Identifying Unforeseen Strains on Local Health Care Ecosystems

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ABSTRACT

Do patients in primary care shortage areas leave their local community for healthcare services? If so, do these patients impact the areas where they seek treatment?

This paper describes an analysis that determined where patients throughout California go for healthcare services. OSHPD conducted an initial analysis that found elevated chronic disease rates (above statewide median) for many primary care shortage areas within California. In further analysis, OSHPD found an abundance of patients in primary care shortage areas traveling to neighboring communities for healthcare services. Consequently, this may be causing a strain on healthcare providers in the neighboring communities, affecting residents' access to care and overall health outcomes.

Researchers at OSHPD utilized SAS Enterprise Guide (EG) to merge several datasets and conduct an analysis to determine where patients go for hospital care. The paper outlines the methodology and discusses how researchers integrated SAS EG with data visualization tools to display compelling results.

INTRODUCTION

California's Office of Statewide Health Planning and Development (OSHPD) promotes access to safe, quality healthcare environments that meet California's dynamic and diverse needs. Within OSHPD, the Healthcare Workforce Development Division (HWDD) works to encourage demographically underrepresented groups to pursue healthcare careers, identify geographic areas of unmet need, and encourage primary care physicians and non-physician practitioners to provide healthcare in health professional shortage areas in California.

OSHPD studies primary care utilization using rational service areas (RSA) which reflect areas where residents obtain most of their primary care. In California, the RSAs are known as Medical Service Study Areas (MSSA), which consist of one or more complete census tracts and do not cross county lines. There are currently 542 MSSAs. Depending on the number of primary care physicians practicing in these defined geographic areas, OSHPD can designate MSSAs as Primary Care Health Professional Shortage Areas (PC-HPSA) making them eligible for a number of benefits to attract providers, including education loan repayment programs and improved Medicare reimbursement rates. Areas not designated as a PC-HPSA should have an adequate number of physicians, and in turn, should have adequate access to healthcare.

Prevention Quality Indicators (PQI) are federally standardized measures of health, based on admission rates for conditions that are potentially preventable by effective outpatient care. OSHPD utilized PQI92, which is a composite of several chronic conditions, as an overall indicator of health. Commonly reported as rates of admission per 100,000 people, higher PQI rates indicate worse health. OSHPD identified 85 MSSAs that have above-median PQI92 values but do not currently qualify for PC-HPSA designation. The department is actively conducting research to identify unforeseen strains that may be impacting access to care in the areas with sufficient providers. This paper discusses how HWDD researchers utilized SAS EG to allocate imperfect data into the specialized geographies used to research healthcare utilization.

A TALE OF TWO GEOGRAPHIES

While MSSAs are extremely useful as research and planning tools, Californians do not know about or use these boundaries when seeking health care. The HPSA designation process accounts for some degree of boundary crossing, but the extent of the practice has not yet been measured. OSHPD hypothesized that patients travel outside of their home MSSA for care more than expected, potentially causing a strain on the neighboring communities.

OSHPD's Healthcare Information Resource Center (HIRC) provided hospital discharge data to aid in the research, which contains abstracted and aggregated information summarizing the encounters at each California hospital. To protect individual patient confidentiality, this data only identifies patient origin by five-digit ZIP code. ZIP codes are a useful geography in data collection, but their origin and focus lies in the delivery of mail, not the delivery of medical services. Consequently, ZIP code and MSSA geographies have little in common (Figure 1).
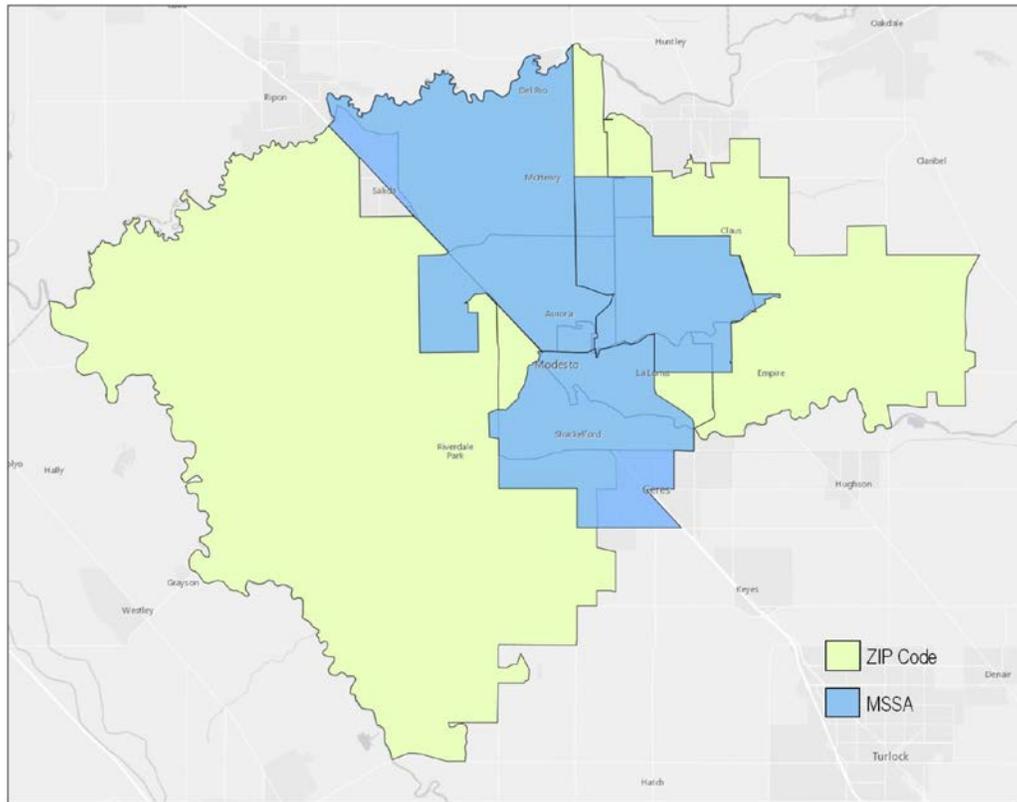
Figure 1. Map of ZIP codes and MSSAs in the Modesto area. USPS defines the Modesto area with seven ZIP codes (green), while OSHPD defines the area with three MSSAs (blue). The boundaries of the two geographies rarely align.

In the absence of more specific addresses, HWDD could not definitively know which MSSA the patient resides. To address this issue, researchers utilized SAS EG to make an educated estimate of patients residing in each MSSA. The United States Department of Housing and Urban Development (HUD) produces quarterly crosswalk files from United States Postal Service data that list the percent of residential and business addresses located within each census tract for each ZIP code (Figure 2). Incorporating this additional data into the research enabled HWDD to allocate hospital discharges proportionally into census tracts, which are the building blocks of MSSAs. For each patient ZIP code, if 23 percent of the residential addresses fell inside one census tract, researchers allocated 23 percent of the discharges to that census tract.

ZIP	TRACT	RES_RATIO	BUS_RATIO
95354	06099001200	0.143	0.067
95354	06099002200	0.007	0.015
95354	06099002002	0.006	0.061
95354	06099002004	0.221	0.020
95354	06099002100	0.129	0.059
95354	06099001100	0.020	0.002
95354	06099001900	0.233	0.051
95354	06099002005	0.114	0.010
95354	06099001700	0.009	0.074
95354	06099001300	0.023	0.001
95354	06099001800	0.095	0.640

Figure 2. Selected rows from the 4th Quarter 2014 ZIP-TRACT Crosswalk File. ZIP code 95354 in Modesto spans 11 different census tracts.

THE DOUBLE CROSSWALK

The discharge dataset also specifies the servicing hospital address. The quantity of addresses made manual MSSA assignment impractical. While GIS tools could geocode and plot the addresses on a map of MSSAs, the skillsets and software required are different and in limited supply. SAS EG enabled HWDD to continue its research until GIS resources became available. Using the business address ratios in the HUD crosswalk file, researchers further allocated the discharges proportionally into census tracts. For each hospital ZIP code, if 64 percent of the business addresses fell inside one census tract, researchers allocated 64 percent of the discharges to that census tract. Dividing the encounters into smaller allocations twice, increased the number of rows in the dataset substantially, but the total number of encounters remained unchanged (Figure 3). Summarized columns in SAS EG enabled HWDD to seamlessly aggregate the data when multiple ZIP codes allocated into the same census tract.
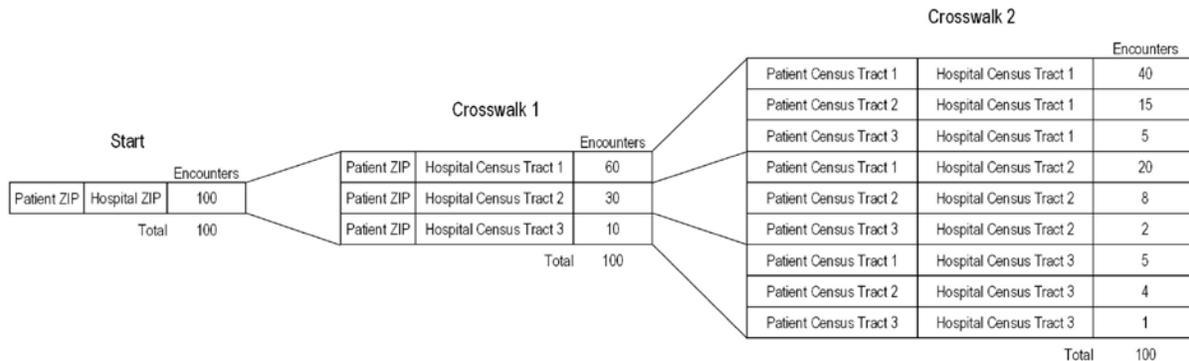

Figure 3. Theoretical diagram of the dataset before and after incorporating crosswalk files from HUD.

RESULTS

OSHPD's analysis began with the MSSAs in Stanislaus County, four of which exhibit elevated chronic disease rates despite having enough providers in the area. As with the discharge data, OSHPD used SAS EG to incorporate HUD crosswalk files and allocate the original PQI92 admissions, which OSHPD also collects by ZIP code, into MSSAs. After calculating the PQI92 for each MSSA in Stanislaus County, researchers combined the information with a map of MSSAs designated as PC-HPSAs (Figure 4). Paradoxically, the areas with a shortage of primary care providers have better health outcomes than those with sufficient providers. This map (Figure 4) served as a visual representation of the original criteria used to identify MSSAs of concern.
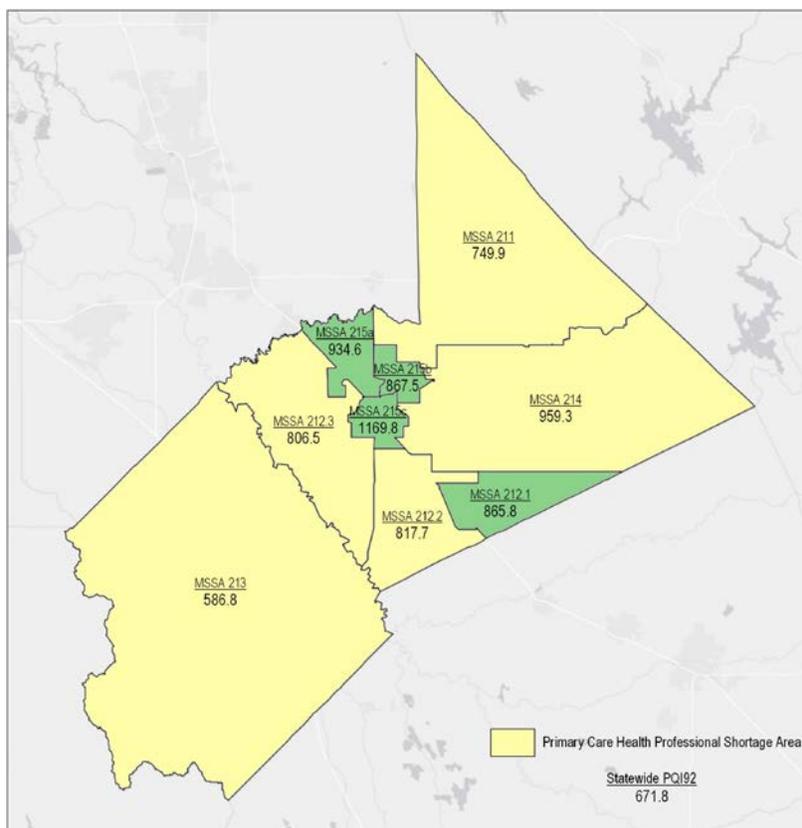
Figure 4. MSSAs in Stanislaus County labeled with PQI92 values. MSSAs designated as PC-HPSAs, which have a shortage of primary care providers, appear in yellow.

A myriad of factors contribute to the health outcomes of a community. OSHPD's research indicates that patients seeking care outside their MSSA may be another factor impacting outcomes in non-PC-HPSA areas. This research in Stanislaus County is the beginning of a larger undertaking to identify unforeseen factors contributing to poor health outcomes, particularly in areas with sufficient providers.

According to 2010-2014 census data, approximately 520,000 people reside in Stanislaus County. The hospital discharge data enabled OSHPD to see where this population went for care. For each MSSA, researchers quantified the 2014 encounters that took place in the same MSSA as the patient's residence (Figure 5). In four of the five PC-HPSAs, none of the encounters met this criterion—100 percent of patients traveled to other MSSAs for hospital care. Among encounters from MSSA 211 residents, the remaining PC-HPSA, 48 percent received care within the MSSA and 52 percent received care outside the MSSA. Countywide, only 28 percent of all encounters involving a Stanislaus County resident took place in the same MSSA as the patient's residence.
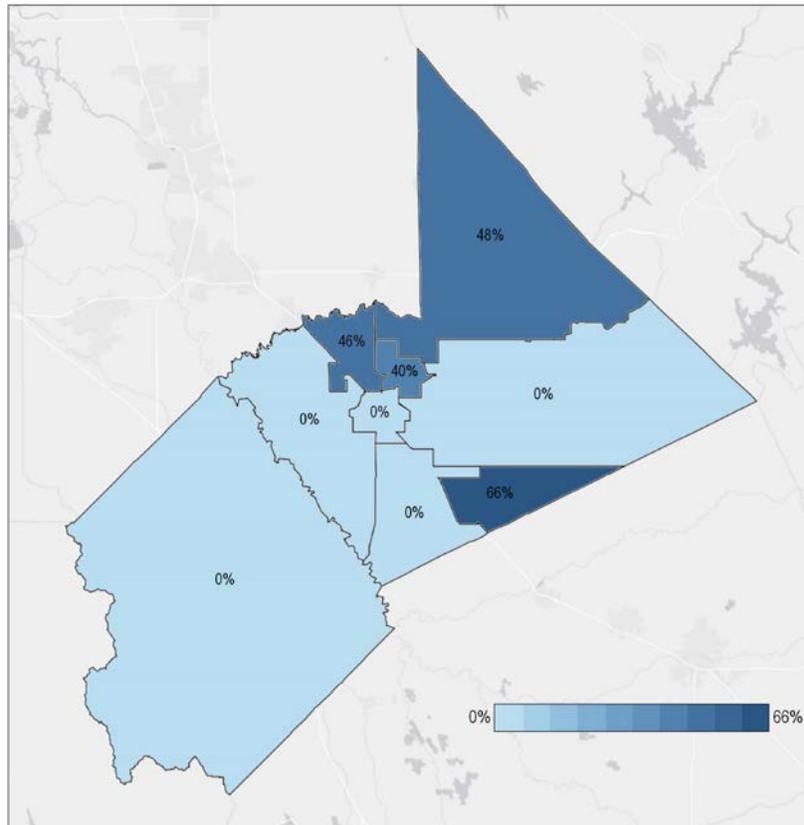
Figure 5. Heat Map of Stanislaus County MSSAs showing the percentage of patients that seek hospital care within the MSSA in which they live.

Knowing that most patients in Stanislaus County seek hospital care outside of their home MSSA, OSHPD continued to analyze the discharge data to discern their destinations. Researchers reorganized the encounter data from the hospitals' perspective and found that nearly 75 percent of all hospital encounters in 2014 involving a Stanislaus County resident occurred in three MSSAs, with MSSAs 215a and 215b accounting for 60 percent of all encounters. A handful of MSSAs care for the entirety of Stanislaus County.

Researchers further categorized the visits at each hospital by patient origin: those residing within the hospital's MSSA and those traveling in from outside. With this method, HWDD could analyze the source of the patient burden on hospitals in each MSSA. The data showed an abundance of patients traveling in from external MSSAs. In both MSSA 215a and 215b, more than 75 percent of the encounters were from external patients. As previously seen in figure 4, these same MSSAs also have some of the highest PQI92 values in the county but do not have the benefits of PC-HPSA designation. In contrast, external patients comprise only 35 percent of the burden for hospitals in the northernmost MSSA in Stanislaus, MSSA 211, which has both lower PQI92 values and benefits from PC-HPSA designation.

OSHPD sorted the five MSSAs by percent of patients from outside MSSAs and by PQI92 in descending order, and found identical results. The MSSA treating the highest percentage of outside patients also had the highest PQI92, the MSSA with the second highest percentage had the second highest PQI92, and so on down the line (Figure 6).
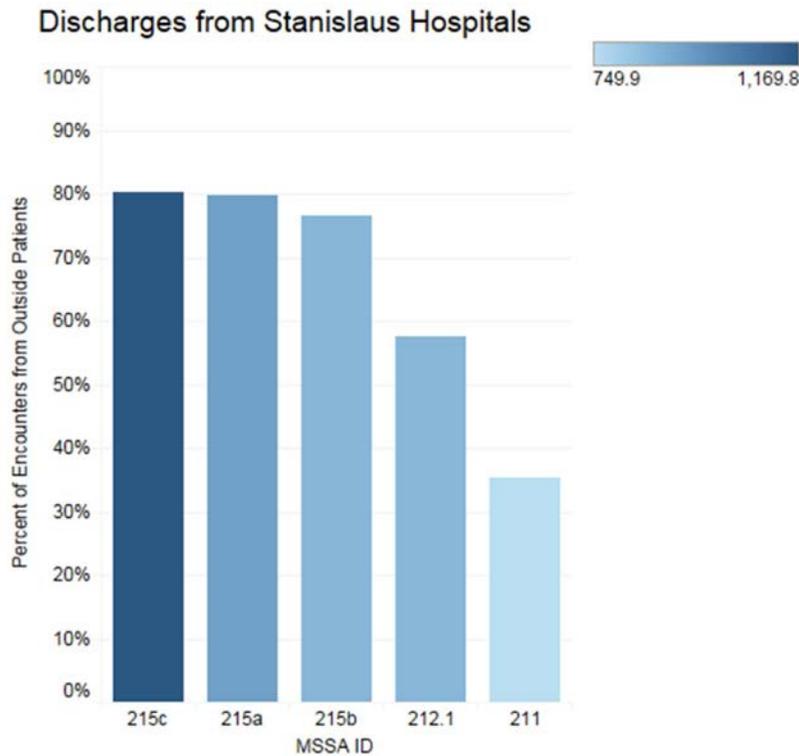
Figure 6. Bar graph of hospital discharges from hospitals in Stanislaus County. The height of the bar indicates the percentage of patients from outside MSSAs, and the darkness of the bar indicates the PQI92 for that area. The tallest bars are the darkest and the shortest bars are the lightest.

METHOD COMPARISON

SAS EG and the HUD crosswalk files enabled the department to work with an educated estimate instead of waiting for the perfect dataset to appear. The estimate allowed researchers to assess the utility of the study before committing additional resources. HWDD re-ran the hospital census tract allocation using GIS to plot each hospital location on a map of California MSSAs. Researchers updated the study with this information and reviewed the accuracy of the original estimate (Figure 7). The crosswalk method compared similarly in most scenarios, almost mirroring the numbers of the GIS method in several cases. In the most densely populated areas, MSSAs 215a and 215b, the accuracy of the estimation decreased. Overall, the estimate served its purpose to triage research projects and remains an intriguing choice in the absence of other options.

Hospital MSSA	Percent of Total Encounters (Stanislaus Residents)	
	Crosswalk Method	GIS Method
215a	30.4%	34.7%
215b	29.3%	24.9%
212.1	14.1%	14.5%
164.1	10.9%	11.1%
211	7.2%	7.2%
162g	0.7%	0.7%

Figure 7. Comparison of results between the two methods of allocating encounters into Hospital MSSAs.

NEXT STEPS

OSHPD initially focused on establishing whether patients disproportionately traveled outside their MSSA for care. With more data and time, OSHPD intends to study how this mass migration of patients affects the primary care system in the receiving areas. Additionally, researchers have started expanding the scope of the study to include

other areas of concern in California, including Shasta, Alameda, and Los Angeles counties. Preliminary data suggests that some of the trends seen in Stanislaus may also appear in parts of these areas.

CONCLUSION

OSHPD promotes access to safe, quality healthcare environments in California. In service of this goal, researchers throughout the department analyze data from a variety of sources to identify and address deficiencies in access, safety, and quality. SAS EG enabled the department to seamlessly incorporate additional data, like ZIP code crosswalk files from HUD, to translate valuable datasets into the specialized geographies used to research healthcare utilization. Through analyzing the origin of patients treated by hospitals in Stanislaus County, OSHPD started quantifying the outside patient burden placed on a community's healthcare system. Armed with new information, OSPHD can better assess the true needs of a community and can more appropriately focus its resources and support to the areas with the most need.

ACKNOWLEDGMENTS

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RECOMMENDED READING

- California Primary Care Needs Assessment 2016

- HUD USPS ZIP Code Crosswalk Files Documentation

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