Does the expansion of hospitals with percutaneous coronary intervention (PCI) capacity have differential effects on procedure volume and outcomes for heart attack patients in advantaged and disadvantaged communities?

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This pilot project addresses system-level mechanisms that contribute to inequalities in access and treatment of cardiovascular diseases. Specifically, we explore changes in procedure volumes among hospitals with the capacity to perform percutaneous coronary intervention (PCI) over time between advantaged and disadvantaged communities and how such change affects treatment of acute myocardial infarction across patients from different types of communities. The proposed database development and exploratory research will lay the foundation for a larger R01 proposal that we plan to submit subsequently.

PCI capability across hospitals has grown rapidly over the past decade, with the growth of PCI centers far outpacing that of population growth and the increase in cardiovascular disease, including acute myocardial infarction. The growth has happened in response to a call for more geographically available care with the rationale that "time is heart muscle," and that the faster patients receive treatment, the better their outcome. However, it is important to recognize the tradeoff between too little access – where patients need to travel far distances for time-sensitive conditions, and *too much access* – which necessarily means fewer procedures per hospital. The focus on expanding access has almost entirely focused on the former argument, without recognition of the potential downstream effects of decreased volume and expertise. Yet receiving care at low-volume hospitals has been shown to be associated with poorer patient outcomes, including higher risks of death, 30-day mortality, and an increased need of repeat revascularization. In fact, in 2013, the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions published that hospitals performing less than 200 PCIs per year had worse patient outcomes. These guidelines were previously used to govern PCI hospital certification, but over time, these regulations have loosened, thus allowing for greater numbers of hospitals to perform these procedures.

An additional dimension that must be recognized is that this growth has happened largely in well-resourced communities, with "favorable payer mix." In other words, hospitals have duplicated PCI services in areas that already have access to PCI, in an attempt to garner more revenue; poorer areas without market incentives for hospitals to provide these additional services have not fared as well. One potential outcome, therefore, could be that higher-income communities may suffer from poorer quality when PCI volumes in a fixed area are diluted across a greater number of hospitals. It is crucial to evaluate these disparate communities separately to determine if there are different patterns of treatment and outcomes. A paradoxical finding could be, then, that disparities are narrowing between high socioeconomic status (SES) communities and low SES communities not because low SES communities are improving, but because both communities are now experiencing worse outcomes, with high SES differentially so.

Using all-payer patient discharge data from California between 2006 and 2019, we propose to look at the following:

1. Has the probability of being treated at low PCI-volume hospitals changed over time differentially between hospitals serving disadvantaged and advantaged communities?
2. Have disparities in treatment and health outcomes between those treated in low-volume and high-volume PCI hospitals grown over time?
3. Does the extent of disparities in treatment and health outcomes between those treated in low-volume and high-volume PCI depend on whether the patients are in disadvantaged or advantaged communities?

We would like to use the pilot's opportunity to explore different metrics of advantaged and disadvantaged communities in the context of cardiac care. Following our prior work and because of what is available from patient discharge data, we will define community at ZIP code level. Our first definition will be a common metric based on income distribution in California using Census data (low-income community vs others). Our second method will utilize the Area Deprivation Index, which is best matched at Census block group level. Census block group can then be matched to ZIP codes via crosswalk from Census. In our third method, we would like to utilize the Agency for Healthcare Research and Quality's (AHRQ) social determinants of health database at ZIP code level to develop a disadvantage index that is specific to cardiac care. The social determinants data capture 5 dimensions of a community (social, economic, education, physical infrastructure, healthcare contexts), and we plan to employ factor analysis to construct a disadvantage index.

Using California data, we have already developed a PCI location database with a previously funded R01 from NHLBI (R01HL134182). We have also identified and cross-validated the clinical codes between ICD-9 and ICD-10 that allow us to define our treatment and health outcomes consistently over the study period. We will build upon that database by linking additional volume and information that defines disadvantaged communities, as well as incorporate the validated ICD-10 codes to capture recent trends after October 2015. We already have approval and access to all of the data we plan to use for the pilot study, so our work on the project can be launched immediately upon approval, and completed within the timeframe of the current year of the Center grant.

As noted, the findings of the pilot study, and the database development to complete it will serve as background to an R01 proposal for a larger-scale proposal that extends the analytic work by taking advantage of both hospital-level performance data and patient-level data. This pilot project is a developmental first step toward this more extensive and multi-pronged investigation to follow. This project is a collaborative effort between an economist and emergency department physician who has worked together in three previous R01 projects (funded by NHLBI) exploring health trends and inequalities in cardiac care.