INSTITUTE FOR HEALTHCARE IMPROVEMENT

INSTITUTE FOR HEALTHCARE IMPROVEMENT
SUMMARY REPORT: 90-DAY PROJECT

Counties of Interest

January 31, 2011

Executive Summary:

There is a strong linear relationship in almost every state between health outcomes and socioeconomic status (SES). However, in some states, there are counties that defy this relationship, achieving outcomes far better or worse than one would expect, given SES. In this project, we develop a method for identifying counties that have a high probability of being outliers. We identified 17 better-than-expected counties and 11 worse-than-expected counties. We complemented the statistical analysis with qualitative investigation and interviews.

The results lend credence to a concept known as the Hispanic paradox, whereby Hispanic populations in the US (particularly Mexican-American populations) seem to achieve better-than-expected health outcomes despite generally poor SES. Nine of the 17 better-than-expected counties had Hispanic populations above the national proportion, compared to only one of the eleven worse-than-expected counties. Beyond the Hispanic paradox, we noted few trends among the better-than-expected counties in terms of size, demographics, or population change. Worse-than-expected counties were predominantly white and have seen declines in populations over the past decade, relative to the nation.

Qualitative research offered few clues into how better-than-expected counties had achieved this status; in several cases, interviewees wondered about flaws in the data. Worse-than-expected counties faced considerable social deprivation problems, and their public policies may not have given due attention to health in the past.

I. Research and Development Team:

- Leader: Zoë Kawaller and John Whittington
- Colleague: Tricia Woodhead

II. Intent:

The intent of this project was to identify counties in the US with health outcomes significantly better or worse than one would expect based in their socioeconomic status (SES). Once these counties were identified, we sought to understand what drivers may have led to those results.

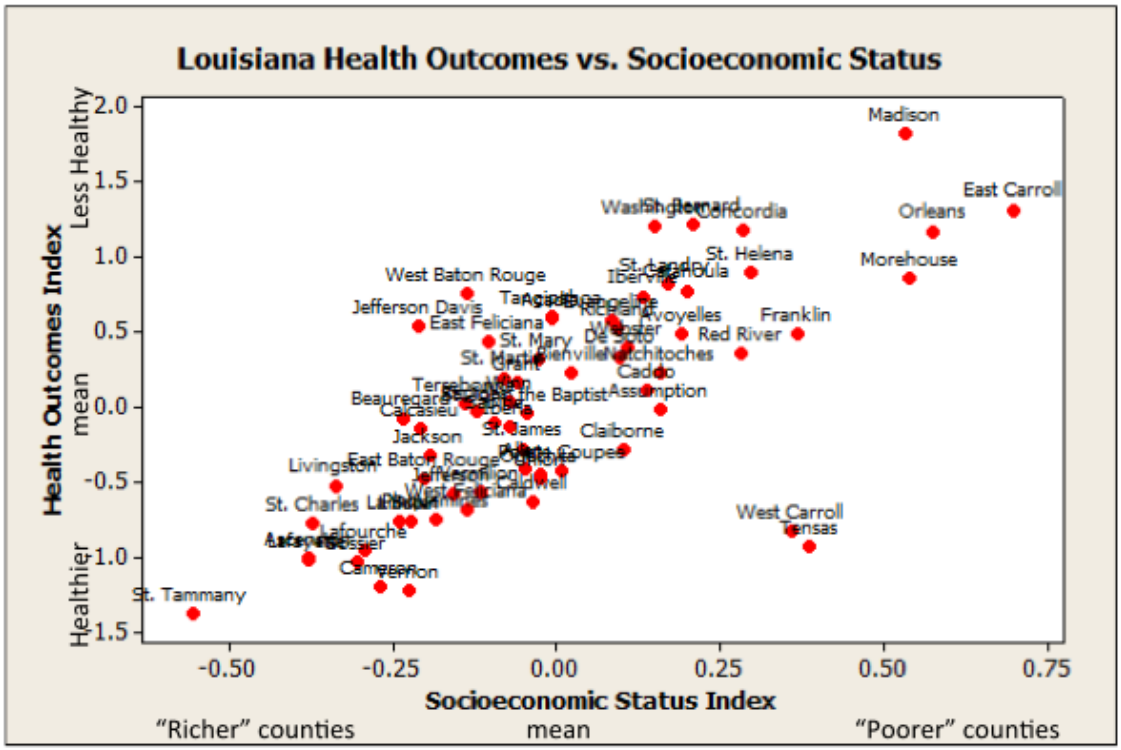
III. Background:

The strong relationship between wealth and health in the United States and abroad is well documented.[1] This seemingly intractable relationship represents a barrier to IHI's ability to improve health outcomes through a focus on health care. This project began with the expectation

some regions' outcomes are not completely foretold by socioeconomic status. In this project, we seek to harvest learning from counties that have achieved better-than (or worse-than) expected outcomes, for application in the Triple Aim Initiative and other programming.

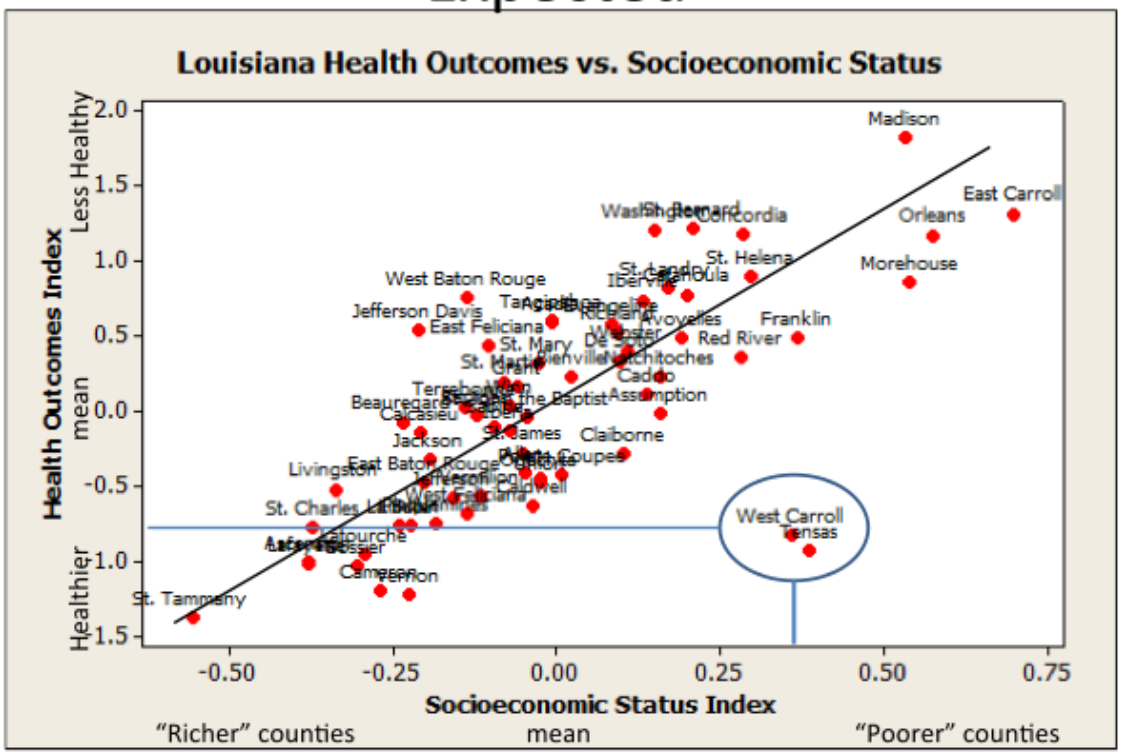
The figures below demonstrate the type of counties we expected to identify. The graph plots summary Z-scores on health outcomes (as measured by deaths before age 75 and self-reported health status, physical and mental "healthy days" and low birth weight)[2] vs. social and economic factors (made up of data on education, unemployment, children in poverty, income inequality, social support structures, and crime)[2] for Louisiana. Counties with the lowest Z-scores for outcomes are the healthiest, and those with the lowest Z-scores for socioeconomic factors are, roughly, the wealthiest; those in the bottom left-hand corner are those doing best on both measures. (Figure 1)

Figure 1. Poorer Counties have Poorer Health



The variables Health Outcome Index versus Socioeconomic status show a strong linear relationship (r=0.714). Visually, West Carroll and Tensas parishes appear to be outliers from the trend. Though they have similar socioeconomic status to Franklin County, they are as healthy as some of the richest counties in the state, according to this data. (Figure 2)

Figure 2. But Some Do Better than Expected



We have conducted the same analysis for every state, and present the results of that quantitative analysis, and follow-up qualitative investigation, in this report.

IV. Description of Work to Date:

The main deliverables for this project were to:

- Identify outlier counties from all 50 states
- Look longitudinally at 7 years of data from Wisconsin to see how county ranks change over time
- Develop a methodology to analyze the outlier counties that have better health outcomes than expected
- To determine through discussion with public-health leaders potential reasons for outlier status (better or worse than socioeconomic status would predict)

In the next section we will describe the methodology that we undertook to identify these counties of interest in various US states

Using and Understanding the County Health Rankings

The CHR data is presented in two broad categories: health outcomes—mortality and morbidity—and health factors—the behavioral, clinical, socioeconomic, and environmental factors thought to influence health. Each category includes several indicators, which the CHR team weighted to build a composite measure for health outcomes and health factors.

Health outcomes is measured by years of potential life lost before age 75, quality-of-life measures related to physical health and mental health, and low birth weight statistics. Health factors are made up of four subcategories, weighted as follows: health behaviors (30%), clinical care (20%), social and economic factors (40%), and physical environment (10%). For our analysis, we used only the social and economic factors.

Tables 1 and 2 below show the statistics used to create the index scores for health outcomes and socioeconomic factors, and the contribution of each measure to the overall score. Weighting was based on the researchers' judgment and considerations of the quality of the data.[3]

Table 1: CHR Health Outcomes metrics, weighting, and sources

Health Outcome	Focus Area	Measure	Measure source and years covered
Mortality (50%)	Premature death	50%: Years of potential life lost before age 75	Vital statistics, NCHS 2004-2006
Morbidity (50%)	Quality of life	10%: Percent of adults reporting poor or fair health	Behavioral Risk Factor Surveillance System (BRFSS) 2002-2008
		10%: Mean physically unhealthy days per month for adults	BRFSS 2002-2008
		10%: Mean mentally unhealthy days per month for adults	BRFSS 2002-2008
	Poor birth outcomes	20%: Percent of live births of low birth weight (<2500 grams)	Vital statistics, NCHS 2000-2006

Table 2: CHR Social and Economic Factors metrics, weighting, and sources

Social/Economic Factor	Measure	Measure Source and years covered

Education (25%)	12.5%: High school freshman graduation rate	National Center for Education Statistics, 2005-2006 State data sources for KY, NH, NC, PA, SC, UT, 2007-2008
	12.5%: Percent of adults with college degrees	Decennial Census, 2000 American Community Survey (ACS) 2005-2007
Employment (25%)	25%: Unemployment rate	Bureau of Labor Statistics, 2008
Income (25%)	18.75%: Percent of children in poverty	Census/CPS—Small Area Income and Poverty Estimates (SAIPE), 2007
	6.25%: Gini Coefficient of Income inequality (based on household)	Decennial Census, 2000 ACS, 2005-2007
Family and social support (12.5%)	6.25%: Percent of adults without social/emotional support	BRFSS, 2005-2008
	6.25%: Percent of households that are single-parent	Decennial Census, 2000 ACS, 2005-2007
Community safety (12.5%)	12.5%: Violent crime rate OR homicide death rate	Uniform Crime Reporting, FBI, 2005-2007 State data sources for IL and KY Vital Statistics, NCHS, 2000-2006

CHR makes their data available in raw form, but also provides the Z-scores and rankings for the combined data. A Z-score is a method for combining data so that it is all on the same scale, presented in relation to the mean. A positive Z-score indicates that the point is above the mean—in this case, that the county is worse than the mean. A negative Z-score is below the mean, or better than the mean.

While the CHR is immensely useful, there are some caveats to the data that are important to recognize for our analysis. First, the data is presented state-by-state. That is, the Z-score for each county tells us where the county is relative to the mean in its state. Shelby, AL has an outcomes Z-score of -1.86; it is the highest ranked county in the state and is doing much better than the mean

in Alabama. However, based on the Z-score alone we would have no idea whether Shelby, AL is any better or worse than Hampden, MA with a Z-score of 1.48. Hampden's Z-score only indicates that it is doing much worse than the Massachusetts mean – it says nothing about the relationship to Alabama. If we were going to compare counties in different states, we would need to calculate Z-scores for the whole US, which is not provided by CHR. For the purposes of this project, the intra-state restriction was helpful. There is tremendous regional variation in health in the US4; by comparing each county to its own state, we eliminated the effect of this variation on the results.

Secondly, the Z-score is not able to capture the confidence intervals of each of the component statistics. Each statistic is generated from separate samples and CHR provides the 95% confidence interval for each individual statistic. For instance, Dukes county in Massachusetts is ranked 2nd in the state for health outcomes, with a Z-score of -.85. However, when we dig into the component statistics, we see that Dukes' YPLL rate (5,302 years/capita vs. a mean of 5,681) has a wide confidence interval that actually straddles the mean for the state (4,115 to 6,724 years/capita). That is, we cannot confidently say that Dukes' mortality score is actually better or worse than the state mean. We will return to this issue later on, but it is important to flag now.

Lastly, because some counties are quite small, the CHR team was not able to confidently provide data for every measure of every county. In many cases, robust data were not available for the measures of people reporting poor/fair health and physically and mentally healthy days. To fill these holes, the CHR team assumed the state mean for these portions of the data. We therefore eliminated from our analyses any counties missing 20% or more of their data for either outcomes or socioeconomic factors.

Methods for Identifying Counties of Interest

Counties of interest are those whose health outcomes Z-scores fall far from the overall pattern of the state, given their socioeconomic status. We used a linear regression model for each state, and calculated each county's "deleted t residual." The deleted t residual tells you how many standard deviations a point lies from the regression line, without including that point in the regression calculation. We set the cut-off point at which a county's residual would be large enough to be "of interest" using a calculation based on the number of counties in the state at a significance level of 90%. In a state with ten counties, a county with a deleted t residual greater than 2.56 (or less than -2.56) would be considered "of interest." A state with 100 counties would require a standardized residual greater than 3.28 (or less than -3.28). This funnel plot method provides greater assurance that the identified counties are true outliers than would be possible using a typical cut-off of 2 standard deviations from the regression line. We would expect about 5% of all counties to fall beyond 2 standard deviations from the line, but we would not be able to tell which of these were outliers. Using the funnel plot method, we can say that there is only a 10% chance that the counties of interest are *not* outliers.

From these counties, we eliminated those whose mortality data confidence intervals traversed the regression line. We ran the state-by-state regressions again using socioeconomic status vs.

premature mortality (YPLL). We chose YPLL because it accounts for 50% of the outcomes composite score, and because the CHR team recommended it as the most reliable data point. For all of the identified counties of interest, we checked that the 95% confidence interval bounds did not cross the regression line. We did this using a deleted t residual for the upper and lower confidence limits.

Lastly, we visually checked these results using scatter plots of each state, to ensure that influential and/or high-leverage outliers did not skew the regression line. This method changed results in two states: Arizona and Texas. In Arizona three counties (Santa Cruz, Yuma and Apache) are set apart from an otherwise linear relationship:

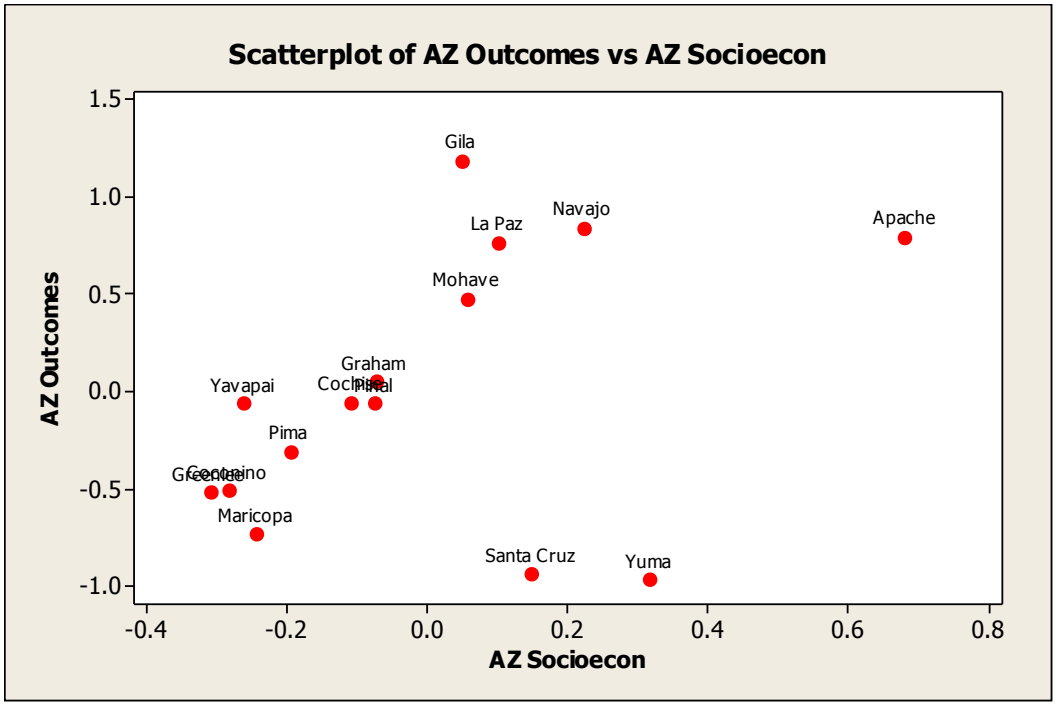
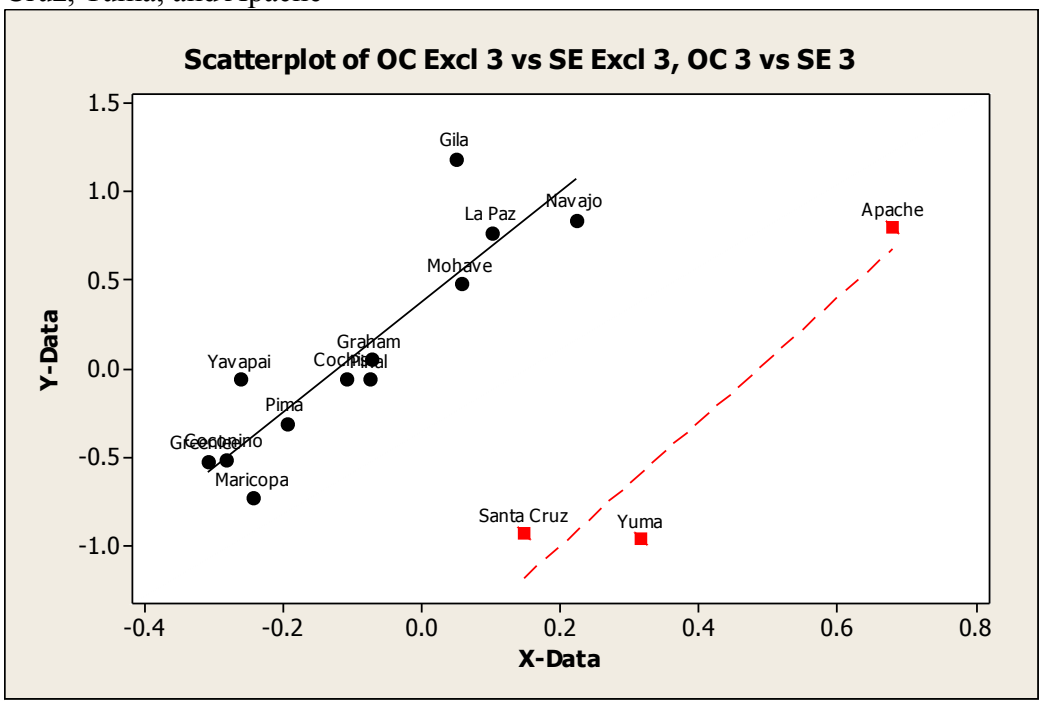


Figure 3: Arizona scatter plot, Outcomes vs. SES

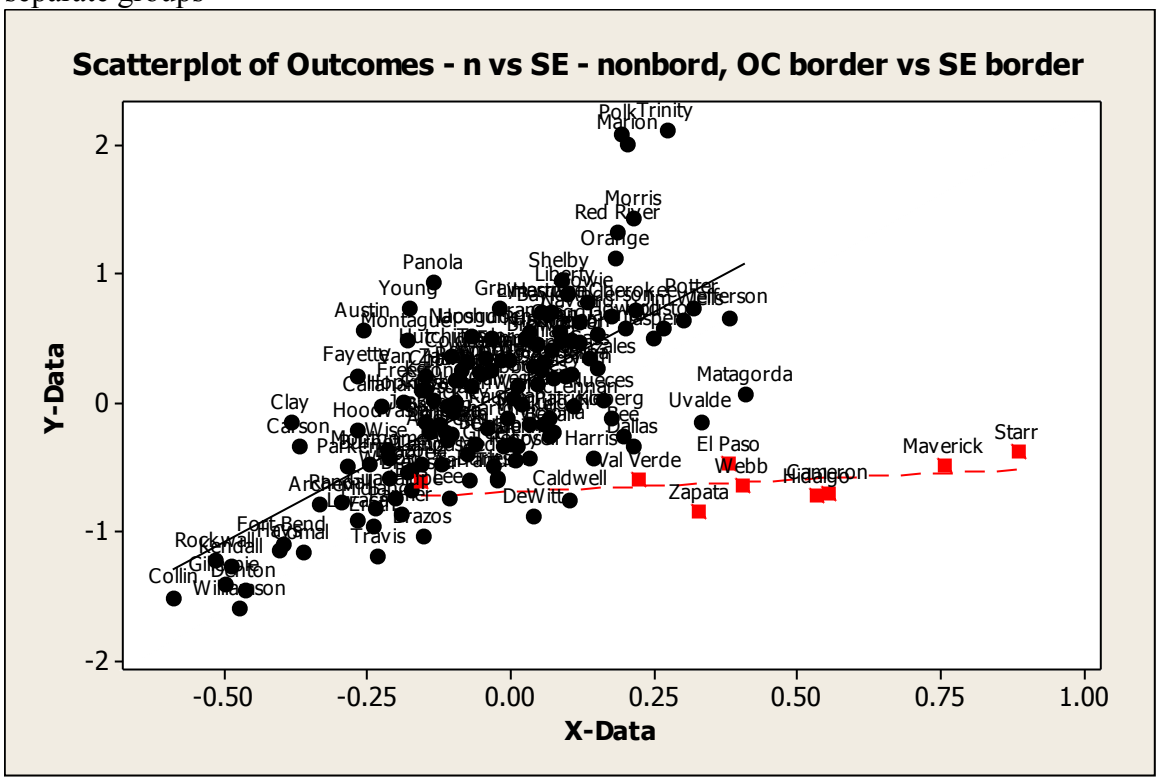
When we exclude Santa Cruz, Yuma, and Apache from the analysis, however, we apply a trend line for the remaining counties. We then use a deleted t residual for Santa Cruz, Yuma, and Apache to determine whether they can be considered "of interest." The cut-off for a state of 12 counties (the number of remaining counties) is 2.62. The three excluded counties indeed count, with deleted t residuals of -5.53, -6.45, and -3.50, respectively. Again, we cross-checked these counties' YPLL confidence intervals, and found that they still remain firmly better-than-expected.

Figure 4: Scatter plot of Arizona, Outcomes vs. SES, showing regression line that excludes Santa Cruz, Yuma, and Apache



We used a similar method in Texas as well, where we analyzed the regression excluding the counties on the border with Mexico. Border counties are shown in red on the graph below. Deleted t residuals for each county were evaluated against the regression line shown in black.

Figure 5: Texas scatter plot, Outcomes vs. SES, treating border and non-border counties as separate groups



After all of the counties of interest were identified, we characterized them based on demographic data. We conducted a qualitative analysis using unstructured interviews with individuals in some of the counties of interest. We sought individuals who understood the local dynamics and might be able to explain what was different about their county. We hoped to identify some possible themes from these individuals that might support further analysis and research. We considered state epidemiologists as one source but felt that their perspective would not likely be different from what we had already gained from the data analysis. We eventually focused our contacts on public health officials. In the US some counties have their own public health officials and others share this function with a number of other local counties.

We conducted interviews related to five better-than-expected counties: Allendale, SC; Tensas, LA; West Carroll, LA; Luna, NM and Saguage, CO. For worse-than-expected counties, we conducted interviews on four regions: West Virginia; Baltimore City, Maryland; California; and Idaho. Write-ups and reflections on those interviews are provided in the appendix.

Method for Evaluating Change over Time

The County Health Rankings are available for Wisconsin from 2003-2008 and 2010. We were therefore curious whether any counties had shown significant improvement or worsening in their

health outcomes over time. Because the CHR team changed the measures they used for outcomes over time, we restricted the analysis to YPLL only. In 2003, they defined premature death as deaths before age 85, not 75, so we excluded 2003.[5]

For each year 2004-2008 and 2010, we calculated the YPLL relative to the year's median, by dividing the counties' YPLL by the state median. We then looked at the range of each county's relative YPLLs across the six years. Because a range must be positive, the distribution of the ranges was skewed right. To find the outliers, we re-expressed these ranges by taking the logarithm of them. Using these methods, we found a Normal distribution, with no outliers (see figures below), indicating that no county experienced a large change in its premature death rate over 2003-2008 and 2010.

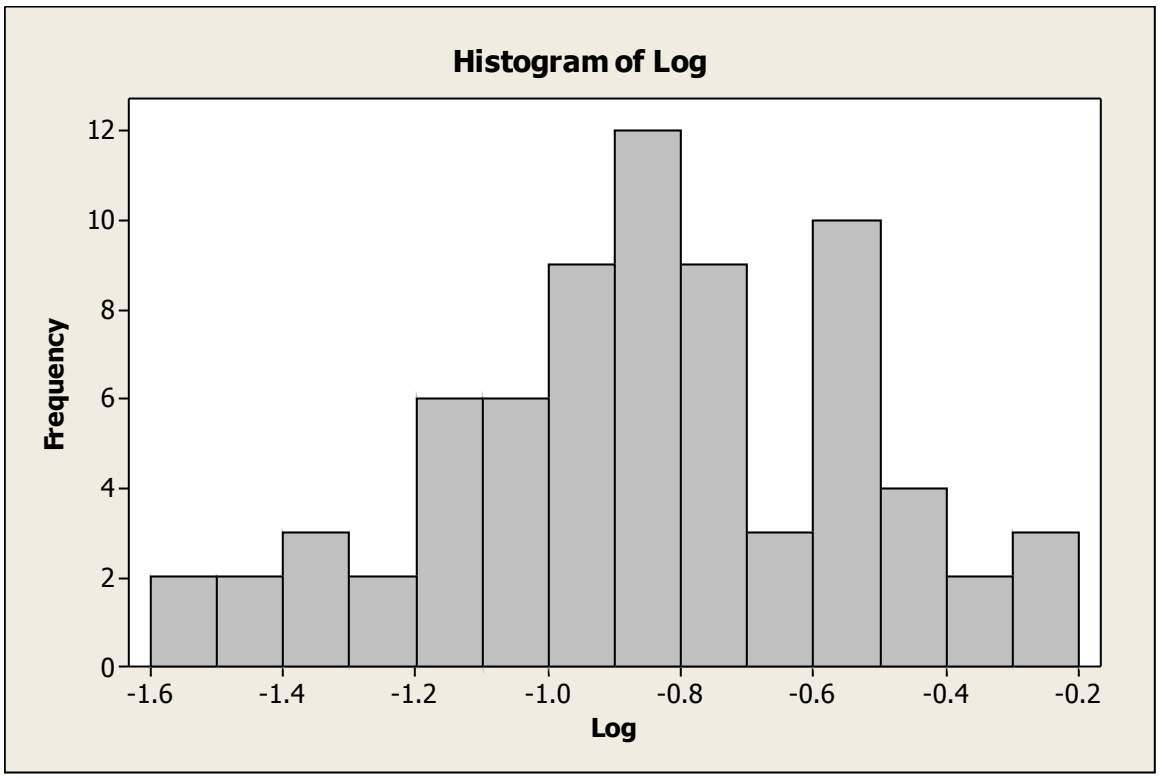


Figure 6: Histogram of YPLL ranges across 2004-2008 and 2010 for all Wisconsin counties. Re-expressed using a logarithmic scale, the ranges are Normally distributed.

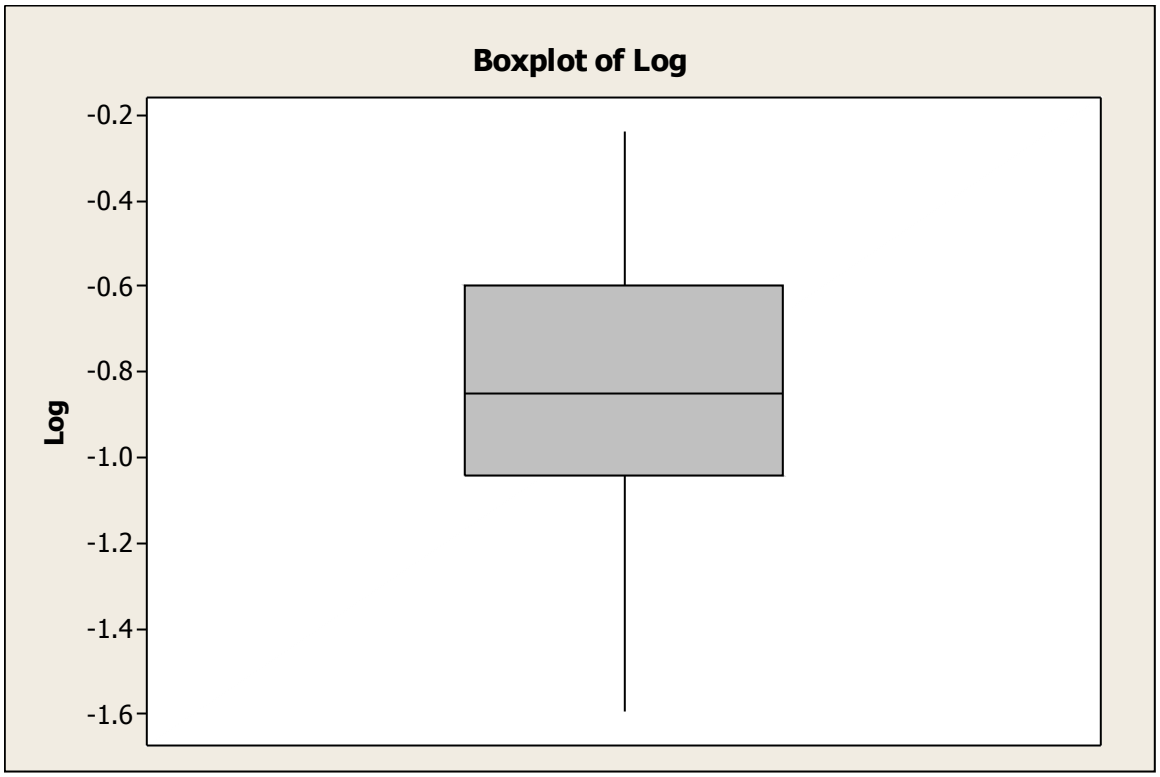


Figure 7: Box plot of the YPLL ranges across 2004-2008 and 2010 for all Wisconsin counties, expressed on logarithmic scale. The box plot indicates no outlier counties.

V. Results of the 90-Day Scan:

Better-than-Expected Counties

Using the methods described above, we identified 17 counties with better-than-expected health outcomes, and 11 counties with worse-than-expected outcomes. We begin with a discussion of the better-than-expected counties, which are listed in Table 3 and shown on a map in Figure 8 below.

Table 3: Counties of interest that had better than expected health outcomes

State	County	Deleted t residual	Residual cut-off for state	Health Outcomes Z-Score	Social and Economic Factors Z-score
Arizona	Apache	-2.67	-2.62	0.80	0.68
Arizona	Santa Cruz	-5.32	-2.62	-0.94	0.15
Arizona	Yuma	-6.45	-2.62	-0.97	0.31
Colorado	Saguache	-3.50	-3.04	-0.22	0.48

Kentucky	Morgan	-3.42	-3.32	-0.95	0.30
Louisiana	Tensas	-3.44	-3.15	-0.93	0.39
Louisiana	West Carroll	-3.38	-3.15	-0.83	0.36
Maine	Franklin	-3.62	-2.72	-1.27	0.09
New Mexico	Luna	-4.56	-2.92	0.09	0.76
New York	Schuyler	-3.21	-3.13	-1.05	0.12
South Carolina	Allendale	-3.48	-3.05	0.77	0.75
Texas	Cameron	-4.09	-3.36	-0.70	0.56
Texas	Hidalgo	-4.06	-3.36	-0.73	0.53
Texas	Maverick	-4.49	-3.36	-0.49	0.76
Texas	Starr	-4.78	-3.36	-0.38	0.88
Texas	Zapata	-3.41	-3.36	-0.85	0.33
Utah	San Juan	-3.96	-2.85	-0.18	0.78

Figure 8: Map of counties of interest with better than expected health outcomes

The Hispanic Paradox

The most striking finding is the concentration of better-than expected counties at the US/Mexico border. These counties have very high Hispanic populations, compared to the US average of 16% (see Table 2). In fact, nine of the counties we identified have above-average Hispanic populations; all but Saguache, CO are located on the US/Mexico border.

Our findings provide further evidence of what has been dubbed the "Hispanic paradox." Briefly, the term suggests that Hispanic populations in the US have favorable morality outcomes despite generally unfavorable socioeconomic status. The effect is strongest among older male Hispanics, and may be strongest in regions with a high concentration of Hispanics and/or immigrants.[6-9]

While the evidence for the paradox is considerable, explanations are less available. Some researchers have pursued the "selection bias" line of reasoning.[10-13] They posit that immigrants to the US tend to be a healthier sample of the overall population of the origin country. Immigrants must be in good enough health to move their lives to another country, and they often come in order to work, indicating some general health. Moreover, immigrants may tend to have a more positive outlook on their future, given the steps they are taking to improve their lives, which might indicate healthier status of choices.[14] However, while the reasoning is intriguing, it is problematic: the healthy migrant effect does not lessen with the immigrant's duration in the US, as one would expect. Furthermore, one would expect a greater advantage among migrants who have travelled further, but the Hispanic advantage is no greater far from the border than close to it.[14]

Similar to this selection bias, some researchers hypothesize that selective return migration (or, more cleverly, the "salmon bias") is at work, particularly among Mexican American populations: older Mexican Americans may return to Mexico when they become sick, leaving behind a healthier pool in the US.[15] However, several researchers have concluded that the salmon bias cannot fully explain the Hispanic paradox.[16, 17]

While these biases likely tell part of the story of the Hispanic paradox, several researchers[16, 18] argue that the paradox is not merely a statistical fluke, but also indicative of significant social processes at play. For instance, Marin and Marin[19] have proposed that core Hispanic cultural values such as family- and community-mindedness promote strong social support structures that have a positive impact on health. At the same time, however, Gallo and others[18] argue that many of these core values might in fact have a negative impact on health (for instance, machismo might tend to impede care-seeking among men). The social dimension of the paradox is, in sum, not well understood.

More information on the paradox can be found in a New York Times article[20] published during the course of this wave: http://www.nytimes.com/2011/01/16/us/16ttexpectancy.html

It is not possible to know precisely how well the County Health Rankings capture the full picture of health along the border; undocumented migrants are often left out of official statistics and constant movement among residents makes a snapshot view through data difficult. This will be an important area for the County Health Rankings team and other researchers to continue to watch.

Additional Learning

Beyond the Hispanic trend, these 17 counties are remarkable in the *lack* of trends among them. They tend to be rural, but not significantly more so than the nation. Using the NCHS urban/rural classification that places counties on a scale of 1 (most urban) to 6 (most rural),[21] 14 of the 17 counties (82%) were classified as a "5" or "6" vs. 65% nationwide (P=0.14). Demographically, the counties are diverse. Three counties had black populations above the US average of 12.9%: Tensas, LA (56.2%); West Carroll, LA (18.3%); and Allendale, SC (71.4%).[22] Two counties (Apache, AZ and San Juan, UT) have majority Native American populations,[22] containing the Fort Apache Indian Reservation. On population change, the counties are split. Eight of the 17 experienced population growth in the past ten years greater than the US average population growth of 9.1%.[22] Of the nine that did not grow as much as the nation, four actually experienced population declines (Tensas, LA; West Carroll, LA; Schuyler, NY; and Allendale, SC). This data can be viewed in Table 4.

Public health officials were in many cases a good source of information about health status, challenges, and change initiatives in their counties. They understood strengths and weakness of their area. They also seemed to be well connected to their community. Overall they seemed to be surprised by the findings that they were better than expected. For Luna County, we interviewed a team of individuals that were based out of the University of New Mexico. Two of them were health extension agents who were or had worked in that area. They understood the Hispanic paradox but they also recognized the challenges that this county faced. There some variation with regards to emphasis on the outcomes data, as well as familiarity with the County Health Rankings. In Allendale, SC, for instance, data was a major motivating force for work at the county- and state-level. Interviews write-ups are available in the appendix.

Table 4: Demographics on Counties of interest that had better than expected health outcomes

County	**NCHS Rural/ Urban Classification[21]**	**Pop. (2009 est)[22]**	**% White non-Hispanic, 2009[22]**	**% Black, 2009[22]**	**% Hispanic or Latino, 2009[22]**	**% Native American, 2009[22]**	**%change in pop., 2000-2009[22]**
Apache, AZ	6	70,591	19.6	1.7	6.3	72.5	1.7%
Santa Cruz, AZ	5	43,771	18.5	0.7	80.0	0.9	14.0%
Yuma, AZ	4	196,972	37.9	3.4	57.0	1.7	23.1%
Saguache, CO	6	7,097	49.6	0.2	47.8	2.3	19.9%

Morgan, KY	6	14,092	93.6	4.8	0.6	0.2	1.0%
Tensas, LA	6	5,609	40.2	56.2	3.1	0.2	-15.2%
West Carroll, LA	6	11,329	78.6	18.3	2.1	0.4	-8.0%
Franklin, ME	6	29,735	96.8	0.4	0.8	0.4	0.9%
Luna, NM	5	27,044	35.8	1.9	61.4	1.4	8.1%
Schuyler, NY	6	18,720	94.8	2.0	1.5	0.5	-2.6%
Allendale, SC	6	10,195	25.0	71.4	3.3	0.1	-9.1%
Cameron, TX	3	396,371	12.1	1.3	86.6	0.7	18.2%
Hidalgo, TX	3	741,152	8.6	1.3	89.8	0.7	30.1%
Maverick, TX	5	53,203	3.9	1.0	94.2	1.7	12.5%
Starr, TX	5	62,671	2.1	0.8	97.2	0.3	16.9%
Zapata, TX	6	14,036	10.5	0.6	88.9	0.4	15.2%
San Juan, UT	6	15,049	38.2	1.5	5.8	54.0	4.4%

Worse-than-Expected Counties

We identified eleven worse-than-expected outlier counties, listed below in Table 5 and shown on a map in Figure 9.

Table 5: Counties of interest that had worse than expected health outcome

State	**County**	**Deleted t residual**	**Residual cut-off for state**	**Outcomes Z-score**	**Socioeconomic Z-score**
Alabama	Walker	4.11	3.16	1.39	-0.14
California	Siskiyou	3.48	3.08	1.28	0.03
Florida	Union	3.94	3.16	1.90	-0.09
Indiana	Scott	3.54	3.24	2.69	0.32
Maryland	Baltimore City	3.28	2.84	2.73	0.80
North Dakota	Sioux	3.41	2.79	2.17	0.77

Ohio	Lawrence	3.82	3.23	2.14	0.17
South Dakota	Custer	3.23	3.01	0.46	-0.27
Virginia	Buchanan	4.22	3.32	2.21	0.25
Washington	Ferry	3.07	2.98	2.10	0.35
Wisconsin	Jackson	3.65	3.17	1.62	0.11

Figure 9: Map showing of counties of interest with worse than expected health outcomes

In this map we do not see any special macro-geographic observations. Only the county of Lincoln, Idaho has an above-average Hispanic population of 23%. The rural/urban distribution is similar to the national rural/urban distribution: eight of the eleven counties (73%) are a classified as a "5" or "6" on the NCHS scale, compared to 65% nationally (P=0.76). Baltimore City is the only major city we identified, in either group, with a population of 637,418. Its population is 63% black. We found no other majority-black counties doing worse than expected. The two majority-black counties with better-than-expected outcomes, Tensas, LA and Allendale, SC, are tiny, rural, and agricultural communities (5,609 people and 10,195, respectively) that cannot justifiably be compared with Baltimore. One common thread to these counties is that none has kept pace with the national population growth rate of 9.1%[22] in the past decade. Nine of the eleven have non-Hispanic white populations greater than the national proportion of 65.1%.[22]

Table 4. Demographics on Counties of interest that had worse than expected health outcomes

County	NCHS Urban/ Rural Classification[21]	Pop.(2009 est)	% White non-Hispanic, 2009	% Black, 2009	% Hispanic or Latino, 2009	% Native American, 2009	pop. %change, 2000-2009
Walker, AL	2	68,742	90.4	6.6	1.7	0.3	-2.8
Siskiyou, CA	6	44,634	80	1.6	10.3	4.4	0.8
Union, FL	6	14,584	70.8	23	4.3	0.7	8.5
Scott, IN	5	23,624	97.2	0.5	1.3	0.2	2.9
Baltimore City, MD	1	637,418	30.9	63.2	3	0.4	-2.1
Sioux, ND	6	4,203	17.3	0.3	3.4	79.4	3.9
Lawrence, OH	3	62,744	95.4	2.2	0.8	0.2	0.7
Custer, SD	6	7,924	91.9	0.3	2.1	4	8.9
Buchanan, VA	6	22,860	95.2	3.4	0.7	0.1	-15.3
Ferry, WA	6	7,520	76.1	0.2	3.5	15.7	3.6
Jackson,	6	19,886	87.5	2.5	3	6.3	4.1

Detailed discussions with Public Health and Social Epidemiologists in these areas indicated that their populations have a very long history of poor health outcomes and a relatively recent history of concerted community- and state-wide collaboration to address the problems on a wider scale. The difficulty in focusing on behavior change (e.g., smoking cessation, limiting alcohol consumption, improving diet, etc.) was often cited as a challenge for these areas. Some interviews revealed that the health implications had rarely been taken into account when making policy choices in the past. This may be changing however, as communities begin to realize how policy and planning decisions can facilitate healthier behavior among individuals.[23, 24] In Baltimore, for example, a 2008 audit of policies found that 43% of Resolutions and Ordinances introduced in the city council had a potential health impact, and of these 85% were *not* referred to the Baltimore City Health Department for review.[25] Details can be found in the attached appendices.

VII. Conclusions and Recommendations:

1. We developed a method to use the County Health Rankings data to identify counties that had better-than-expected or worse-than-expected health outcomes for their socioeconomic status.
2. Of the 17 counties with better-than-expected outcomes, nine had large Hispanic/Latino populations. This finding may partly be attributable to data-gathering difficulties among immigrant communities, but it is likely also in part reflective of the so-called "Hispanic paradox" for health outcomes.
3. Better-than-expected counties were diverse in terms of size and population change
4. Public health officials tended to be the best contacts with knowledge about a county's health status and activities.
5. It was difficult for most of those we interviewed to explain why they were better or worse than what SES would predict.
6. Public health officials in poorly-performing counties are aware of their counties' health outcomes. From interviews, there appears to be some progress in putting health implications more at the center of policy planning.
7. The County Health rankings is one component of the 'knowledge' available to policy and planning teams and should be considered with other more responsive and local information sources. In small counties, the statistics are extremely sensitive to influence by a small number of data points. In our analysis, we have eliminated counties with very wide confidence intervals and highlighted only the counties that we can be fairly confident are true outliers (see Methods section for additional details). Still, this analysis is only as good as the data provided; among very small counties in particular, we can never be completely certain that outcomes results are as good or as bad as our analysis suggests. The data should always be combined with local analysis.
8. Population health whether better or worse than socioeconomic status predicts is sensitive to demographics, community leadership and racial dynamics over time. The provision of healthcare in the traditional model of primary provider and hospital services is only a small component of the solution to better health, better experience and better value.

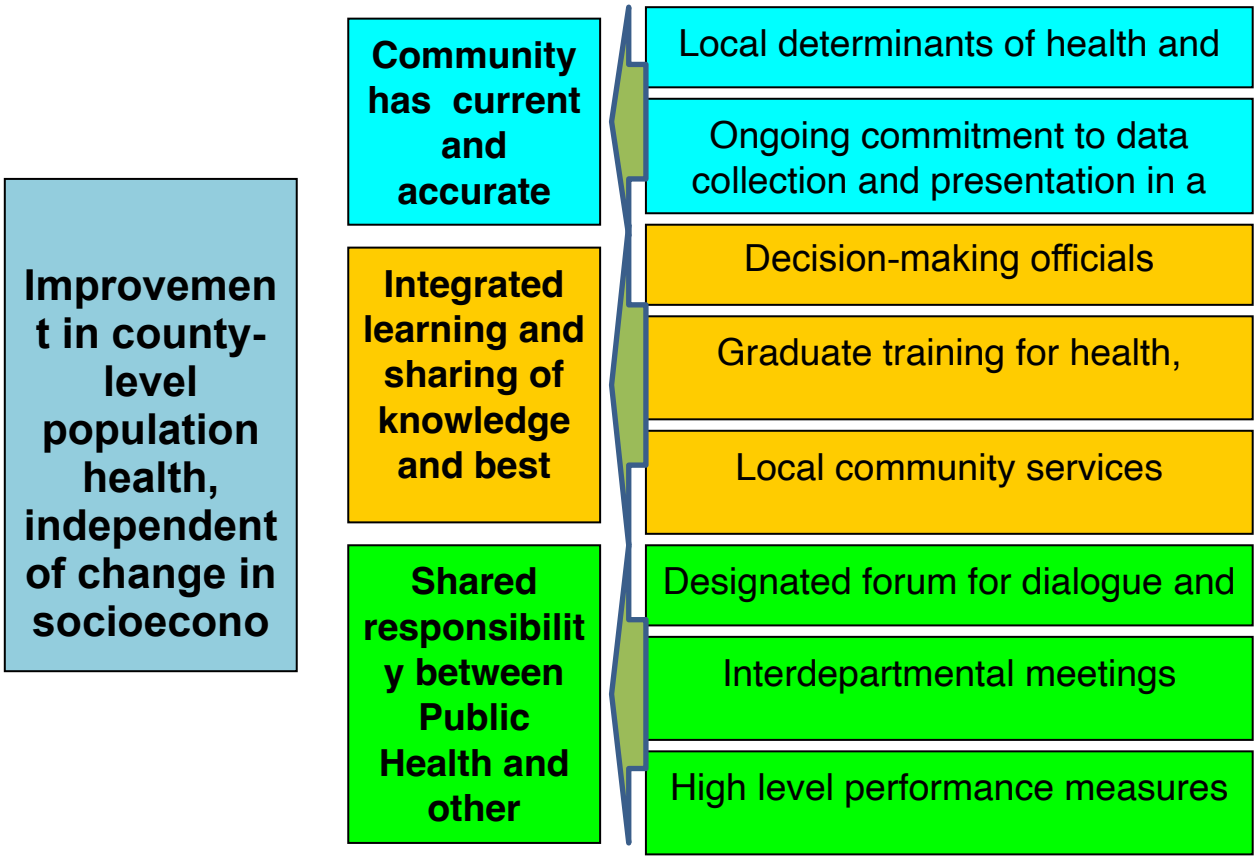
VI. Open Questions and Potential Future Research

1. According to our analysis, Baltimore is the largest city with worse-than-expected outcomes compared to SES. However, Baltimore City is a county-equivalent in Maryland, whereas most cities in the US are part of larger counties that may mask poor data outcomes. Further analysis might focus on the health outcomes of major metropolitan areas, to see if Baltimore truly is an outlier.
2. There is considerable information now available with respect to racial and ethnic differences and how these will impact communities in the next decade. Much of this is being delivered by University Public Health Faculties but action requires a wider platform for community engagement.

3. We learned of several Collaboratives and other initiatives going on in these communities, such as the Healthy Communities Collaborative in South Carolina, the Joint Center's "Place Matters" initiative, and New Mexico's outreach work modeled on the Department of Agriculture's outreach. IHI might consider continuing to watch these and other initiatives for results, learning, and contacts.
4. We were not able to delve into research on the two adjacent counties with large Native American populations (Apache, AZ and San Juan, UT). Further research might explore these counties, and the Fort Apache Indian Reservation, for clues as to achieving positive outcomes in resource-limited settings.

VIII: Appendix A: Driver Diagram Draft

Tricia Woodhead has developed this draft driver diagram for how to improve county-level population health, even in the absence of changes in SES. If this work continues, this diagram will need to be tested and refined.



IX. Appendix B: Interviews on Better-than-Expected Counties

Zoë spoke with two officials from Louisiana's Region 8 Office of Public Health, the Regional Medical Director and the Regional Administrator. Region 8 covers twelve parishes in northeastern Louisiana, including Tensas (pronounced Ten-saw) and West Carroll, two counties of interest with better-than-expected outcomes. They were somewhat surprised that West Carroll appears to be doing better than other similar parishes in the region, but offered some possible explanations related to the community-involvement and social equity. However, they were incredulous that Tensas has achieved such outcomes, and suspected that the data was not fully accurate for this tiny parish.

Both Tensas and West Carroll are rural, agricultural areas with high unemployment (October 2010 unemployment rates were 14.%1 and 14.5%, respectively)[26] and small populations (5,609 and 11,329).[22] By the County Health Rankings' measures, they have similar socioeconomic statuses, with West Carroll ranked 58th and Tensas ranked 60th. However, their close score is due primarily to West Carroll's high unemployment in 2008. In all other respects, West Carroll is better off socioeconomically. Tensas is significantly poorer, with a median household income of $26,405, vs. $30,922 in West Carroll. In Tensas, nearly a third of the population lives below the poverty line, compared to less than a quarter in West Carroll. Moreover, Tensas' income inequality is far greater than that of Louisiana as a whole, while West Carroll is more equal than the state.[2] Demographically, the communities also look different: Tensas is 56% black, whereas West Carroll is only 18% black. Louisiana as a whole is 36% black.[22]

These statistics are reinforced by the information provided by the interviewees. They perceived the community in West Carroll to be relatively equal, without the large disparities seen in other parishes. Most people cluster around a similar income level, they said. Indeed, the Gini coefficients confirm this perception.[2] Moreover, West Carroll has no private school, so everyone supports the public school – in marked difference from other counties, like neighboring East Carroll. They reported that West Carroll is a "close-knit" community that is "athletic-minded," insofar as much of the community activity revolves around support for the high school's football team. West Carroll also recently built a community center that holds live performances and is an important hub of activity and culture. The interviewees observed that the population has remained very stable, with few people coming or going. Indeed, between 2000 and 2009 the population has only shrunk by 0.8%.[22] Some heads-of-household have left for work, but they send money back to the family remaining in West Carroll. The economy is largely agricultural, with small family farms playing a large role in the economy. It is, as the medical director put it, "typical, rural middle class America."

In contrast to West Carroll, the interviewees report that Tensas is extremely poor, unequal, and isolated. Where West Carroll is known for family farms, Tensas is known for large plantation-style farms owned by a small number of people. It is home to Lake Bruin, a popular vacation and retirement spot for wealthier people. The medical director wondered if this wealthier, seasonal population might have been included in the County Health Rankings' dataset, unduly elevating

health outcomes scores. It is 80 miles from the nearest big city, Monroe, and the medical director described it as being "in the middle of nowhere." In the past Tensas had significant access problems for health care, with no hospital and few providers. However, the interviewees say this has improved in the last few years with a federally-qualified health center and more providers beginning to work in the county. They were dubious that Tensas' health outcomes were truly better than expected. When I asked about past initiatives that could have impacted health in the county, they acknowledged that some projects had occurred periodically, but that nothing ever seemed to come of these efforts. Indeed, they could not think of a single specific program.

Allendale County, South Carolina

Zoë interviewed the Director of Health Education and Community Services for South Carolina's Public Health Region 5, which includes Allendale County. Allendale is very small (10,195 people), rural, and of very poor socioeconomic status. The population is 71% African American, and the number of people living there has declined by about 10% over the past decade.[22] It is an isolated community; whereas traffic used to go through the county along route 301, that traffic now goes along I-95, skipping Allendale. Economic opportunity in the area is limited. The interviewee mentioned that some laborers are bused into other cities for 12-14 hour days, leaving kids at home unattended. As in other poor, rural areas, the biggest public health challenges are related to heart disease, hypertension, diabetes and obesity. The county's obesity rate is 76%.

Despite these grim statistics, there is much to be hopeful about in Allendale. Most notably, they have been successful in engaging multiple community stakeholders in tackling a chief public health crisis in the area, obesity and diabetes, through the Healthy Communities Collaborative. The Collaborative is part of a diabetes initiative that has been running for about six years. It is now also joining a state-wide initiative called "Eat Smart, Move More South Carolina."[27] The Collaborative has support from a wide cross-section of community leaders. Its Board includes the county administrator, hospital administrator, school superintendant, representatives from the University of South Carolina – Salkehatchie, some business leaders in the area, and the interviewee representing the Public Health department. The providers in the community are great partners in this work. The hospital is perennially short-staffed, but is expecting a grant that will help them to organize their patient flow. The Collaborative has worked to educate providers on diabetes protocol, and the interviewee reports that their public health view is expanding.

Some of the tangible steps the Collaborative has achieved so far has been to build a two mile walking trail in the downtown area of Allendale and start a community garden in a low-income neighborhood. The garden is strategically located two blocks from an elementary school, and has a partnership with the school so that kids have learned to garden. Both the garden and the walking trail are being expanded, and the public feedback has been extremely positive. The Health Department has worked significantly on community-engagement, through a tool known as "Mobilizing for Action through Planning and Partnerships" (MAPP).[28]

Although the work of this Collaborative is exciting and inspiring, the interviewee was not necessarily convinced that its work is responsible for the County Health Rankings' positive statistics. She notes that the county is very small, so statistics need to be taken with a grain of salt. She finds the BRFSS statistics for mental health, which put Allendale well-ahead of the rest of the state, particularly problematic. There is a huge gap in mental health resources in the area she says; however, she expects that the general community is simply not aware of what mental health problems look like, or how prevalent they are. She did state that the county's poor SES statistics has made it a target for health promotion work from the University and the health department. These efforts may be partly responsible for the positive health outcomes statistics in Allendale.

Luna, New Mexico:

- Social connectedness is good in the county
- There is a great nurse with strong personal effectiveness when it came to gaining secondary advice. She has taught medical students
- The Public Health office uses the Department of Agriculture model and extends it to health
- Wonder if the Hispanic paradox is at play in the Luna statistics.
- LUNA county has been impacted by a flood of people from Mexico. Do we know whether undocumented immigrants are captured in CHR's data pool?
- New Mexico tracks pediatric immunizations with Arizona, so that migration between the two states doesn't make them lose track of children.
- Don't think there is accurate data on subpopulations that would help to understand further recent arrivals or other subgroups. Schools system may be helpful. The elderly population statistics may be affected by the snowbirds (i.e., retirees who spend the winter there) – are they in the data?
- Immigrants may have some protective characteristics for health, but we would expect them to decline with time. For example, diet may start better but change with more time spent in the US.
- More violence in border cities has impacted on what is happening- very difficult to follow one person entering the US and what happens to them. With the recession, people have decided to migrate further into the US as well as complex family relationships
- Francisco doubts that border areas are very different from areas in the center of the state. Most immigrants move away from border counties because of high unemployment in those areas. Economic pressure has pushed more people north.
- Mexican mothers come to Deming in US to have their babies so they are US citizens. In some areas, 50% of school kids are actually resident in Columbus Mexico but at school in Deming, the county seat of Luna. The hospital is in Deming. There is a strong health department presence there.
- They work with schools to do health education at a young age.
- Pre medical students to encourage entry to medical school so as to grow more local professionals for healthcare services

- Grant from Project Hope. Now working on mobile van that will deliver education and screening services in places where access to health care is limited.
- Creating a "mobile pantry" to distribute food. Will coordinate this with mobile screening. Need to secure a referral system to accompany the mobile screening. .
- There are two federally qualified health centers
- They often need technical support, which the university can provide in part. .
- Personal experience has been very useful where MDs have trained in Mexico and have come to the US some time in the past. These Mexican-American MDs are able to work with the community, able to translate the experience of the immigrant into good service concepts and a good dialogue. Dedication sounds to be imperative
- Worrisome rise in HIV and other contributors to poor neonatal and birth outcomes
- New hospital lead, so not sure what the hospital will provide in terms of health assessments.
- Human resources are lacking – people with the right skills and education
- Need data in a more timely way. The lag time is a problem and anecdotal information is relied upon, when grants actually want numerical data.
- New AHRQ grant is about primary care practice extension- they would like to use IHI as a support

Saguache County Colorado
It is located in South Central Colorado. It is made up of a lot of public land. They grow barley and winter wheat. They raise beef cattle. They have lots of seasonal workers. There is no hospital in the community. They do have an FQHC. 46 % of the children live in poverty. It appears that the 2008 public health act in Colorado created a standard set of services that public health was to deploy. The county has a large Hispanic population.
Assets: self reliance, learning to do without, social connectedness
Weaknesses; Brain drain- people move away. Bimodal distribution young and old.
When asked who else would be good to talk with about the county she mentioned the superintendent, someone from the mental health center, senior center and county board of commissioners

X. Appendix C: Methods and Interviews on Poorly-Performing Counties (Tricia Woodhead)

Eleven states were identified with a single outlying county within each that had worse than expected health outcomes when correlated with socioeconomic status (County Health rankings methodology).

My initial analysis of the counties in question consisted of a Wikipedia overview of characteristics (geographic, historical, political, demographic and economic) of each county.

Further analysis consisted of using Google search engine by county, state and the term public health. This generated a variety of web sites and addresses. All the counties had either their own or

a shared web site on which there was information about immunization, child health, flu and locality specific infections (for example, Rocky Mountain Fever) plus emergency preparedness. Some counties had more detailed sites enabling access to support services (Alabama), contact details for Medicare and Medicaid advice (Alabama and Idaho) as well as advice on diet, exercise and smoking. The Google search in some cases gave email addresses and phone contact details were used to access individuals with good local knowledge.

The following more detailed information on some of the index counties has been obtained via a combination of email replies to questions and interviews with the lead public health professional in the county.

Buchanan, VA

Interview with the Public Health Physician for SW Virginia including Buchanan and other challenged counties

There is a complex range of factors affecting health in SW Virginia, the Appalachians in general, and Buchanan in particular. Buchanan has the worst health outcomes of the 132 counties in Virginia. 98% of population is white. Health problems seem to be the result of a combination of poverty, smoking, and diet. Access to care can be difficult or not sought due to lack of education and knowledge. For example there is a very high prevalence of people over 30 who are edentulous. There is a low level of physical activity. Educational attainment is relatively low and median income is just 50% of that for the State of Virginia. The SW Virginia Blueprint for Health Enabled Prosperity[23] comprehensively describes the complex history of poor health in the region.

One doctor in the area ascribed the poor performance in the region to the effect that poor economic opportunity has had on the culture. He explained that much of the population subsists on state payments, and stated that "lifestyle habits don't matter if you don't need to get out of bed in the morning… People say that if there was more money, the problems would be solved. But we need to incentivize work. Working people, controlled for all other factors, live longer and healthier lives than non workers."

Despite the poor statistics, we learned of various initiatives underway to improve health in the region. The previously mentioned SW Virginia Blueprint[23] sets out 20 goals and 40 measureable objectives to track and support change and developments. There is a strong collaborative spirit and 'in-it-together' commitment. Other efforts include a $40,000 grant from the regional Appalachian Fund to work on health disparities. The University of Virginia and a Graduate Medical Association have developed initiatives including a new dental school, a new model of consortium based medical education along with the Federally Qualified Health Centers.

Baltimore City, Maryland

Electronic interview with social epidemiologist in Baltimore City Health department of office of Epidemiology and Planning.

Baltimore City has a population in 2009 of 637,000. It has shrunk since the 1980s because manufacturing base has diminished. The population is located centrally within Maryland. It is the largest independent city in the US and has 2.7 million residents in its metropolitan area. The relative size of the black population grew from 23.8% in the 1950s to 46.6% in the 1970s. The inner harbor area was neglected in the 1970s. The populations survey 2006-9 showed 63% black, 31.9% non-Hispanic white.

Overall mortality has reduced over the last ten years by 22%. However there is a considerable amount of evidence presented by the interviewee showing the ongoing impact of social determinants on health. Areas where more than 25% of the population is below the poverty line have higher density of fast food stores, carry-out stores, corner-stores for food purchase, tobacco outlets, liquor stores, and vacant building lots than in areas where less than 10% is below the poverty line. See Table 5 below:

Table 5: Number of establishments per 10,000 residents in areas where 25% of population is below the poverty line and where less than 10% is below the poverty line.

	>25% pop. BPL	<10% pop. BPL
Fast food stores	5	1.4
Carry-out stores	20.9	6.6
Corner stores for food purchases	11.6	2.8
Alcohol stores	10	2.7
Vacant building lots	1549	36.9

The health department conducted an audit of city policies that showed that 88% of all policies reviewed or introduced at the city government level had had *no* review prior to implementation of their health impacts.[25] A new procedure in place is meant to ensure that all policies are screened for health impacts, scope, assesses, appraises report, evaluate and monitor. A great deal of work now being carried out, increasing emphasis and training for all local government staff to understand the long term health impacts of land use, housing, economic and policy decisions on the shape of the landscape in which people live, learn, work and play.

Interviews and some recent reports[29] indicate the need for public health agencies to change their focus from access to health care, to mitigating upstream determinants of poor health. A doctor I interviewed stated, “Public health is missing an understanding of the sociological, political and anthropological impacts on health in a community.” Within Baltimore, racial segregation, poverty, and unemployment are major contextual issues for health He mentioned one recent innovation, an initiative that allowed community residents to order groceries at the local library, which is far closer than the nearest supermarket.

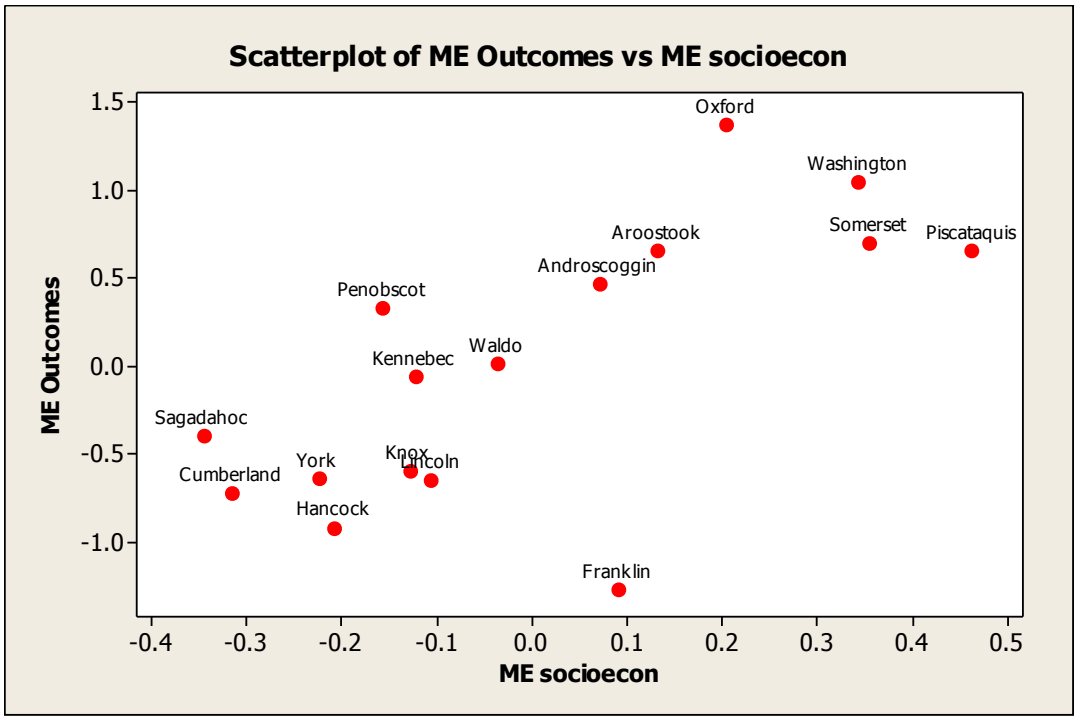
Nationwide Initiative on Health Disparities

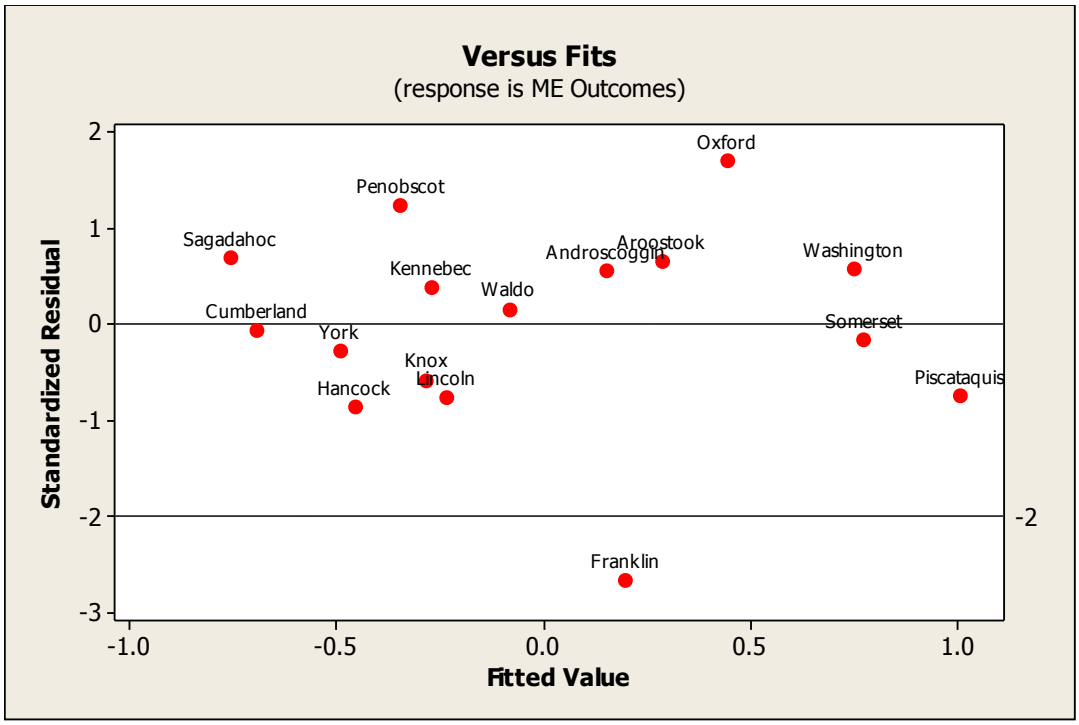
In the course of our research, we learned of the Joint Center's initiative "Place Matters" focused on reducing health disparities.[24] The mission is: "To ignite a Health Equity movement that gives people of color the inalienable right to equal opportunity for healthy lives"

The following counties and cities are participants:

- Alameda County, CA
- Baltimore, MD
- Bernalillo County, NM
- Boston, MA
- Cook County, IL
- Cuyahoga County, OH
- Jefferson County, AL
- Marlboro County, SC
- Martin Luther King, Jr. County, WA
- Mid-Mississippi Delta Counties (Coahoma, Washington, & Sunflower), MS
- Orleans Parish, LA
- Prince George's County, MD
- San Joaquin Valley Counties (Fresno, Kern, Kings, Merced, Madera, & Tulare), CA
- South Delta Counties (Sharkey-Issaquena), MS
- Washington, DC
- Wayne County, MI

XI. Appendix D: Maine Outcome Data





References

1. Adler NE, Rehkopf DH. U.S. disparities in health: descriptions, causes, and mechanisms. Annu Rev Public Health. 2008;29:235-52.
2. County Health Rankings. County Health Rankings. 2010 [cited 2011 February 11]; Available from: http://www.countyhealthrankings.org/
3. Booske BC, Athens JK, Kindig DA, Park H, Remington PL. Different Perspectives for Assigning Weights to Determinants of Health. *County Health Rankings* Working Paper 2010 [cited 2011 January 31]; Available from: http://www.countyhealthrankings.org/sites/default/files/differentPerspectivesForAssigningWeightsToDeterminantsOfHealth.pdf
4. Kindig DA, Seplaki CL, Libby DL. Death rate variation in US subpopulations. Bull World Health Organ. 2002;80(1):9-15.
5. Peppard P, Kindig D, Riemer A, Dranger E, Reming tP. Wisconsin County Health Rankings, 2003: Wisconsin Public Health and Health Policy Institute; 2003.
6. Eschbach K, Ostir GV, Patel KV, Markides KS, Goodwin JS. Neighborhood context and mortality among older Mexican Americans: is there a barrio advantage? Am J Public Health. 2004 Oct;94(10):1807-12.
7. LeClere FB, Rogers RG, Peters KD. Ethnicity and Mortality in the United States: Individual and Community Correlates. Soc Forces. 1997;76(1):169-98.
8. Huie SAB, Hummer RA, Rogers RG. Individual and Contextual Risks of Death among Race and Ethnic Groups in the United States. J Health Soc Behav. 2002;43(3):359-81.
9. Krueger PM, Huie SAB, Rogers RG, Hummer RA. Neighbourhoods and Homicide Mortality: An Analysis of Race/Ethnic Differences. Journal of Epidemiology and Community Health (1979-). 2004;58(3):223-30.
10. Hummer RA, Rogers RG, Nam CB, LeClere FB. Race/Ethnicity, Nativity, and U.S. Adult Mortality. Social Science Quarterly (University of Texas Press). 1999;80(1):136-53.
11. Stephen EH, Foote K, Hendershot GE, Schoenborn CA. Health of the foreign-born population: United States, 1989-90. Adv Data. 1994 Feb 14(241):1-12.
12. Immigrants in Australia: A health profile. Canberra, Australia: Australian Institute of Health and Welfare; 2004.
13. Chen J, Ng E, Wilkins R. The health of Canada's immigrants in 1994-95. Health Rep. 1996 Spring;7(4):33-45, 37-50.
14. Markides KS, Eschbach K. Aging, migration, and mortality: current status of research on the Hispanic paradox. J Gerontol B Psychol Sci Soc Sci. 2005 Oct;60 Spec No 2:68-75.
15. Palloni A, Arias E. Paradox lost: explaining the Hispanic adult mortality advantage. Demography. 2004 Aug;41(3):385-415.
16. Franzini L, Ribble JC, Keddie AM. Understanding the Hispanic paradox. Ethn Dis. 2001 Autumn;11(3):496-518.
17. Abraido-Lanza AF, Dohrenwend BP, Ng-Mak DS, Turner JB. The Latino mortality paradox: a test of the "salmon bias" and healthy migrant hypotheses. Am J Public Health. 1999 Oct;89(10):1543-8.

18. Gallo LC, Penedo FJ, Espinosa de los Monteros K, Arguelles W. Resiliency in the face of disadvantage: do Hispanic cultural characteristics protect health outcomes? J Pers. 2009 Dec;77(6):1707-46.
19. Marin G, Marin BV. Research with Hispanic populations. Newbury Park, CA: Sage; 1991.
20. Ramshaw E. On the Border, Long Lives Despite Dismal Statistics. New York Times. January 15 ed. Edinburg; 2011.
21. Centers for Disease Control and Prevention (CDC). 2006 NCHS Urban-Rural Classification Scheme for Counties. 2009 [cited 2011 February 11]; Available from: http://www.cdc.gov/nchs/data_access/urban_rural.htm
22. US Census Bureau. State & County QuickFacts. [cited 2010 February 11]; Available from: http://quickfacts.census.gov/qfd/index.html
23. Southwest Virginia Health Authority. Blueprint for Health Improvement and Health-Enabled Prosperity. 2009 [cited; Available from: http://issuu.com/healthyappalachia/docs/blueprint09
24. Joint Center. Place Matters. 2008 [cited 2011 February 2]; Available from: http://www.jointcenter.org/hpi/pages/place-matters
25. Petteway R. Health Impact Assessment and City Council Policy: Opportunities to Address Social Determinants of Health in Baltimore: Baltimore City Health Department; 2008.
26. Bureau of Labor Statistics. Local Area Unemployment Statistics. [cited; Available from: http://www.bls.gov/lau/data.htm
27. Eat Smart, Move More South Carolina. 2010 [cited 2011 February 11]; Available from: http://esmmsc.org/
28. National Association of County & City Health Officials (NACCHO). Mobilizing for Action through Planning and Partnerships (MAPP). 2011 [cited 2011 February 6]; Available from: http://www.naccho.org/topics/infrastructure/MAPP/index.cfm
29. Baltimore City Health Department. 2010 Baltimore City Health Disparities Report Card. 2010 [cited; Available from: http://www.baltimorehealth.org/info/2010_05_25_HDR-FINAL.pdf