar stores elsewhere), but a place like Metropolitan market which is located in what we call the 'North End', essentially the richer part of Tacoma, is very upscale. They have quality ingredients, a vast organic foods section, and their products tend to be more expensive thereof. In 'South Tacoma' what you'll find are chain stores like Safeway/Albertsons, Fredmeyers (which isn't even a dedicated grocery store), and low-end stores like Saar's Super Saver Food's (formerly known as Saar's Market Place)

and Dollar Tree (which again isn't a grocery store but they carry some essentials). Now, two people with the same budget for food are not going to get the same quality and perhaps not the same quantity of food if one has an option like Metropolitan market and the other has Saar's Super Saver Food's or Dollar Tree.

Moving Forward

We have dissected the idea of food insecurity into a variety of dimensions thanks to Coates, Swindale, and Bilinsky and have looked at what does not work in past models of food security measurement thanks to Maxwell. Now, we should also understand that there is a spatial access gap in how we measure food insecurity and that is meaningful because there are people out there that do not struggle with the financial access to food but are still food insecure. If spatiality did not have an effect on food insecurity then food deserts would not exist and there would not be a grocery supply chain disparity among different sections of the same city (Tacoma). With the knowledge base that we have established, the question I would like to propose is as follows: **What is the effect of proximity (i.e. to grocery stores) on measures of food insecurity for people in the United States?**

Methodology

Purpose of research The purpose of this paper is exploration with the focus being proximity and its role in measuring food insecurity. This proposal is inductive since I am taking the current methods of measuring food insecurity and extrapolating on the idea that there could be more to it than what has previously been established. I merely want to dig into the holes of the previously mentioned researchers' methods and measurements and learn something new about how we understand food insecurity.

What could very well come of this study is that proximity has nothing to do with food insecurity, but logically there seems to be a connection (i.e. existence of food deserts). This outcome for studying proximity's relationship to food insecurity still seems bright. If the study shows a strong correlation between proximity and food insecurity then that opens the floodgates to future more in depth and rigorous research into the phenomena.

Mode of observation Survey research will be the chosen mode with which to build a foundation for analysis. Initially I wanted to conduct some statistical analysis by taking census or housing data and comparing it to store location data and programmatically figure out what areas in a given place (in this case Tacoma) are disproportionately affected by proximity. However, that form of data analysis would benefit from the context(s) that would be developed/discovered from the more qualitative-leaning research that surveying would provide. In my mind, survey research would allow for an initial inspection to see if proximity is even viable as a variable to currently established measurements of food insecurity.

Calculating the number of households within a 1 mile range of a Safeway does not tell you how many of those households drive a car, ride the bus, or walk to the grocery store, but being on the ground and asking individuals those questions would. Depending on the questions asked, the study could reveal more information that hadn't been previously thought of like treating places like Dollar Tree or Rite Aid as a viable place to get certain foods.

Population, sample, units of analysis and observation Surveying people temporally and financially scales with the amount of people that would be surveyed; we see this with the United States census in how it takes multiple years of preparation and

action to conduct. As per the research question, the population that I would like to represent is the Tacoma, WA population. Thus, as an exploratory starting point for future research and keeping in mind the temporal and financial variables I will be using a subset of Tacoma as the sample, say 200 to 300 individuals. Obviously the more people the better, but for one person over four months I'm unsure of how many people I could survey so 200 to 300 will be the goal.

Because a single city in Washington state is likely not representative of the entire United States population, a non-probability strategy will be implemented in the form of both purposive and convenience sampling. Since I have some geographical knowledge of Tacoma having grown up there it will be easier to design a plan of action around distinct areas and locations which is the purposive portion of the sampling methods I am using. The convenience sampling comes from the fact that the people that I will be surveying will come out of convenience (i.e. whoever is home at the time).

My units of analysis will be individuals, which means that I will not be looking at household representation since earlier methods, as pointed out by Maxwell (1996, p.293), that involved surveying an individual to represent a household resulted in several biases/problems with data representation accuracy (i.e. memory lapses). A caveat, however, is that my ability to fulfill a large enough sample size will be cut down tremendously since I will be surveying individually. My units of observation will essentially be knocking on doors and perhaps talking with passersby within the designated areas.

The variables Proximity is the dependent variable for this research proposal. What I mean by proximity is essentially the distance that an individual would have to travel (with context of their mode of transportation) to get to their most common grocery

shopping locations (see Appendix page 14, question 2). The scale of measurement will be ratio, essentially being as accurate/raw as the individual will allow. The value will be cross-referenced in post by comparing it to the calculated distances based on the coordinates of the individual's location and the coordinates of the grocery stores they provide (see Appendix page 14, question 3). I expect this variable to be fairly reliable, the main issue being that determining distances can be tough, hence the cross-referencing. I expect some issues with validity in that routes that people take can differ from time to time and between people; the most efficient route isn't necessarily taken all the time which means the distance one would travel would be slightly different between one trip and another.

Money spent on groceries is a contextual variable that I'm surveying for (see Appendix page 14, questions 4 and 5) and is straightforward in its conceptualization and operationalization since ideally it will be raw numbers. I expect this variable to be fairly reliable in that people seem to usually keep track of their food budgets whether they are trying to make sure they are not overspending or if they need to make sure every dollar counts. Something that could degrade the reliability would be if people responded with not knowing how much they spend (simply not keeping track) or not having a budget. The validity relies heavily on how well people track their food spending because lapses in memory would cause the same issues other researchers faced in their own studies.

Monthly income is another contextual variable that will be used for calculating the percent of one's income that goes toward food (see Appendix page 15, question 6). Conceptualized as financial comfortability and operationalized similarly to proximity in that the scale of measurement will be ratio; this will likely be put into temporary intervals in post during visualizations. Reliability is similar to 'money spent on

groceries' in that I feel like most people know how much money they have coming in (and going out), but sometimes people live paycheck to paycheck which would need to be extrapolated into a monthly income unless the individual is not in a position thereof to keep track of their income. The internal validity faces the same issue as 'money spent on groceries' because of the same memory laps issue.

Common grocery store (location) data has its role in extrapolating the quality of food that people are buying since grocery stores tend to differ in the quality of their products depending on the neighborhoods or part of the city they are located in. This will be nominal since each store is categorical and there is no order to them. The conceptualization and operationalization are not too complicated in that simply asking for names of places should be easy enough as should asking participants to identify which locations they go to most. Reliability should be pretty high, however there might come situations where store names will be ones that are not traditionally 'grocery stores'. This variable seems to offer moderately high internal validity in that grocery choices are finite in Tacoma and so the data, I imagine, should not be spread too thin across 'too many' unique values. However, this variable will be hard to translate outwards as many cities have different common grocery stores (even more different across state lines), thus the external validity for this variable is arguably pretty low.

Figure 1

Variables in this Study		
Dependent Variables	Independent Variables	Other contextual variables
<i>Proximity from grocery stores</i> <ul style="list-style-type: none"> Intervals of 1 mile 	<i>Common grocery locations (ranked by frequency)</i>	<i>Money Spent on groceries</i> <ul style="list-style-type: none"> Intervals of \$25
		<i>Mode of Transportation</i> <ul style="list-style-type: none"> Walking Bike or similar Bus or rideshare Own car
		<i>Monthly Income</i> <ul style="list-style-type: none"> As accurate as possible Rounded to nearest 100

Figure 2

Timetable	
Jan. 1 - 7	<ul style="list-style-type: none"> Determine and map out neighborhoods to survey and ideal routes along with time(s) of day to conduct said survey Finalize survey questions and pretest them with friends, family, and perhaps passersby Set up the data framework; whether Excel, Database or something else (ideally a database?)
Jan. 8 - 14	<ul style="list-style-type: none"> Begin work on Spanaway
Jan. 15 - 21	<ul style="list-style-type: none"> Finalize work in Spanaway Reflect on the good and bad of last two weeks <ul style="list-style-type: none"> Iterate on any processes to make things more accurate or efficient Speculate on trends within the area
Jan. 22 - 28	<ul style="list-style-type: none"> Begin work in Parkland
Jan. 29 - Feb. 4	<ul style="list-style-type: none"> Finalize work in Parkland

	<ul style="list-style-type: none"> • Reflect on the good and bad of last two weeks • Compare to Spanaway data
Feb. 5 - 11	<ul style="list-style-type: none"> • Begin work in Lakewood
Feb. 12 - 18	<ul style="list-style-type: none"> • Finalize work in Lakewood • Reflect on the good and bad of last two weeks • Compare with previous areas
Feb. 19 - 25	<ul style="list-style-type: none"> • Begin work in South Tacoma
Feb. 26 - Mar. 4	<ul style="list-style-type: none"> • Finalize work in South Tacoma • Reflect on the good and bad of last two weeks • Compare with previous areas
Mar. 5 - 11	<ul style="list-style-type: none"> • Begin work in East Tacoma
Mar. 12 - 18	<ul style="list-style-type: none"> • Finalize work in East Tacoma • Reflect on the good and bad of last two weeks • Compare with previous areas
Mar. 19 - 25	<ul style="list-style-type: none"> • Begin work in North End
Mar. 26 - Apr. 1	<ul style="list-style-type: none"> • Finalize work in North End • Reflect on the good and bad of last two weeks • Compare with previous areas
Apr. 2 - 8	<ul style="list-style-type: none"> • Begin work in North East Tacoma
Apr. 9 - 15	<ul style="list-style-type: none"> • Finalize work in North East Tacoma • Reflect on the good and bad of last two weeks • Compare with previous areas
Apr. 16 - 22	<ul style="list-style-type: none"> • Begin work in Downtown
Apr. 23 - 29	<ul style="list-style-type: none"> • Finalize work in Downtown
Apr. 30 - May 6	<ul style="list-style-type: none"> • Analyze the data in its entirety; iterate on visualizations <ul style="list-style-type: none"> ◦ Attempt to find new insights • Reflect on the study

Budget

	BUDGET NAME	Overall Time Frame				TOTALS
		January	February	March	April	
01-Salaries						
	Myself	2880	2880	2880	2880	11520
02-Personal Service Contracts						
	I wasn't planning on needing translators?	0	0	0	0	0
03- Other Contractual Services						
	No need for third party contractual services	0	0	0	0	0
04 - Travel						
	local travel, assume 0.25 cents per mile	25	25	25	25	100
05 - Supplies and Materials						
	Office Supplies; Folders, binders, pens, etc.	35	35	35	35	140
06- Equipment						
	No equipment necessary	0	0	0	0	0
07 - Benefits						
	Calculate 14.2% of your salary. Otherwise consult A&S instructions	408.96	408.96	408.96	408.96	1635.84
08 - Student Aid and Other Grants and Services						
	e.g. your tuition					
	Total Direct Costs:					13395.84
	Amount Subject to F&A Costs: Typically this would be amounts in 01 thru 06					
	Indirect Costs (UW Overhead) : multiply Total Direct Costs by 54.5% to get total budget amount					7300.7328
	Total Total Amount of Budget:	20696.5728				

Appendix

Question 1: What is your usual mode of transportation? (mode of transportation)

Question 2: How far do you usually travel to get to the grocery store/stores that you shop at the most? (proximity)

Question 3: Which stores do you shop at for food most often? If there are a few places then that is fine. (proximity)

Question 4: How much money do you spend on groceries in a month? (money spent on groceries)

Question 5: How much did you spend this month? (money spent on groceries)

Question 6: What is roughly your monthly income? More accurate is best but if you need to round then that is fine. (monthly income)

Question 7: Please describe what grocery shopping looks like for you in a 'good' month.
(for extra context)

Question 8: Please describe what grocery shopping looks like for you in a 'bad' month.
(for extra context)

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