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Understanding the Influences and Organization of Systems to Improve Community Health

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Understanding the Influences and Organization of Systems to Improve Community Health

by

Jennifer L. Frehn

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Committee in Charge:

Assistant Professor Amanda L. Brewster, Chair
Professor Hector P. Rodriguez
Professor Stephen M. Shortell
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Abstract

Understanding the Influences and Organization of Systems
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In any given community, there are multiple organizations and sectors – including health care, public health, education, and social services – that have a hand in addressing health, as well as the social and economic determinants of health. Often, these sectors are siloed and not coordinating as well as they could be. This dissertation examines organizational changes within different sectors that can support linkage and collaboration across sectors. The first study examines what area characteristics promote the establishment of school-based health centers (SBHCs), which are a key way to increase access to health care for children who are most in need. Findings showed that the availability of nearby community health centers, as well as the existence of a SBHC state advocacy organization, supported the establishment of SBHCs. These results point to the need for extra financial and technical support for school districts in counties that have few or no community health centers. The second study examines multilevel organizational influences of physician practices' screening for social risks, a care delivery innovation recommended to mitigate disparities, and a key step for preparing health care systems to engage in relationships with relevant community organizations in service of addressing identified needs. Increasingly, physician practices are being acquired by health systems. This study examines how system versus practice characteristics influence whether practices implement screening for social risks, with the goal being to understand what organizational level of intervention may be most effective for increasing screening for social risks. We found that practice-level characteristics explained more of the variance in a practice's screening for social risks, which suggests that efforts to expand social risk screening among system-owned practices should focus on strategies at the practice level, such as increasing technology capacity and patient engagement strategies. The third study tests an approach for identifying US counties with better-than-expected child health outcomes, also known as positive deviants. This study provides the first step – identification of positive deviant counties – that future qualitative research can build on to understand community activities, including multi-sector collaboration and linkages, that contribute to exceptional child health outcomes.

Dedicated to my parents, and in memory of my grandparents.

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Dedicated to those in the past, present and future who fight for health equity.

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Acknowledgements

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Introduction

As has been well-documented, social determinants of health, defined as "the conditions, in which people are born, grow, work, live and age," are strong predictors of poor health outcomes.[1–3] Social risk factors such as low income, education, and living conditions are correlated with premature death, increased rates of chronic disease, poor mental health, and cognitive decline.[2,4–6] In any given community, there are multiple organizations and sectors – including health care, public health, education, and social services – that have a hand in addressing health and the social and economic determinants of health. Often, these sectors are not coordinating as well as they could be. The Institute of Medicine identifies multi-sector partnerships as a key tool in improving health.[7] By combining resources and expertise from multiple groups, each sector is able to more effectively play their part in improving population health.[8]

There are several categories of sectors important for addressing health as well as upstream determinants of health. Three of the most important are: public health programs and systems; health care delivery; and other health-supporting sectors, such as transportation, housing, and education. When these sectors are working in concert to address the social determinants of health through multi-sector partnerships and collaboration, they are transformed into an integrated health development system. This system, show in in **Exhibit 1**, is informed by several frameworks and perspectives,[9–12] which emphasize the importance of these and related sectors taking a collaborative approach to improving health. In order to effectively transform from a configuration in which different sectors are siloed and not routinely collaborating, to an integrated system, changes within each sector are needed to support linkage across the sectors. This dissertation consists of three aims that examine factors necessary for such a transformation to an integrated system that is better able to address upstream determinants of health.

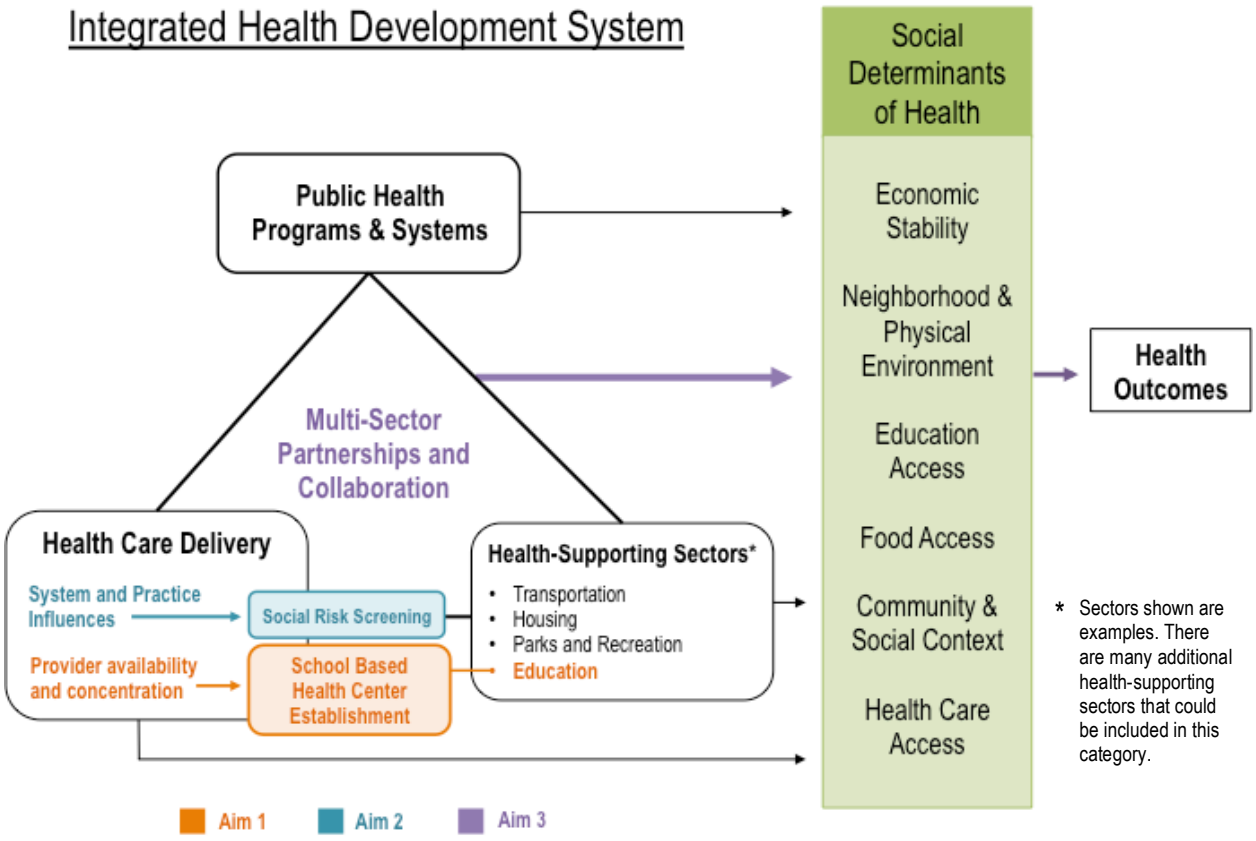
Aim 1 of the dissertation is to examine what area characteristics (including provider availability and concentration) promote the establishment of school-based health centers (SBHCs), which are a key way to increase access to health care for children who are most in need. SBHCs are themselves an integrated form of care, as they are located on school grounds, and often times also serve members of the surrounding community.

Aim 2 of the dissertation is to determine whether health care system or practice characteristics have a greater influence on a practice's screening for social risk factors, which will help policymakers and others understand at what level interventions to increase social risk screening should be targeted (the health care system versus the physician practice level). Screening for social risk is a key step in preparing health care systems to engage in relationships with relevant community organizations, either in the

form of referring patients to identified needed services, or potentially in acquiring a greater understanding of community need, and subsequently collaborating on addressing those needs with other organizations. For this reason, in the conceptual model, social risk screening is placed along the path of the "multi-sector partnership and collaboration" between the health care delivery sector and health-supporting sectors.

Aim 3 of the dissertation is to develop and test an approach for identifying communities with better-than-expected child health and wellbeing outcomes, taking their circumstances into account. These findings provide a first step (identifying positive deviant counties) that future qualitative research can build on to further understand community activities and mechanisms that contribute to exceptional child health outcomes, which is expected to include multi-sector partnerships.[13]

Exhibit 1. Dissertation Conceptual Model and Aims



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- Halfon, N. Bethell, C. (2014) Introducing the Maternal and Child Health Measurement Research Network. MCHB Webinar Series.
- Arah OA, Westert GP, Hurst J & Klazinga NS. (2006). A conceptual framework for the OECD Health Care Quality Indicators Project. *International Journal for Quality in Health Care*. 5-13.

Chapter 1

Influences on the Establishment of School-Based Health Centers in the United States

Introduction

Among U.S. children, inequalities in health and academic outcomes by income, race and ethnicity have been well documented and disadvantages in these domains appear to reinforce one another throughout the life course.[14–17] Poor health outcomes among children are associated with low academic performance,[18–21] and low academic performance has in turn been associated with lower health status in adulthood and reduced longevity.[22,23] School-based health centers (SBHCs) are a promising organizational model for serving children who would otherwise not have access to health care, which can aid in reducing inequalities.

Generally established in low-resource urban and rural areas in a direct response to community needs, SBHCs seek to reduce student barriers to accessing health services by providing free or low cost acute, primary and preventive health care on school grounds.[24,25] Because of SBHCs' unique setting on school campuses where students are in daily attendance, their care models can differ from those of a community provider in that SBHCs have the potential to incorporate primary, secondary and tertiary prevention into medical care, which can address multiple determinants of health.[26] Prior research has shown that SBHCs reduce inappropriate emergency room use for students and improve a range of academic outcomes including tardiness, absences, dropout rates, and test scores.[27–30]

The number of SBHCs in the U.S. has grown substantially in the past two decades, from 150 in 1989, to 2,584 as of 2017.[31,32] However, only a small percentage (2.4%) of public schools in the US have a SBHC, and access to SBHCs is unevenly distributed geographically.[32,33] Given the positive impact of SBHCs on student health and academic achievement it is important to understand what factors aid in the dissemination of this unique model of care.

Organization theory as well as traditional market forces can provide useful lenses for understanding SBHC establishment in the U.S., as SBHCs operate in niche markets where economic theory explanations for market entry may be limited. Organization theory has been usefully applied to understand the spread of other innovative models of care, such as Accountable Care Organizations,[34] but no prior studies have examined SBHC expansion from this perspective. Several studies have examined school and community-level factors associated with SBHCs and/or the presence of specific health

services on school grounds, including those relating to resources present, student need, and barriers experienced.[35–39] However, these studies were limited by small samples or conducted during the early stages of SBHC diffusion. This study aims to fill these research gaps and examine county and state-level characteristics positively associated with the presence of SBHCs across the country.

Conceptual Model and Hypotheses

Transaction Cost Economics and Organizational Ecology

The establishment of a SBHC can be initiated by any number of actors within a community, including those at the school or school district, local health care providers, and those at county and state-level organizations. When deciding a location for a SBHC, a planning group typically takes into account geographic need for a SBHC in terms of the student population, as well as the availability of the expertise of an established health care organization as a sponsoring partner, if such a partner is not already a part of the planning group. Health care organizations often provide many benefits key to startup and support of their operations, such as contributions in the form of staffing and planning. Close to 90% of SBHCs are sponsored by organizations outside of the school system,[31,32] including community health centers (CHCs), Federally Qualified Health Centers (FQHCs), and FQHC Look-Alikes.[31,32] These organizations and SBHCs have aligned missions to serve low-income or safety net populations.

Transaction cost economics theory posits that when coordination costs are high, organizations integrate new services within their organizational boundaries rather than assure the service through a contractual or partnership relationship.[40] The local presence of nearby health care organizations such as CHCs and FQHCs are assets to SBHC planning groups that can lower the transaction costs of establishing a SBHC. Organizational ecology theory suggests that SBHCs will be more likely to form in environments that foster their development, such as environments with expanded health insurance coverage and incentives for the provision of preventive care.[41] The presence of CHCs also serves as an indictor of a social and political environment that enables the establishment and sustainability of SBHCs. If a geographic area has a high number of CHCs/FQHCs, that means there are more potential partners for planning groups to team up with to form a SBHC. In a recent study, the strongest predictor of SBHC presence in California high schools was the existence of a nearby non-school-based family planning clinic.[35] Therefore, we hypothesize we will see this same relationship in this study:

> *Hypothesis 1 (H1): Schools in counties with greater availability of health centers (CHCs/FQHCs/FQHC Lookalikes) will be more likely to have a SBHC, after controlling for covariates.*

Traditional Market Forces

Past research has not examined how competition in the market for health services is associated with SBHC establishment. When traditional market forces prevail,

an increase in competition among health care providers could incentivize existing health care organizations to expand into the market for school-based health services in order to tap unmet demand for services.[42] However, we anticipate that market forces do not operate in this manner for the provision of health services for the population served by SBHCs – low-income children. Studies have found that communities use SBHCs, which provide low cost or free services, to fill a niche in their health care delivery system that most health care providers are not interested in filling.[43] For this reason, we hypothesize that competitiveness within the local market for health care services, as measured by the Herfindahl-Hirschman Index (HHI, described below), will be unrelated to SBHC presence in schools.

> *Hypothesis 2 (H2): There will not be an association between HHI in a county and the presence of a SBHC in a school in that county, after controlling for covariates.*

Institutional Theory

Normative influences on SBHC establishment are also relevant. Legitimacy, a key principle of institutional theory, is defined as the "degree of cultural support for an organization [and the] the extent to which the array of established cultural accounts provide explanations for its existence."[44] An organizational form achieves legitimacy when cultural, professional and political expectations regard the form as obligatory.[45]

SBHC state associations, which are state SBHC trade organizations that advocate and support state policies and programs that grow the number of SBHCs, can serve as a measure of socio-political legitimacy. Currently 21 states have a SBHC state association, which generally provide leadership, resources and technical assistance to SBHCs. In this sense, in addition to adding socio-political legitimacy to SBHCs through state-level advocacy, state associations provide instrumental support for the establishment of SBHCs and sustainment of their operations, which can also reduce transaction costs. In a 2004 study, SBHC state associations were found to be positively associated with the availability of general health services at SBHCs.[39] Given normative influences and instrumental support, we hypothesize:

> *Hypothesis 3 (H3): The existence of a SBHC state association in a state will be positively associated with the presence of a SBHC in a school in that state, after controlling for covariates.*

The conceptual model and study measures are summarized in **Figure 1**.

Methods

Data

The 2013-2014 National Census of School-Based Health Centers, a triennial national survey of school-based and school-linked health centers, were linked to county-level data from several sources. Health facility measures were obtained from Area Health Resource File (AHRF) data, maintained by the Health Resources & Service

Administration. HHI was obtained from the SK&A Office Based Physicians Database provided by IMS Health (now known as Quintiles). Additional covariates were obtained from the 2013-2014 National Center for Education Statistics, 2010 Census Population Estimates, the American Community Survey 2009-2013, and David Leip's 2012 Atlas of US Presidential Elections. This study uses the 2013-2014 SBHC census, as this census round matched our independent variables of interest.

Analytic Sample

The sample includes nearly all counties in the United States (n = 2,971, or 91%), excluding those in Alaska, Guam, Puerto Rico, and the Virgin Islands. The data for the 2013-2014 census were collected from July 2014 to May 2015, identifying 2,315 centers and programs nationwide. The completion rate for the survey was 82.1%, representing 1,900 programs. The census defines a SBHC as at least providing primary care, so programs providing only mental or dental health services (n=163) were excluded. After listwise deletion of 130 counties with missing or invalid values on key variables, 2,841 counties remained in the final analytic sample.

Measures

***Dependent variables*:** The probability of a school having a SBHC in 2013-14 was our dependent variable.

Independent variables: We used the number of CHCs per 10 schools in a county as our independent variable to account for the fact that different counties have different numbers of schools that the CHCs might serve as a resource for.

We used the Herfindahl-Hirschman Index (HHI) for primary care physicians in the school's county as our measure of market concentration.[46] The HHI was calculated by squaring the 2012 market shares of primary care physicians competing in a market and summing the values across physicians. The existence of a state SBHC association as a measure of legitimacy was obtained from the School Based Health Alliance's website.[47]

***Covariates*:** In planning for SBHC growth, many need-based factors of school populations are considered by planning groups. Following other studies, we include Census-derived county level measures of the percent of the population identifying as minority racial or ethnic groups, percentage of children on Medicaid/CHIP, and percentage of children uninsured as covariates.[35,36] County rurality, obtained from the US Census, is also included as a covariate because greater rurality has been previously associated with lower pediatrician supply, which may impact CHC availability and SBHC presence.[48] Because past studies have found that political environments in which SBHCs are situated can impact school health services,[35,39] the percentage of a county that voted Republican in the 2012 US General Election is included as a covariate.

Statistical Analyses

We used multivariate multilevel regression models to test whether our independent variables – the ratio of community health centers to every 10 schools in a county, market competition, and whether or not a state has a SBHC state association –

was associated with our dependent variable, the presence of SBHC in a school, adjusting for covariates.

We regress $sbhc_{ij}$ (representing the number of SBHCs in a county) of county *i* in state *j* on chc_{ij} (representing the ratio of community health centers to every 10 schools in a county), hhi_{ij} (representing a continuous standardized variable for level of market competition) and $state_j$ (representing a dichotomous variable for whether or not a state has a SBHC state association) in the following way:

$$\text{logit}\,(P_{ij}) = \beta_0 + \beta_1 chc_{ij} + \beta_2 hhi_{ij} + \beta_3 state_j + \zeta_j$$

$$P_{ij} \sim \text{Binomial}\,(schools_{ij}, P_{ij})$$

We use a binomial model, where $schools_{ij}$ is the number of schools in county *i* in state *j*. Binomial logistic regression provides the opportunity to analyze SBHC presence at the school level, even when other school-level data are unavailable. We write P_{ij} to mean the conditional probability for a school in county *i* in state *j* to have a SBHC. All results are conditioned on the other covariates, and ζ_j, a state-level random effect. Covariates included percentage minority, percentage of children on Medicaid/CHIP, percentage of children uninsured, percentage of a county designated as rural, and percentage of a county voting Republican.

To examine (H1), we estimate e^{β_1}, which is the odds ratio for a school in a county in a state with a SBHC associated with each additional CHC per 10 schools in a county in that same state, controlling for covariates. To test (H2), we estimate e^{β_2}, which is the odds ratio for a school in a county in a state having a SBHC associated with each additional unit of HHI in a county in that same state, controlling for the other covariates. To test (H3), we estimate e^{β_3}, which is the odds ratio for a school in a county in a state having a SBHC comparing states with and without a SBHC state association, conditioned on the two states having the same zeta value, controlling for the other covariates. Analyses were conducted using Stata 15.

Sensitivity Analysis

Given that SBHCs are typically established in areas with the most socioeconomic need, we suspected the relationship between the independent variables and SBHC presence would vary by a county's level of socioeconomic need. To examine this possibility, the analytic sample was divided into 3 categories with different percentages of children on Medicaid: high-Medicaid counties (n=709); moderate-Medicaid counties (n=711); and low-Medicaid counties (n=1,421). High-Medicaid counties are those above the 75th percentile for percentage of children on Medicaid, which in this sample are counties with 48% or more of children on Medicaid. Moderate-Medicaid counties are those counties between the 50th to 75th percentiles (in this sample, counties with between 40% to 47% of children on Medicaid). Low-Medicaid counties are those below the 50th percentile for percentage of children on Medicaid (in this sample, counties with 39% or less of children on Medicaid).

Results

Descriptive Statistics

A small minority (2.3%) of schools had a SBHC and 15.9% of counties had at least one school with a SBHC. The majority (52.7%) of counties had at least one CHC and 36.6% of counties are in states that have SBHC state associations. The number of SBHCs per county ranged from 0 to 162 with a mean of 0.68 and a standard deviation of 4.66. Summary statistics for continuous variables are shown in **Table 1**.

The ratio of CHCs to schools per county ranged from 0 to 2.1, with a mean of 0.11 (SD= 0.20). The ratio of CHCs to every 10 schools per county ranged from 0 to 21, with a mean of 1.05 (SD=1.98). The HHI of each county ranged from 0 to 10,000.00, with a mean of 3653.33 (SD=2732.55).

Multivariable Regression Results

We found that a higher ratio of CHCs to schools in a county was associated with a school in that county having a SBHC, supporting Hypothesis 1 (**Table 2**, Model 1). Specifically, for every additional CHC per 10 schools in a county, the adjusted odds of a school in that county having a SBHC increase by 33% ($p<0.001$; 95% CI: 1.297, 1.365). In the stratified analyses by socioeconomic need, this relationship is robust. For every additional CHC per 10 schools in a county, the odds of a school in that county having a SBHC increase by 23% ($p<0.001$; 95% CI: 1.184, 1.274) in high-Medicaid counties, 39% in moderate-Medicaid counties ($p<0.001$ 95% CI: 1.317, 1.473), and 48% ($p<0.001$; 95% CI: 1.393, 1.568) in low-Medicaid counties. When examining Wald test scores for these results, the moderate-Medicaid group was significantly higher than the high-Medicaid group (test score = 3.59). The moderate- and low-Medicaid groups were not significantly different (test score = 1.42).

County HHI was not associated with SBHCs in schools ($p = 0.384$, 95% CI: 0.858, 1.061), consistent with Hypothesis 2. In the stratified sample, this relationship is robust for all segments except for the medium-Medicaid counties, where an increase in one standard deviation of HHI was significantly associated with a 28% decreased odds of a school in that county having a SBHC ($p = 0.007$; 95% CI: 0571, 0.916). The moderate-Medicaid group was significantly different from the other two (test scores = 3.09 and 2.49).

The presence of a SBHC state association was associated with a school in a county in that state having a SBHC, consistent with Hypothesis 3. In adjusted analysis, the odds of SBHC establishment in schools in states with a SBHC state association were more than twice as high for schools in states without a SBHC state association, conditioned on the two states having the same zeta value (OR=2.38; 95% CI: 1.381, 4.105, $p = 0.002$). In the stratified sample, this relationship was consistent.

In adjusted analysis, voting patterns were also found to be associated with the establishment of SBHCs. For every 14 point increase in percentage of a county voting Republican, the odds of a school in that county having a SBHC decreased by 10% ($p = 0.011$, 95% CI: 0.829, 0.9756). The stratified analyses indicate this finding was only

relevant for the low-Medicaid counties, but not for high-Medicaid and moderate-Medicaid counties.

Discussion

This study examined national county-level SBHC data, taking into account its geographic context, including its provider availability and concentration, its local political and economic profile, and state-level services and supports. The results suggest greater availability of CHCs in a county and the existence of state SBHC associations promote the establishment of SBHCs. In contrast, provider competition does not appear to impact the establishment of SBHCs in most markets.

The positive association between the ratio of CHCs to schools in a county and SBHC presence supports our proposition that CHCs can serve as a resource for the establishment of a SBHC. For the stratified sample, the relationship of CHC availability and SBHC establishment is nearly two times stronger in moderate-Medicaid counties compared to high-Medicaid counties. One possible explanation for this result is that if a county has a relatively lower percentage of children on Medicaid, the CHCs operating in that county may have more slack resources and greater capacity for collaboration on an endeavor such as establishing and sustaining a SBHC.

The lack of an association between a county's market competitiveness of primary care physicians and the establishment of SBHC provides evidence that SBHCs operate in a different market than most primary health care providers. Instead, SBHCs are niche health care organizations that do not compete with other organizations providing primary care services. In stratified regression analysis, higher market competitiveness was associated with SBHC presence in moderate-Medicaid counties. It is possible that increased market competitiveness is a limiting factor for SBHC establishment in counties that have both a sizeable segment (40% to 47%) of the pediatric population on Medicaid and also have greater provider competition. In these moderate-Medicaid counties, traditional market forces may dominate, and providers may not necessarily perceive SBHCs as niche organizations for special populations with unmet needs, but rather as their competitors.

The fact that schools are more likely to have SBHCs when SBHC state associations are present, particularly for counties that have among the highest pediatric Medicaid populations, should provide encouragement to those working in these state associations. Federal and state policymakers and funders may wish to boost funding for these organizations in states where they exist, as well as support efforts to create SBHC state associations in states where they currently do not exist.

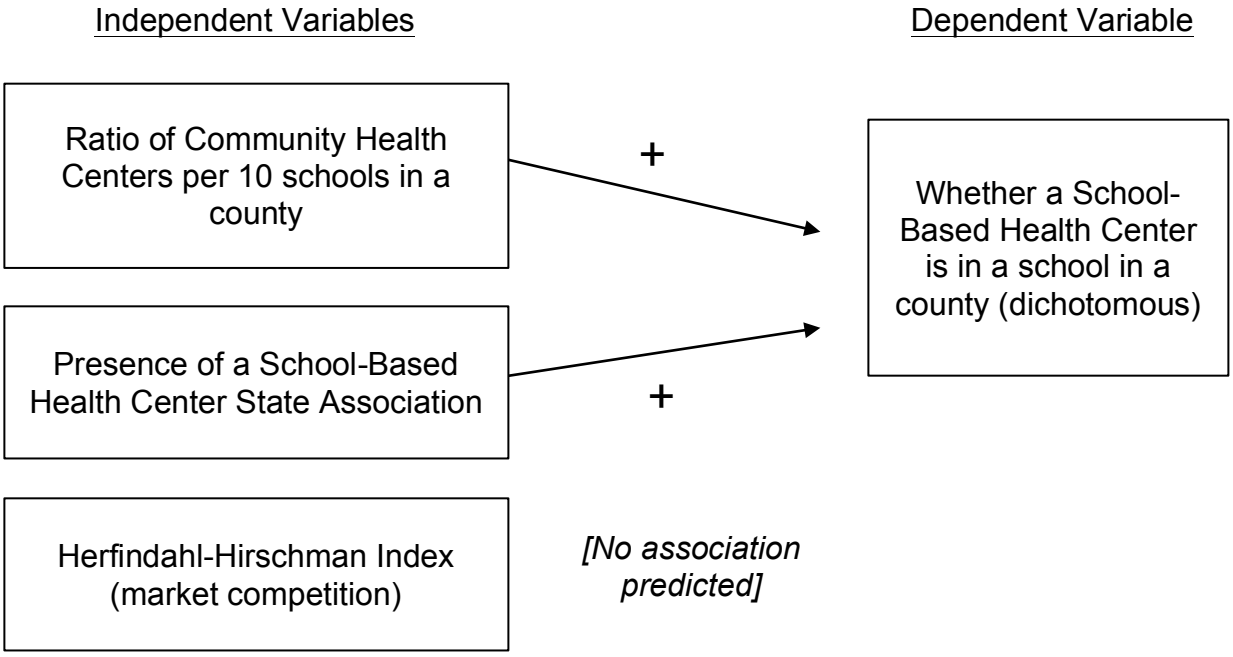
Our finding that SBHCs are less likely to exist in politically conservative counties is in line with previous research that found a greater percentage of Republican voters in a school district reduces the likelihood of SBHCs in California high schools.[35] Stratified analyses indicate that the negative association between percentage of a county voting Republican and SBHC presence is driven by low-Medicaid counties, which generally have less need for SBHCs in the first place. Political influences that deter the establishment of SBHCs in low-need counties appear less prominent than in the in

highest-need counties across the country. A qualitative study examining barriers to SBHC establishment in four communities found that objections to actual or perceived provision of reproductive health services provided in SBHCs mobilized opposition to SBHCs. [49] It is possible that in the highest-need settings any such opposition is outweighed by obvious evidence of community need.[49]

Our results should be considered in light of some limitations. First, these analyses are cross-sectional, which limits causal inference and understanding of the temporal ordering of SBHC establishment and the study variables. Future research should examine these associations using longitudinal data and natural experiment methods,[50] which would also be able to provide a clearer picture of what predicts SBHC survival over time, as factors that aid in establishment may be different from factors that aid in sustainability. Second, we were not able to account for school- or school district-level characteristics, so unmeasured confounders could change the results in either direction. In spite of these limitations, analyzing associations at the county and state level provides a broad and updated analysis of SBHC establishment nationally. The study also includes nearly all US counties, improving the generalizability of the results.

According to recent data, 80 percent of FQHCs do not sponsor SBHCs, which presents an opportunity for partnership and expansion of the SBHC model.[51] Policy makers, districts and technical assistance organizations may wish to target high-need schools in counties that have CHCs, but currently do not have SBHCs, for technical assistance aimed at SBHC development. Districts and planning groups in counties that have few or no CHCs may face large hurdles in forming SBHCs, as the absence of CHC organizations, which can serve as partners, increases transaction costs of establishing a SBHC. Therefore, technical and financial support from local and state organizations and funders for the establishment of SBHCs may be particularly important for high-need school districts in counties without CHCs.

Figure 1. Conceptual Model: Relationship between Area-Level Characteristics and School-Based Health Center Establishment



Notes. Covariates (not shown in figure) were: percentage of a county that is a racial/ethnic minority; percentage of children in a county on Medicaid/CHIP; percentage of children in a county who are uninsured; percentage of a county designated as rural; and percentage of a county voting Republican.

Table 1. Summary statistics for county and state level organizations, market competitiveness and county demographics

	Counties (N = 2,841)	
	Mean	Std. Dev.
Main Variables		
School-based health centers per county	0.68	4.66
Schools per county	29.70	78.69
Community health centers per county	2.58	9.45
Ratio of community health centers to schools	0.10	0.20
Ratio of community health centers to schools x10	1.05	1.98
Herfindahl-Hirschman Index	3653.33	2732.55
Covariates		
% Minority	22.00	19.64
% of children on Medicaid	39.86	12.74
% of children uninsured	8.58	3.87
% Voting Republican	60.06	14.45
% of a county that is rural	59.41	30.42

Table 2. Multivariable Predictors of School-Based Health Center Establishment, All Counties vs. Counties Stratified by Percentile of Children in a County on Medicaid

	All Counties	Counties Stratified by Medicaid Percentile		
	(Model 1) Entire Sample	(Model 2) Above 75th Percentile	(Model 3) 50th to 75th Percentile	(Model 4) Below 50th Percentile
N	2841	709	711	1421
Ratio of community health centers to schools per county (x10)	1.331***	1.228***	1.393***	1.478***
	(0.0174)	(0.0230)	(0.0397)	(0.0448)
School-based health center state association presence	2.381**	3.322**	3.459**	1.406
	(0.662)	(1.395)	(1.409)	(0.464)
Herfindahl-Hirschman Index [a]	0.954	1.124	0.723**	1.039
	(0.0515)	(0.0957)	(0.0873)	(0.0924)
% Minority [a]	1.404***	1.399*	1.835***	1.168
	(0.0677)	(0.185)	(0.153)	(0.108)
% of children on Medicaid [a]	0.979	1.134	0.995	2.153***
	(0.0432)	(0.173)	(0.322)	(0.264)
% of children uninsured [a]	0.678***	0.795	0.808	0.495***
	(0.0513)	(0.145)	(0.108)	(0.0639)
% Voting Republican [a]	0.899*	1.102	1.000	0.834**
	(0.0373)	(0.119)	(0.0853)	(0.0563)
% of a county that is rural [a]	0.954	0.985	1.303**	0.811*
	(0.0473)	(0.0984)	(0.120)	(0.0750)
Constant	0.00446***	0.00405***	0.00327***	0.00566***
	(0.000854)	(0.00146)	(0.00107)	(0.00142)

Notes. Exponentiated coefficients shown. Standard errors in parentheses. Asterisks indicate statistical significance at *p<0.10, **p<0.05, and ***p<0.001 levels. Superscript [a] indicates the variable has been standardized for analysis.

Chapter 2

Comparing Health System and Physician Practice Influences on Social Risk Screening

Introduction

Social determinants of health, defined as "the conditions, in which people are born, grow, work, live and age," are strong predictors of poor health outcomes.[1–3] Social risk factors such as low income, education, and living conditions are correlated with premature death, increased rates of chronic disease, incarceration, poor mental health, and cognitive decline.[2,4–6] Recognizing the importance of social determinants, institutions such as the World Health Organization, the National Academy of Medicine, and the Centers for Medicare and Medicaid Services have all called for primary care physicians to address social determinants of health.[2,52–54]

One important way for primary care physicians to assist in addressing social determinants of health is to screen their patients for social risk factors. Screening for social risk factors can have numerous benefits, including 1) informing medical care decisions, 2) helping the health care team to understand root cause issues that impact the patient's health and ability to adhere to a given care plan, 3) detecting which patients may benefit from a referral to community resources for additional support, and 4) informing broader efforts to understand unmet needs in the community.[55–58] Early evidence about the prevalence of screening for social risk among physician practices in the U.S. has begun to accumulate and indicates that screening is still relatively uncommon, with only 15.6% of practices screening for five social risk factors considered priorities by the National Academy of Medicine.[59] Prior research comparing physician practices has found social risk screening to be associated with having high innovation capacity and a focus on low-income populations,[59,60] but little is known about how the larger health systems that often own practices may be influencing adoption of this emerging innovation.

Increasingly, physician practices are being acquired by health systems, as systems address the challenges of new value-based payment models. From 2012 to 2018, the number of physician practices owned by hospitals or health systems increased by 124%, resulting in nearly 1 in 3 medical practices (31.2%) being owned by hospitals.[61] A recent systematic review concludes that besides occasionally including hospital system membership as a control variable, the influence of different kinds of organizational linkages on adoption of innovations is seldom considered.[62] System-level

policies, resources, and learning can support dissemination of innovations such as screening for social risk, but further evidence is needed to understand how health systems influence innovation implementation among their member practices. Currently no studies examine organizational influences on the use of social risk screening at multiple organizational levels. This study addresses this gap by examining multilevel influences of social risk screening among system-owned physician practices, which can help those seeking to increase social risk screening understand at what level of intervention – the local practice level versus the broader health care systems level – may be most effective in furthering adoption of screening.

Conceptual Model and Hypotheses

This study uses theory and research on adoption of innovation in health care to formulate hypotheses about practice-level and system-level influences on adoption of social risk screening.[62–64] Greenhalgh et al's model of determinants of innovations and the Consolidated Framework for Implementation Research (CFIR) serve as helpful guides that outline influences at different levels and stages.[63,64] We focus on organizational factors relevant to the beginning of the innovation diffusion process – adoption, which fall into two categories: 1) inner and outer context characteristics, and 2) compatibility characteristics.

Inner and outer context characteristics are antecedents for innovation – features of organizations that past research has shown increase the likelihood an innovation will be adopted and incorporated.[63] Inner context characteristics are those that describe aspects inside of an organization. This includes structural determinants of innovation, such as size and degree of decentralization. Inner context also includes knowledge and receptiveness characteristics, such as technology capacity and degree of innovation culture. Outer context characteristics are those in the environment in which an organization is situated. This includes aspects such as environmental uncertainty and competition.

In their conceptual model, Greenhalgh et al. also discuss how innovations that are compatible with an organization's existing "values, norms, strategies, goals, skill mix, supporting technologies and ways of working" (p. 108) are more likely to be adopted.[63] For example, in one study, an innovation's alignment with the major activities of an organization was found to be positively associated with innovative behavior of hospitals and health departments.[65] For social risk screening, compatibility factors would include characteristics that signal an organization has an interest in addressing upstream factors, either out of strategic necessity – such as having a patient population with high needs for social services – or alignment of values, such as taking steps to address the individualized needs of patients.

In our conceptual model (**Figure 1**), a practice's screening behavior is influenced by the inner and outer context, and organization-innovation compatibility at both the system and practice levels. For example, a practice may benefit from its own information technology capacity that can assist in efforts to build social risk data collection tools, or the practice may benefit from the technology capacity of the system it

belongs to, through availability of enterprise-wide tools for documenting and using social risk data.

Study Aims and Hypotheses

Aim 1. This study first examines the extent to which a practice's screening for social risk is associated with practice-level characteristics versus system-level characteristics. In previous studies examining the variation in patient experience measures at multiple organizational levels, the greatest share of variation was explained by the lowest organizational levels of units examined.[66–68] For example, in a study examining ambulatory care experience measures at each of four levels – physician, care site, medical group, and primary care service areas – the largest share in variation was explained by the physician and care site levels.[67] One possible explanation was that activities that affected the experience measures, such as appointment scheduling and patient follow-up activities, were mainly organized and implemented at the practice site level. The uptake of screening for social risk may follow a similar pattern, as it is likely that both the reasons for screening (e.g., to help address the needs of particular vulnerable populations) as well as the capabilities and contexts that would enable adoption of screening (e.g., technology capacity and degree of innovation culture) would depend on local-level circumstances, which vary across the practices in each health system. For these reasons, we hypothesize:

> *Hypothesis 1: Practice-level characteristics will explain more of the variance in a practice's screening for social risk than will system-level characteristics.*

Aim 2. This study also examines specific characteristics at the system and practice levels as they relate to practice screening for social risk. Though it is expected that practice-level characteristics will be more strongly associated with practice-level screening, we predict that certain types of systems will be more likely to be associated with practice-level screening than others. Based on the literature for each of these characteristics (outlined below) we hypothesize the following:

> *Hypothesis 2: Practices that belong to systems that have greater technology capacity, innovation culture, and competition; are larger; have lower centralization; and have activities or needs that signal compatibility with social risk screening will be more likely to screen for social risk than practices in systems without these characteristics.*

Anticipated Impacts of Specific Practice and System Characteristics

Technology Capacity is defined as technical knowledge and resources that reflect an organization's ability to leverage information technology, which has been positively associated with innovation.[69] Technical knowledge and resources of either the practice itself, or the practice's health system owner could support deployment of tools that enable the practice to screen for social risk in ways that minimize the potential burden that screening may pose for either the staff or the patients.

Innovation Culture. A prior study examining both independent and system-owned physician practices found that greater innovative culture in practices was associated with practice's screening for a broader range of social risks.[60] The Competing Values Framework of culture purports that an organization will be dominant in one of four culture types: group/team culture, hierarchical culture, rational culture, or entrepreneurial culture. The last culture type – entrepreneurial – emphasizes flexibility and an external focus, one that prioritizes growth and change.[70] It is likely that organizations with entrepreneurial cultures will be more open to innovations.

Competition has been known to have both positive and negative influences on adoption of innovation, though a systematic review has found that competition tends to be positively associated with innovative behavior in studies with statistically significant results.[62] A healthcare system or physician practice facing a competitive market may seek to differentiate itself from others in its market by understanding more about its patient population and their needs through screening for social risk.

Size. With some exceptions, organization size is usually positively and significantly associated with innovative behavior.[62,63,69] Size has also been thought of as a proxy for other determinants of innovation, such as resources. In a related study examining both independent and system-owned physician practices, a composite scale of perceived barriers to the use of innovations (barriers that included insufficient financial resources and lack of knowledge/expertise) was negatively associated with the adoption of social risk screening.[60] We anticipate that practices that are themselves large and/or belong to large health systems may have access to resources and other support that would make adopting social risk screening an easier endeavor. Larger systems may also present greater opportunities for learning from each other.

Centralization is an organization's locus of authority, described by Damanpour (p. 589) as "the extent to which decision-making autonomy is dispersed or concentrated in an organization."[69,71] A recent meta analysis suggests that greater centralization may be negatively associated with innovative behavior;[62] as the concentration of power narrows, there may be less potential for new ideas to circulate.[72] A health care system where decision-making is highly centralized may therefore lag in adopting emerging and innovative practice such as screening for social risk.

Compatibility of social risk screening with the priorities or needs of the system or practice would be expected to increase social risk screening at the practice level. In our study, we identify three factors signaling that social risk screening would likely be compatible with organizational priorities or needs of the system or practice: 1) having low income patients who are likely to be experiencing higher levels of social risk, 2) having made other investments in population health, and 3) having made other investments in patient-centered care.

Methods

Data

Data were obtained from the National Survey of Healthcare Organizations and Systems (NSHOS), a nationally representative survey administered between 2017-2018 to primary care practice sites (N = 2,190, response rate = 47%), and health care

systems that owned or managed at least two primary care multi-specialty medical practices or acute care hospitals (N = 325, response rate = 60%).[73] The survey was completed by a key informant leader on behalf of the system or practice. We linked survey responses with IQVIA data on characteristics of health care systems and physician practices. We utilized a subset of the overall sample where we could link physician practice surveys (N = 820) with the surveys of their parent health care system (N = 253). Following exclusion of systems and/or physician practices for which data on key covariates were missing, our analytic sample included 781 physician practices nested in 243 parent health care systems (96% of respondents).

Measures

Dependent variable: The dependent variable, practice-level social risk screening, is measured as the number of social risks for which a practice reported having a system in place to routinely screen patients. Practices could screen for a maximum of 5 social risks: food insecurity, housing instability, utility needs, interpersonal violence, and transportation needs.

Independent variables:

Below are summary descriptions of the independent variables. A full description, including all survey items and scoring of responses, is found in **Appendix A**.

Size. Size is measured at the system level by number of practices and hospitals owned by the system, and at the practice level by number of physicians in the practice.

Competition. Competition is measured at the system level by a survey question on the perception of the intensity of competition for patients in the outpatient setting in the system's largest market. It is measured at the practice level by the perception of the intensity of competition for patients in the practice's market.

Technology Capacity. Technology capacity was measured at the system level by a 5-item composite score of the share of the medical groups in the health system that had specific health information systems capabilities, including patients having electronic access to their medical records and physicians knowing whether their patients have filled their prescriptions.

At the practice level, technology capacity is measured by an index (range: 0-7) that includes whether or not the practice's health information system allows for the five capabilities included in the system-level measure (described above), as well as how often clinicians have access to the following when they need it: 1) information from groups that are not using their EHR, and 2) information from local public social service agencies.

Innovation culture. Innovation culture was measured at the system level using four statements that asked respondents to allocate 100 points across 4 organizational culture statements using an ipsative scale. System innovation culture is measured by the number of points (between 0-100) allocated to the statement, "Our system is a very dynamic and entrepreneurial place. People are willing to try new things to see if they work."

Innovation culture was measured at the practice level using responses to questions assessing how often different innovation-supportive activities happened in the

practice, such as team members openly sharing patient care challenges and failures with each other, and there being protected time given to generate new ideas and innovations.

Centralization. There are four measures for centralization at the system level. The first is a composite measure of questions that asks at what level (*local, regional/divisional, systems*) the various activities of a health care system, such as strategic planning, are primarily conducted. Additional individual measures of centralization are: whether the system has a system-wide approach for keeping up with new evidence; how often the system approaches clinical care as a single, integrated group; and whether front-line care clinicians have significant involvement in setting annual clinical performance improvement priorities.

Compatibility. There are several measures assessing organization-innovation compatibility. As described above, these measures fall into three categories:

1) Having patients likely to be experiencing higher levels of social risk. At the system level, this is measured by whether or not the system includes FQHCs or FQHC look-alike. At the practice level, this includes whether or not the practice is an FQHC or FQHC look-alike, as well as the practice's percentage of revenue that is Medicaid.

2) Investment in population health. This is measured by whether or not the system participates in population health collaboratives.

3) Investment in patient-centered care. At both the system and practice levels, this is measured by whether or not the system/practice has a method for identifying complex high-need patients. At the practice level, we also include a measure of the practice's score on the Patient Engagement Scale, made up of 30 patient engagement capabilities reported by the practice. These capabilities fall into four main categories: shared medical appointments; motivational interviewing; shared decision-making and provision of decision aids; and collection of patient-reported outcomes.

The composite scales described above were scored using 3-4 point Likert scales and had internal consistency reliability scores that were high (range = 0.71-0.92).

Covariates: This study includes a control variable measuring whether the system is a nonprofit, as past research has shown that non-profit hospitals were more likely to engage in activities that are community-oriented and address social determinants than were for-profit hospitals.[74,75]

Statistical Analyses

Aim 1 - To test Hypothesis 1, we examined a variance component model (null model). In this model, $screening_{ij}$ represents the number of social risks screened for by practice *i* in system *j*. Component β_0 represents the overall mean of screening across all groups, u_j is the random deviation of system *j*'s mean from the overall mean β_0, and e_{ij} is the random deviation of $screening_{ij}$ from system *j*'s mean.

$$screening_{ij} = \beta_0 + u_j + e_{ij}$$

We then determined the proportion of the variance that is accounted for by the system level and the proportion of variance accounted for by the practice level by estimating the intraclass correlation (ICC). This indicates the overall portion of the variance explained by each level. In order to determine the contributions of the specific

system and practice characteristics, a model with only system-level variables was fit, followed by a model with only practice-level variables. We compared the R^2 for the model with only practice-level variables to the R^2 for model with only system-level variables to understand whether the system or practice level accounts for more of the variance in screening for social risk at the practice level.

Aim 2 - To test hypotheses 2, we regressed $screening_{ij}$ (representing the number of social risk factors a practice screens for) of practice *i* in system *j* on a set of practice-level and system-level variables in the following way:

$$screening_{ij} = \beta_0 \quad \textit{(variables at each level shown below)}$$

$$\textit{(practice level)} \quad + \beta_1 Size\_p_{ij} + \beta_2 Competition\_p_{ij} + \beta_3 Technology\_p_{ij} + \beta_4 Innovation\_p_{ij} + \beta_5 Complex\_p_{ij} + \beta_6 FQHC_{ij} + \beta_7 Engagement\_p_{ij} + \beta_8 Medicaid\_p_{ij}$$

$$\textit{(system level)} \quad + \beta_9 Size_j + \beta_{10} Competititon\_s_j + \beta_{11} Technology\_s_j + \beta_{12} Innovation\_s_j + \beta_{13} Complex_j + \beta_{14} FQHC\_s_j + \beta_{15} Centralization_j + \beta_{16} Collaborative\_s_j + \beta_{17} Nonprofit_j + \zeta_j$$

Component β_0 represents the overall mean of screening across all groups. Next are components listed at the practice level, then those at the system level. Variables at both the system and practice levels are system/practice size, competition, technology capacity, innovation culture, and care plans for complex high-need patients. Additional variables at the practice level only are: patient engagement, the percentage of revenue that is from Medicaid; and whether or not the practice is an FQHC. Additional variables at the system level only are: variables representing system centralization; whether or not the system participates in mutli-sector population health collaboratives; whether or not the system has FQHCs; and the nonprofit status of the system. Component ζ_j is a system-level random effect that has variance ψ and is the random intercept for system *j*, deviation of system *j*'s intercept from mean intercept β_0. Continuous independent measures were standardized with a mean of 0 and a variance of 1.

To be sure we identify non-linear relationships, we examine quartiles of key continuous variables as a sensitivity analysis. We also test the robustness of our findings by utilizing logistic regression to model the odds of screening for each of the 5 social risks separately.

All analyses were conducted in Stata 15.

Results

Descriptive Statistics

System-owned practices screened for an average of 1.7 (SD = 1.8) of the 5 social risks assessed. Seventeen percent of practices screened for all 5 factors, while 34% of practices screened for none. Interpersonal violence was the most screened-for factor, with 57% of practices screening for this risk. For all other risks, the percentage of

practices screening for the risk ranged from 23% to 32%. A summary of social risk screening activity for physician practices can be found in **Table 1**.

Physician practices had an average technology capacity index score of 3.9 (SD=1.4), an average innovation culture scale score of 52.6 (SD=20.7), an average patient engagement scale score of 39.9 (SD=21.2), and average percentage of revenue from Medicaid of 19.2 (SD=17.8). A majority (76%) had a method for identifying complex high-need patients, and 17% were an FQHC or FQHC look-alike.

Health care systems had an average technology capacity scale score of 53.6 (SD=23.7) and an average innovation culture score of 25.11 (SD=15.3). A majority (64%) had a method for identifying complex high-need patients, and 36% of systems include FQHCs or FQHC look-alikes. About half (48%) of health care systems owned multiple hospitals, 14% owned one hospital, and 38% owned no hospitals. A majority (72%) were not-for-profit, and about 60% reported participating in population health collaboratives. A majority (57%) reported that their system approached care as an integrated group "most of the time" or "always," and 56% reported that they had a system-wide approach for keeping up with new evidence. Characteristics of physician practices and their health system owners are found in **Table 2**.

Multivariable Regression Results

In the main analyses (**Table 3**), the only system-level characteristic associated with practice social risk screening was a measure of system size: practices in systems owning multiple hospitals screened for an additional 0.44 social risks ($p = 0.046$) compared with practices in systems owning no hospitals.

Several practice characteristics were significantly associated with social risk screening. Practice-level health information technology capacity ($\beta = 0.20$, $p = 0.005$), innovation culture ($\beta = 0.26$, $p < 0.001$), patient engagement strategies ($\beta = 0.57$, $p < 0.001$), and percentage of a practice's revenue from Medicaid ($\beta = 0.23$, $p < 0.001$) were positively associated with the number of social risks a practice screens for. Practices with a method for identifying complex high-need patients screened for an additional 0.34 social risks ($p = 0.006$) compared with practices that did not have this method. Practices that are FQHCs or FQHC lookalikes screened for an additional 0.43 social risks ($p = 0.006$) compared with non-FQHC practices. Sensitivity analysis examining quartiles of technology capacity, innovation culture, and patient engagement revealed associations were driven by the 3rd or 4th quartiles of each.

The intraclass correlation indicates 16% of the variation in practices' screening was attributable to differences among the health systems that own them, with 84% attributable to differences between practices. The R^2 for the model containing only practice variables was more than 10 times larger than the R^2 for the model with only system variables (0.26 vs. 0.02).

In sensitivity analyses using logistic regression to model the odds of screening for each of the 5 social risks separately (**Table 4**), several system-level variables were significant, which is a divergence from the main analysis where only one system-level variable was significant. The odds of screening for transportation needs (OR = 2.54, $p = 0.016$) and interpersonal violence (OR = 2.29, $p = 0.025$) were more than twice as high

in practices belonging to health systems that owned multiple hospitals, as compared with practices in health systems that owned no hospitals. For every 15 point increase in a system's innovation culture, the odds of a practice in that system screening for interpersonal violence decreased by 21% (OR = .79, p = 0.037). The odds of screening for food insecurity were 61% lower for practices in systems that reported competition was "somewhat" intense in the outpatient setting in the system's largest market (OR=0.39, p = 0.044), as compared with practices in systems that reported competition was "not at all" intense.

Discussion

This study generates new evidence on multi-level organizational influences of adoption of social risk screening among health system-owned physician practices. Supporting our first hypothesis, system-level capabilities accounted for a smaller amount of the variance in a practice's screening for social risks relative to practice-level capabilities. The fact that at least some (16%) of the variation in practices' screening is attributable to differences among the health systems that own them suggests that system-level capabilities have *some* influence in social risk screening adoption, but the specific system capabilities that are important for screening adoption were largely not captured in this study, as only one system-level characteristic was found to be significant in the main analyses. This points to the need to better understand and measure capabilities at the system level that influence physician practice adoption of innovations such as screening for social risk.

The sole system-level factor that was significantly associated with screening in the main analyses – the system owning multiple hospitals – suggests that practices in health systems that are larger and perhaps require care coordination across several integrated organizations either see an advantage to screening for social risks, such as helping to reduce preventable admissions and readmissions for which hospitals are subject to financial penalties, or have more resources at their disposal to screen, than practices belonging to systems without hospitals.

The significant relationship between system-level factors and specific social risk screening suggests that systems may play a bigger role in a practice's screening – or not screening – for some types of social risks compared to others. There is not yet a standard set of social risks that health care organizations are required to screen for as a package. In the absence of official protocol, systems may exert influence selectively based on their perceptions and needs. A practice in a system owning multiple hospitals had increased odds of screening for transportation needs and interpersonal violence. The relationship for transportation needs screening may be because practices in systems with multiple hospitals have greater a need to ensure their patients are able to arrive to appointments on time at different care facilities.

For interpersonal violence, this was the most screened-for factor of the five social risks, which is likely because it has been discussed and recommended for a longer period of time than screening for the other social risks in this study. As such, systems with multiple hospitals may simply have more documentation or protocol for screening

for interpersonal violence that they pass on to the practice. Interestingly, there was a *negative* relationship between system innovation and practice screening for interpersonal violence. It is possible that more innovative systems prioritize screening for what might be considered more innovative risk factors, but this explanation seems tenuous.

There was also a negative relationship between a system reporting competition was "somewhat" intense in its largest outpatient market, and practice screening for food insecurity. In the innovation literature, competition is known to have mixed influences on innovation adoption,[62] so it's possible that systems that perceive a competitive market will de-prioritize innovations such as screening for food insecurity.

Consistent with predictions for specific capabilities, a practice's technology capacity, innovation culture, and patient engagement strategies were positively associated with practice-level screening for social risks. Based on the sensitivity analysis, it is important to note that these variables were significant at only the higher quartiles, suggesting a practice's increased screening activity does not take place until a practice has high levels of these capabilities.

Along with patient engagement strategies, several other compatibility characteristics at the practice level were associated with screening, including being an FQHC, the percentage of revenue from Medicaid, and a practice having a method for identifying complex, high-need patients. This supports the notion that when there is a match in an organization's values and/or strategic needs, they will adopt screening for social risk.

Limitations

These results should be interpreted in light of study limitations. The relationships studied are cross-sectional, so this study is not able to determine causality. However, we adjust for several characteristics believed to influence social risk screening, and this study provides the first evidence in multilevel influences of screening. This study also examines system-owned practices, which are not necessarily representative of all physician practices. However, system-owned practices are becoming the norm, as health systems have been increasingly acquiring practices so that they can expand their networks.[76]

Practice Implications

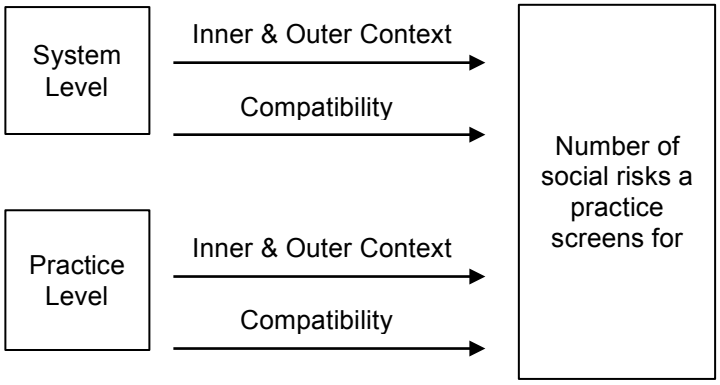
Our findings have several implications for practice. The results showing that practice-level variables account for more of the variance in social risk screening than system-level variables suggests that efforts to expand social risk screening among system-owned practices should focus on supporting practice-level capabilities, including enhancing health information technology capacity, promoting an innovative culture, instituting plans for identifying complex high-need patients, and engaging patients in their care. In the COVID-19 era of practices increased use of telehealth and related innovations in care delivery, developing these capabilities takes on increased importance.

Because this study is cross-sectional, whether each of these capabilities leads to increased screening, or the other way around, remains unclear. In spite of this, the mechanisms connected to social risk screening have high face validity. For example, a practice having the ability to customize its electronic health record would make it easier to include items that prompt providers to screen for social risk factors. Additionally, developing directories of local nonprofits and public social service agencies (e.g., shelters, food programs, etc.) would give providers confidence that they can help address factors they uncover, particularly if these directories contained information about the quality and capabilities of these organizations,[77] which may make screening for social risk factors more likely. Additionally, if a practice is engaging with patients in a nuanced way, for example through shared decision making, this might reveal particular social vulnerabilities of their patients, which may prompt the practice to develop a more systemized way of tracking and addressing these vulnerabilities through social risk screening.

Conclusions

Multilevel influences are increasingly important to understand as practices continue to be acquired by healthcare systems, and policymakers and others seek ways to accelerate the adoption of upstream approaches to prevention. This study adds to the limited evidence on multilevel influences of adoption of innovation among system-owned physician practices. Analyses indicate that health care systems do exert some influence on physician practice's adoption of social risk screening, but most of the influence is at the physician practice level.

Figure 1. Conceptual Model



Notes. The conceptual model focuses on organizational factors relevant to the beginning of the innovation diffusion process – adoption, which fall into two categories: 1) inner and outer context characteristics, and 2) compatibility characteristics. Inner context characteristics describe aspects of the organization itself, such as size and technology capacity. Outer context characteristics are those that describe the environment in which an organization is situated, such as competition. Compatibility characteristics are those that align with an organization's mission, strategies and needs.

Table 1. Physician Practice Social Risk Screening Activity

		Frequency	%
Number of social risks a practice screens for	0	264	33.8
	1	224	28.7
	2	85	10.9
	3	32	4.1
	4	43	5.5
	5	133	17.0
Number of practices screening for specific social risks	Food Insecurity	230	29.5
	Housing Instability	214	27.4
	Utility Needs	182	23.3
	Interpersonal violence	449	57.5
	Transportation Needs	252	32.3

Source: National Survey of Healthcare Organizations and Systems (NSHOS).

Table 2. Descriptive Statistics of Physician Practices and Health Care Systems

		Freq/Mean	% / SD
Characteristics of physician-owned practices		N = 781	
Practice size	0-3 physicians	159	20.4
	4-7 physicians	297	38.0
	8-12 physicians	133	17.0
	13-19 physicians	72	9.2
	20+ physicians	120	15.4
Intensity of competition	Not at all	181	23.2
	Somewhat	423	54.2
	Very	177	22.7
Has method for ID-ing complex patients		596	76.3
Practice is an FQHC		136	17.4
Technology capacity		3.9	1.4
Innovation culture*		52.6	20.7
Patient engagement*		39.9	21.2
% of revenue from Medicaid		19.2	17.8
Characteristics of Health Systems		N = 243	
Size: Number of hospitals	No hospitals	92	37.9
	One hospital	34	14.0
	Multiple hospitals	117	48.2
Size: Number of physician practices		63.46	113.25
Not for Profit Status	For Profit	60	24.7
	Not for Profit	176	72.4
	Government	7	2.9
Intensity of competition	Not at all	18	7.4
	Somewhat	105	43.2
	Very	120	49.4
Centralization: How often system approaches care as an integrated group	Never	2	0.8
	Sometimes	102	42.0
	Most of the time	120	49.4
	Always	19	7.8
Centralization: Has system-wide approach for keeping up with new evidence		137	56.4
Centralization: Frontline staff has involvement in setting clinical performance improvement priorities		141	58.0
Centralization: Level of Activities*		81.86	31.0
Has method for ID-ing complex patients		156	64.2
Participation in population health collaboratives		148	60.9
System includes FQHCs		87.00	35.8

Technology capacity*	53.55	23.7
Innovation culture	25.11	15.3

Notes: Data presented as mean and standard error for continuous measures, and frequency and percentage for categorical measures. Variables marked with * are composite scales calculated from multiple survey items. Scale scores can range from 0 – 100.
Source: National Survey of Healthcare Organizations and Systems (NSHOS).

Table 3. Predictors of number of social risks a system-owned physician practice screens for

		Coefficient	Robust SE
Characteristics of Physician-Owned Practices			
Practice size	0-3 physicians	Ref	
	4-7 physicians	-0.19	-0.14
	8-12 physicians	-0.28	-0.16
	13-19 physicians	-0.21	-0.21
	20+ physicians	0.03	-0.17
Intensity of competition	Not at all	Ref	
	Somewhat	-0.15	-0.13
	Very	-0.01	-0.16
Has method for ID-ing complex patients		0.34**	-0.12
Practice is an FQHC		0.43**	-0.16
Technology capacity		0.20**	-0.07
Innovation culture		0.26***	-0.07
Patient engagement		0.57***	-0.06
% of revenue from Medicaid		0.23***	-0.06
Characteristics of Health Systems			
Size: Number of hospitals	No hospitals	Ref	
	One hospital	0.34	-0.28
	Multiple hospitals	0.44*	-0.22
Size: Number of physician practices		-0.03	-0.09
Not for Profit Status	For Profit	Ref	
	Not for Profit	-0.29	-0.29
	Government	-0.81	-0.51
Intensity of competition	Not at all	Ref	
	Somewhat	-0.38	-0.29
	Very	-0.21	-0.3
Centralization: How often system approaches care as an integrated group	Never	Ref	
	Sometimes	-0.19	-0.36
	Most of the time	-0.17	-0.34
	Always	0.3	-0.38
Centralization: Has System-wide approach for keeping up with new evidence		0.1	-0.14
Centralization: Frontline staff has involvement in setting clinical performance improvement priorities		-0.06	-0.14
Centralization: Level of Activities		-0.06	-0.07
Has method for ID-ing complex patients		-0.08	-0.15
Participation in population health collaboratives		-0.1	-0.15
System includes FQHCs		0.14	-0.16

Technology capacity	-0.1	-0.07
Innovation culture	-0.04	-0.07
Constant	1.93***	-0.43
Random Effects Parameters		
System Constant	0.22	0.12
System Residual	2.09	0.15
Observations	781	

* p<0.05, ** p<0.01, *** p<0.001
Continuous variables standardized for analysis
Source: National Survey of Healthcare Organizations and Systems (NSHOS).

Table 4. Probability of Screening for Any Single Social Risk

Characteristics of physician-owned practices		Food Insecurity Odds Ratio	Housing Instability Odds Ratio	Utility Needs Odds Ratio	Interpersonal Violence Odds Ratio	Transportation Needs Odds Ratio
Practice size	0-3 phys	Ref	Ref	Ref	Ref	Ref
	4-7 phys	0.73	0.68	0.83	0.87	0.62
	8-12 phys	0.8	0.55	0.54	0.93	0.55
	13-19 phys	0.75	0.66	0.61	1	0.68
	20+ phys	0.98	0.89	1.35	0.9	0.84
Intensity of competition	Not at all	Ref	Ref	Ref	Ref	Ref
	Somewhat	0.91	0.75	0.8	0.62*	1.22
	Very	1.33	1.03	0.76	0.78	1.28
Has method for ID-ing complex patients		2.47**	1.1	1.51	1.43	2.85***
Practice is an FQHC		1.62	1.87*	1.39	2.41**	1.26
Technology capacity		1.18	1.36**	1.32*	1.29*	1.21
Innovation culture		1.39**	1.49***	1.38**	1.36**	1.39**
Patient Engagement		1.87***	1.94***	2.35***	1.71***	2.28***
% of revenue from Medicaid		1.34**	1.51***	1.34**	1.08	1.43***
Characteristics of Health Systems						
Size: Number of hospitals	No hospitals	Ref	Ref	Ref	Ref	Ref
	One hospital	1.33	0.87	0.97	2.29	2.05
	Multiple hospitals	1.19	1.35	1.27	**2.30***	**2.54***
Size: Number of physician practices		1.02	1.08	0.94	0.86	0.91
Not for Profit Status	For Profit	Ref	Ref	Ref	Ref	Ref
	Not for Profit	0.72	0.77	0.68	0.73	0.48
	Government	0.35	0.4	0.25	0.32	0.54
Intensity of competition	Not at all	Ref	Ref	Ref	Ref	Ref
	Somewhat	**0.39***	0.64	0.74	0.6	0.75
	Very	0.43	0.87	1.01	0.93	0.78
Centralization: How often system approaches care as an integrated group	Never	Ref	Ref	Ref	Ref	Ref
	Sometimes	1.87	1.17	1.05	0.39	0.5
	Most of the time	1.58	1.34	0.79	0.42	0.51
	Always	1.63	2.17	1.9	0.91	0.99
Centralization: Has System-wide approach for keeping up with new evidence		1.19	1.02	1.01	1.57	1.19

Centralization: Frontline staff has involvement in setting clinical performance improvement priorities	0.86	0.85	0.99	0.89	0.87
Centralization: Level of Activities	0.96	0.85	0.91	0.91	0.88
Has method for ID-ing complex patients	0.98	1	0.71	0.99	0.75
Participation in population health collaboratives	0.96	0.9	0.77	1.14	0.68
System includes FQHCs	1.19	1.1	1.43	1.24	1.18
Technology capacity	1.02	0.85	0.86	0.9	0.87
Innovation culture	1.02	1.05	1.11	**0.79***	0.95

* p<0.05, ** p<0.01, *** p<0.001
Continuous variables standardized for analysis
Source: National Survey of Healthcare Organizations and Systems (NSHOS).

Chapter 3

Using a Positive Deviance Approach to Identify Counties with Exceptional Child Health and Wellbeing Outcomes

Introduction

Currently in the US, vast inequities among children persist in regard to key health outcomes.[14,15] For example, there are higher rates of low birthweight and infant mortality among black families compared to white families.[78,79] Researchers have also found a gradient effect for socioeconomic status such that each decrease in a child's socioeconomic status was linked to an increased health risk.[80] Disparities also exist in access to high quality education, an important determinant of health throughout the life course.[81,82]

There is a need to understand mechanisms at the local level that can improve outcomes for children and mitigate disparities. Local and state organizations responsible for the health and wellbeing of children (e.g., health care providers, public health departments, school systems, and social service agencies) may be able to improve outcomes through high-quality services that reach children most in need. However, these service providers have differing levels of control over factors that may influence disparities. Characteristics that are largely outside of the control of local organizations responsible for population health include population served, and poverty levels of a region. Other factors are largely inside local organization control, such as what programs and interventions they deploy given their resources, and their coordination and partnership activity with other agencies.

While there is some data linking budgetary aspects, such as increases in public health spending,[83] to better outcomes, there is limited data on strategies that local organizations responsible for the health and wellbeing of children might enact – individually or in concert – to improve outcomes. One area that is considered promising for tackling challenges such as child health disparities, which span the domains of multiple sectors and service providers, is that of multisector partnerships.[7,13,84–86] The rationale behind multi-sector partnerships is that since no one organization or sector has full influence over determinants of health, successful solutions to addressing health issues will require coordination and collaboration between multiple organizations and sectors.[87] A longitudinal study found that communities with multisector networks that support population health activities had decreases in mortality.[88] The study also recognized that it was not able to determine the specific pathways by which this activity

led to better health outcomes, but speculated that it took place in sectors beyond solely medicine, and likely involved changes in social and environmental conditions.

In addition to partnerships, there are other actions organizations can take that can affect population health for children, such as the investments they make in particular services or in the community. It is still a question however of what the most promising mix of such investments is for organizations from the health care, public health, education, and social service sectors, and how optimal strategies may vary according to community context.

When there is not yet a large body of work on mechanisms that work well which are inside an organization's or community's control, an alternate method is to work backwards and identify which communities are achieving outstanding outcomes across multiple measures of child health and wellbeing, then examine the activities of those star communities that we wish to learn from. Communities achieving strong results across multiple measures of child health and wellbeing may have systemic strategies that enhance supportive services for children across sectors and life stages. However, child health outcomes are highly associated with poverty, so an approach that focuses exclusively on identifying communities across the U.S. with top outcomes would likely identify mostly high income communities, which may not provide examples of services and strategies that are effective at helping reduce health disparities in low-income communities. Therefore, instead of examining communities that are simply performing at the top ("high performers"), we are interested in identifying communities performing well across several measures of child health and wellbeing given their circumstances of poverty. This signifies that their performance is not simply due to having a population that is better off to begin with, but instead because the community is conducting activities differently than other counties that face similar challenges.

This is considered a positive deviance approach, which originated from the idea that there may be uncommon health behaviors that individuals practice which result in better-than-expected health outcomes.[89] In other words, these uncommon health behaviors enable the positive deviant individuals/groups to thrive while their equally at-risk neighbors do not. Once discovered, these practices can then be shared with others in similar circumstances to ideally result in similar better-than-expected outcomes. This approach has been increasingly applied in research to understand effective approaches to delivering health care, public health, and other public services, including strategies to enhance child wellbeing.[90]

This study will develop and test an approach for identifying communities with better-than-expected child health and wellbeing outcomes, taking their circumstances into account. We are interested in determining how many counties qualify as positive deviants based on the chosen criteria, as well as developing descriptive profiles of the positive deviant counties to determine characteristics that may be different from non-positive deviant counties. We are also interested in determining whether there are counties that are positive deviants for multiple outcomes, which would signal the presence of purposeful efforts from diverse service providers aimed at improving these outcomes.

These findings provide a first step (identifying positive deviant counties) that future qualitative research can build on to further understand community activities and mechanisms that contribute to exceptional child health outcomes, which other counties with similar contexts can learn from.

Methods

Overview

The purpose of this study is to develop a method for identifying communities with better-than-expected child health outcomes. This method consists of four key parts, described in more detail in each section below. First, we reviewed existing indices and available data to choose a set of measures to represent child health and wellbeing. Second, we used regression analysis to determine county performance on each of our chosen measures, after adjusting for poverty levels. Third, we implemented a threshold for determining whether counties qualify as positive deviants. Fourth, we examined the performance of our approach of identifying positive deviants by conducting descriptive analyses comparing positive deviant counties to non-positive deviant counties.

Choosing Outcome Measures

Outcome measures were chosen using two criteria: 1) The measures needed to be widely used to gauge child health or wellbeing; and 2) The measures needed to be publicly available at the U.S. county level for a majority (more than 75%) of counties.

There are multiple child health and/or wellbeing indices, and this study examined several of the most prominent, including: the Kids Count Index (both the OI-measure index from pre-2012, as well as the revised 2012 index), the American Children Report index, and Ken Land's 28-Measure Child Well-Being Index.[91–93] In order to be included as an indicator for this study, the measures needed to appear on at least two of these indexes. With respect to children, health and academic outcomes have been found to be intertwined such that health problems among children are associated with low academic performance, and low academic performance has conversely been associated with lower health status.[18–23] As such, in addition to health outcomes, we considered education outcomes as measures of child wellbeing.

Based on the above two criteria, we identified four outcome measures: two reflecting early childhood and two reflecting adolescence. Early childhood measures were percentage of live births with low birth weight (< 2500 grams), and percentage of 3 and 4 year olds enrolled in preschool. Adolescent measures were teen birth rate (per 1,000 female population, ages 15-19), and high school graduation rates (percentage of a ninth-grade cohort that graduates in four years).

Data and Sample

Data on U.S. counties were derived from publicly available county-level datasets. A majority of the variables were obtained from the 2018 Robert Wood Johnson County Health Rankings files, which contain variables from between 2010-2016. Percentage of 3 and 4 year olds in preschool was obtained from the 2018 American Community

Survey (5-year average). Data on nonprofits and social capital were obtained from the Northeast Regional Center for Rural Development for the year 2014.[94,95]

Following exclusion of counties for which data on key variables were missing, our analytic sample included 2,527 counties (80% of counties nationally, containing 98% of the original sample population). Sample characteristics are shown in **Table 1**.

Determining Performance Adjusted for Poverty Levels

We used regression residuals to identify counties that were performing better than expected on each outcome. For the regression model, because child health outcomes are highly associated with poverty, we included the percentage of children under age 18 in poverty in a county as a covariate, regressing each outcome variable Y (4 models total, one for each outcome) on poverty in the following way:

$$Y = \alpha + \beta * \text{poverty} + e$$

Instead of including all factors known to affect the outcomes, we designed the model to be akin to a risk-adjusted model to understand true differences in county performance. In other words, we did not want to inadvertently adjust away factors that organizations in a community may have some influence over. Adjustment for these factors can have the unintended consequence of masking meaningful differences in performance on outcomes, and could imply that worse outcomes are excused or expected for populations with specific characteristics.[96,97] For example, we are purposefully not including race/ethnicity as a covariate in the model because doing so may excuse poor performance based on race/ethnicity, and remove the expectation that a county should try to mitigate disparities by race/ethnicity.

Defining and Identifying Positive Deviant Counties

Next, we identified positive deviant counties based on the standardized residuals determined in the regression models. A county was considered a positive deviant for a specific outcome if it satisfied the following two requirements: 1) It had standardized residuals with z-scores higher than 1.28, or less than -1.28 in cases where an inverse score was needed (α=0.10; central area =0.80); and 2) the county performed better than the unadjusted 75th percentile for that outcome. For example, if the 75th percentile of those graduating high school in the entire sample was 85%, only those counties that had a z score above 1.28 **and** had a percent graduating high school above 85 were considered a positive deviant county for the high school graduation outcome.

Developing Profiles of Positive Deviant Counties through Descriptive Analysis

In order to understand the performance of our method for identifying positive deviant counties, we obtained county-level data on multiple measures of population demographics, social determinants of health, and community capacity.

Demographic measures included: county population; percentage of the population below 18; percentage of a county that is rural; and percentage of the population that is a racial or ethnic minority.

Social determinants of health measures included: housing problems (percentage of households with at least 1 of 4 housing problems: overcrowding, high housing costs,

or lack of kitchen or plumbing facilities); food access (percent of the population who are low-income and do not live close to a grocery store); pollution (average daily density of fine particulate matter in micrograms per cubic meter); unemployment (percentage of population age 16 and older unemployed but seeking work); and child health care access (percentage of children uninsured).

Community capacity measures included: ratio of population to primary care physicians (PCP); ratio of population to dentists; number of nonprofits; and the social capital index.

We then used a two-sample t-test assuming unequal variance to determine if there were differences for the above characteristics between the following two groups: 1) positive deviant counties compared with non-positive deviant counties, and 2) positive deviant counties compared with negative deviant counties. Negative deviant counties were those that had standardized residuals with z-scores less than -1.28 (or greater than 1.28 in cases where an inverse score was needed) and performed below the 25th percentile for a given outcome. Non-positive deviant counties are simply counties that were not identified as positive deviants for a particular outcome, which includes negative deviant counties.

Results

Summary of Counties Identified as Positive Deviants

After conducting the above analyses, 577 counties (23%) were identified as positive deviants for at least one of the four outcomes. The outcome of percentage of 3 and 4 year olds in preschool had the highest number of counties identified as positive deviants (N=242), followed by low birth weight (N=162), high school graduation (N=141), and teen birth (N=107). A majority of positive deviant counties were located in the South (47%), followed by the Midwest (27%), West (14%), and Northeast (11%).

While a positive deviant outcome in this study is by definition at or above the 75th percentile (a criteria for being categorized as a positive deviant), we also examined what percentage of the positive deviant counties were *very* top performers (at or above the unadjusted 95th percentile nationally) for each outcome. The outcome of high school graduation had the highest percentage of counties that were positive deviants at or above the 95th percentile (69%, N=96), followed by preschool (52%, N=125), low birth weight (45%, N=73), and teen birth (29%, N=31).

Counties with Multiple Positive Deviant Outcomes

While 577 counties had at least 1 positive deviant outcome, 73 of these counties had multiple (2 or more) positive deviant outcomes (**Appendix B, Exhibit A**). Of counties that had two positive deviant outcomes, the most common combination was "low birth weight + teen birth" (N=17), followed by "low birth weight + high school graduation" (N=15) and "preschool + teen birth" (N=15) (**Table 2**). All of the possible six combinations of outcomes were observed.

Similar to the broader total of positive deviant counties (for counties with one or more positive deviants), a majority of counties that had multiple positive deviant outcomes were located in the South (55%) followed by the Midwest (22%) (**Table 2**).

We were also interested in determining the number of counties with multiple positive deviant outcomes when dividing them into strata that might be relevant for further in-depth analysis in a subsequent qualitative study. We stratified by four such measures (child poverty, rurality, percent minority, and population). For each stratum (low, medium, high), there were at least 10 counties each (**Table 2**).

Comparison of Positive Deviant to Non-Positive Deviant Counties

We developed profiles of the positive deviant counties, using measures of population demographics, social determinants of health, and community capacity. Summary statistics for these measures are found in **Table 1**. For each of these characteristics, we compared the means of positive deviant counties with that of two groups: non-positive deviant counties (N = ~2,300)(**Table 3**), and negative deviant counties (N = ~200) (**Appendix B, Exhibit B**).

For most of the four child wellbeing outcomes (low birth weight, preschool, teen birth rate, and high school graduation), there were significant differences between the means of positive deviant counties and that of non-positive deviant counties for a majority of the profile characteristics examined. There were, however, no clear patterns for most of these characteristics across the four outcomes examined. That is to say, in comparison to non-positive deviant counties, in some cases the positive deviant counties had worse conditions, and in some cases they had better conditions. For example, counties that were positive deviants for the preschool and teen birth outcomes had a higher percentage of housing problems than non-positive deviant counties had, but counties that were positive deviants in high school graduation had a lower percentage of housing problems than non-positive deviant counties had for that outcome.

Discussion

This study tested a method to identify counties in the US performing better than expected on child health and wellbeing outcomes. By examining standardized residuals of regression models that adjusted for poverty levels, we identified positive deviant counties for each of our four outcomes, as well as a subset of counties that were positive deviants for multiple outcomes. Given that we were able to include most counties in the US based on the data available, and given that there was appreciable variability on these measures across counties that resulted in positive deviance, this emerges as a feasible method for identifying a sizable proportion of U.S. counties that are performing better than expected on child health and wellbeing outcomes.

Our criteria for determining whether counties qualified as positive deviants for a given outcome were two-fold: the county needed to have standardized residuals with z-scores above 1.28, and the county needed to perform better than the national unadjusted 75th percentile. The decision to only include counties that were performing

above the 75th percentile meant that we lost between 2% to 37% of potential positive deviant counties for each outcome, yet this also meant that the counties remaining were performing *both* better than expected (positive deviance) and were also high performers in unadjusted terms nationally. This contributes to the face validity of the positive deviant counties, and provides support for the notion that they are stand-out counties, possessing strategies and activities that under-performing counties would likely want to emulate and learn from.

Profile Comparisons

We compared the means of positive deviant counties versus non-positive deviant counties for the purpose of creating profiles. For most profile characteristics, there were not patterns across the board, with a few exceptions. Across the four outcomes, positive deviant counties tended to have higher social capital compared to non-positive deviant counties and negative deviant counties. When differences in means between the two groups were significant, positive deviant counties tended to have a lower population-to-dentist ratio and lower levels of pollution in comparison to non-positive deviant counties and negative deviant counties. From these profiles, it's hard to say to what extent these differences matter for child health in each county, but these patterns may be interesting starting points for subsequent in-depth studies.

Application of the Positive Deviance Approach as it Relates to Subsequent Studies

One aim of this study was to determine the feasibility and usefulness of this method for identifying counties performing better than expected, which could then be selected for in-depth data collection and analysis in a subsequent qualitative study. While a majority of positive deviant counties identified were performing better than expected for only *one* of the four outcomes studied, a subset of these counties was performing better than expected on *multiple* outcomes. It is this subset that we believe should be the focus of a future qualitative study, as their positive deviant performance across multiple outcomes suggests that distinctive strategies may be at work. The sample size of 73 counties and diversity of these counties on characteristics such as census region, poverty levels, and population demographics, suggest that it would be possible to employ stratification to learn generalizable lessons from studying these counties in depth. First, there was geographic diversity, with each region of the country (Northeast, Midwest, South, and West) having at least eight counties that were positive deviants for multiple outcomes. Similarly, there was diversity in strata among several measures that might be relevant for learning lessons from communities of different sizes, poverty levels, and race/ethnicities. Finally, there was also heterogeneity in the pairings of outcomes (e.g., a county being a positive deviant for "low birth weight + teen birth" or "preschool + high school graduation," etc.) This suggests the child health and wellbeing outcomes chosen were a useful assortment of measures that may yield multi-service stream system capacity lessons in these communities in a subsequent qualitative study.

Limitations

These findings should be considered in light of certain limitations. First, this study is cross-sectional, examining outcomes at only one point in time. Future studies may wish to examine county performance in these outcomes over time, which would uncover which counties are performing well over a sustained period. Second, we lost 20% of counties when accounting for missing variables. Our remaining sample contains 98% of the population, which means that the counties we dropped were mostly low in population, potentially limiting generalizability for extremely low-population counties.

Conclusion

There is much interest in understanding how communities can improve performance in child health and wellbeing.[84,98–100] This study adds to this stream of research by testing an approach for identifying communities with better-than-expected child health and wellbeing outcomes, taking their circumstances into account. We found positive deviance to be a useful approach for identifying such communities. Further qualitative research will be needed to determine what uncommon practices and strategies these communities employ that enable them to thrive, which are lessons that can be passed on to other communities facing similar challenges and circumstances.

Table 1. Sample Characteristics

N = 2,527	Mean	Std. Dev.	Min	Max
Outcome Variables				
Percent low birth weight	8.20	1.91	3.33	18.02
Percent 3 & 4 year olds in preschool	43.67	12.31	0.00	100
Teen birth rate (per 1,000)	34.38	15.63	2.82	112.96
Percent graduating high school	86.18	8.00	30.14	100
Model Covariate				
Percent of children in poverty	22.32	8.98	2.90	66.30
Profile Characteristics				
Population	125406.70	364138.60	1557.00	10100000
Percent of population below 18	22.46	3.19	7.07	40.79
Percent of county that is rural	51.31	28.69	0.00	100.00
Percent minority	23.92	19.46	2.03	97.19
Percent w/ housing problems	14.87	4.10	3.33	39.14
Percent w/ poor access to healthy food	7.13	5.41	0.00	52.67
Pollution	9.21	1.49	4.30	15.40
Percent adults unemployed	5.35	1.74	2.03	23.52
Percent of children uninsured	5.92	3.04	0.83	24.63
Population to PCP ratio	2616.41	2454.10	-1947	45996
Population to dentist ratio	3053.08	2499.73	-3806	28824
Number of nonprofits	559.56	1540.41	7	37547
Social capital	-0.23	1.00	-3.18	21.81

Notes. PCP is an abbreviation for primary care physician.

Table 2. Characteristics of Counties with Multiple Positive Deviant Outcomes

Most Common Combinations for Counties with Two Positive Deviant Outcomes

	Freq.	Percent
Low birth weight + Preschool	7	9.86
Low birth weight + Teen birth rate	17	23.94
Low birth weight + High school graduation	15	21.13
Preschool + Teen birth rate	15	21.13
Preschool + High school graduation	13	18.31
Teen birth + High school graduation	4	5.63

Stratification of Counties with Multiple Positive Deviant Outcomes

	Freq.	Percent
Child Poverty		
Low	10	13.7
Medium	37	50.68
High	26	35.62
Rurality		
Low	16	21.92
Medium	20	27.4
High	37	50.68
Percent Minority		
Low	26	35.62
Medium	28	38.36
High	19	26.03
Population		
Low	44	60.27
Medium	19	26.03
High	10	13.7

Frequency of Counties with Multiple Positive Deviant Outcomes, by Census Region

	Freq.	Percent
Northeast	9	12.33
Midwest	16	21.92
South	40	54.8
West	8	10.96

Table 3. Comparing Characteristics of Positive Deviant (PD) versus Non-Positive Deviant Counties

Low Birth Weight		PD mean	Non-PD mean	P value
Demographics	Population	39282.35	131306.11	0.000
	% of population below 18	22.17	22.48	0.307
	% of county that is rural	62.43	50.55	0.000
	% minority	17.47	24.36	0.000
Social Determinants of Health	% w/ housing problems	15.55	14.82	0.058
	% w/ poor access to healthy food	8.30	7.05	0.022
	Pollution	8.40	9.27	0.000
	% adults unemployed	5.68	5.33	0.070
	% of children uninsured	6.54	5.88	0.035
Community Capacity	Population to PCP ratio	2546.87	2621.17	0.669
	Population to dentist ratio	2678.77	3078.72	0.013
	Number of nonprofits	201.23	584.11	0.000
	Social capital	0.32	-0.26	0.000
Preschool		PD mean	Non-PD mean	P value
Demographics	Population	163578.44	121363.99	0.100
	% of population below 18	21.64	22.54	0.000
	% of county that is rural	48.49	51.61	0.136
	% minority	33.64	22.89	0.000
Social Determinants of Health	% w/ housing problems	16.30	14.72	0.000
	% w/ poor access to healthy food	7.68	7.07	0.186
	Pollution	9.09	9.22	0.167
	% adults unemployed	5.56	5.33	0.060
	% of children uninsured	5.22	5.99	0.000
Community Capacity	Population to PCP ratio	2422.06	2636.99	0.125
	Population to dentist ratio	2934.58	3065.63	0.453
	Number of nonprofits	878.32	525.80	0.012
	Social capital	0.01	-0.25	0.000
Teen Birth		PD mean	Non-PD mean	P value
Demographics	Population	151053.20	124272.73	0.498
	% of population below 18	18.94	22.61	0.000
	% of county that is rural	47.65	51.47	0.213
	% minority	20.17	24.09	0.014
Social Determinants of Health	% w/ housing problems	18.93	14.69	0.000
	% w/ poor access to healthy food	8.06	7.09	0.194
	Pollution	8.84	9.23	0.003
	% adults unemployed	5.05	5.36	0.010
	% of children uninsured	5.58	5.93	0.237

Community Capacity	Population to PCP ratio	1734.29	2655.41	0.000
	Population to dentist ratio	2566.89	3074.57	0.024
	Number of nonprofits	818.89	548.10	0.222
	Social capital	-0.05	-0.23	0.037
Graduation		PD mean	Non-PD mean	P value
Demographics	Population	17850.61	131762.68	0.000
	% of population below 18	22.53	22.45	0.766
	% of county that is rural	73.69	49.99	0.000
	% minority	22.52	24.00	0.378
Social Determinants of Health	% w/ housing problems	13.70	14.94	0.000
	% w/ poor access to healthy food	7.41	7.11	0.587
	Pollution	8.90	9.23	0.004
	% adults unemployed	5.91	5.32	0.002
	% of children uninsured	9.22	5.72	0.000
Community Capacity	Population to PCP ratio	3680.19	2553.55	0.000
	Population to dentist ratio	4486.10	2968.39	0.000
	Number of nonprofits	78.99	587.96	0.000
	Social capital	-0.41	-0.21	0.024

Conclusion

The findings from these three studies provide valuable insights into factors that contribute to a transition to an integrated health development system that is better able to address the upstream determinants of health. The first study examined what area characteristics promote the establishment of school-based health centers (SBHCs). Findings showed that the availability of nearby community health centers, as well as the existence of a SBHC state advocacy organization, supported the establishment of SBHCs. These results point to the need for extra financial and technical support for school districts in counties that have few or no community health centers. Sitting at the intersection of education, health care, and public health, SBHCs are an integrated form of care in and of themselves, and provide a way for students to access care in an environment that is convenient and familiar to them. Increasing establishment of SBHCS in underserved communities will serve to strengthen ties between several sectors key to health and development for vulnerable populations.

The second study examined multilevel organizational influences of physician practices' screening for social risk. We found that practice-level characteristics explained more of the variance in a practice's social risk screening than system-level characteristics, which suggests efforts to expand social risk screening among system-owned practices should focus on strategies at the practice level, such as increasing technology capacity and patient engagement strategies. In addition to informing patient care decisions, increasing social risk screening in physician practices will also serve to inform broader efforts to understand unmet needs in the community. As health care organizations gain increased understanding about the upstream challenges their patients face, they will be better equipped to work toward addressing these challenges in partnership with other community organizations working in these areas.

The third study tested an approach for identifying US counties with better-than-expected child health outcomes, also known as positive deviants. This study provides the first step – identification of positive deviant counties – that future qualitative research can build on to understand community activities that contribute to exceptional child health outcomes. Identifying those that are both positive deviants (performing better than expected given their circumstances of poverty), and are also are high performers (performing well in unadjusted terms) means that the lessons learned from these communities in subsequent studies will be tactics that can potentially bring lower-income communities to not only be in line with the national average, but to exceed the national average for these outcomes. Based on previous related research,[13] it is expected that multi-sector partnerships and collaboration will be key tactics utilized by organizations in these positive deviant counties. Future research can help uncover the programmatic and organizational factors that make up the kinds of multi-sector efforts that result in exceptional child health and wellbeing outcomes.

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Appendices

Appendix A – Full Description of Independent Variables (Chapter 2)

Size. Size is measured at the system level by number of practices and hospitals owned by the system, and at the practice level by number of physicians in the practice.

Competition. Competition is measured at the system level by a survey question on the perception of the intensity of competition for patients in the outpatient setting in the system's largest market. It is measured at the practice level by the perception of the intensity of competition for patients in the practice's market.

Technology capacity. Technology capacity was measured at the system level by a composite score of the share of the medical groups in the health system (*none, some, most, all*) that have the following specific health information system capabilities: 1) patients have electronic access to their medical records; 2) patients can electronically input information in their medical records; 3) physicians and patients can communicate with one another via email; 4) physicians can know whether their patients have filled their prescriptions; and 5) advanced analytic systems, such as predicting future utilization. Items were scored as 0 for "none," 33.3 for "some," 66.6 for "most," and 100 for "all." A composite scale was calculated using the average of the five item responses (range = 0-100; α [internal consistency reliability] = 0.71).

At the practice level, technology capacity is measured by an index (range: 0-7) that includes whether or not the practice's health information system allows for the five capabilities described above, as well as how often (never, sometimes, often, always) clinicians have access to the following when they need it: 1) information from groups that are not using their EHR, and 2) information from local public social service agencies (e.g., county or city shelters, social workers, food programs).

Innovation culture. Innovation culture was measured at the system level using four statements that asked respondents to allocate 100 points across 4 organizational culture statements using an ipsative scale. System innovation culture is measured by the number of points (between 0-100) allocated to the statement, "Our system is a very dynamic and entrepreneurial place. People are willing to try new things to see if they work."

Innovation culture was measured at the practice level using responses to questions assessing how often the following occurrences happened in the practice: 1) successful care delivery innovations are highly publicized; 2) team members openly share patient care challenges and failures with each other; 3) there is protected time given to generate new ideas and innovations; 4) the practice encourages trying new ideas to see if they work, 5) the practice considers itself to be the testing ground for new approaches to engage patients in their care. Each item was scored as 0 for "never," 33.3 for "sometimes," 66.6 for "often," and 100 for "always." A composite scale was calculated based on the average of all item responses (range = 0-100; α = 0.80).

Centralization. There are four measures for centralization at the system level. The first is a composite measure of questions that asks at what level (*local, regional/divisional, systems*) the following activities of a health care system are primarily conducted: 1) strategic planning, 2) capital budgeting, 3) setting of clinical improvement priorities, 4) human resource policies and practices, 5) selection of information

technology vendors, and 6) contracting with insurers. Items were scored as 0 for "local," 50 for "regional/divisional," and 100 for "systems." A composite scale was calculated using the average of the six item responses (range = 0-100; α = 0.89).

Additional individual measures of centralization are: whether the system has a system-wide approach for keeping up with new evidence (*yes/no*); how often the system approaches clinical care as a single, integrated group, using common guidelines for specific populations (*never, sometimes, most of the time, always*); and whether front-line care clinicians have significant involvement in setting annual clinical performance improvement priorities (*yes/no*).

Compatibility. There are several measures assessing organization-innovation compatibility. As described above, these measures fall into three categories:

1) Having patients likely to be experiencing higher levels of social risk. At the system level, this is measured by whether or not the system includes FQHCs or look-alikes (*yes/no*). At the practice level, this includes whether or not the practice is an FQHC or look-alike (*yes/no*), as well as the practice's percentage of revenue that is Medicaid.

2) Investment in population health. This is measured by whether or not the system participates in population health collaboratives (*yes/no*).

3) Investment in patient-centered care. At both the system and practice levels, this is measured by whether or not the system/practice has a method for identifying complex high-need patients (*yes/no*). At the practice level, we also include a measure of the practice's score on the Patient Engagement Scale, made up of 30 patient engagement capabilities reported by the practice. These are: shared medical appointments (adoption in general, as well as for specific clinical areas: cardiovascular disease, asthma, diabetes, advanced directives); motivational interviewing (smoking cessation, weight loss/diet, increase in physical activity, medication adherence, training staff and/or clinicians); shared decision-making (physician/staff formally trained in shared decision-making, routinely engage in shared decision-making, routinely use decisions aids, and follow-up after shared decision-making); decision aids (for selecting diabetes medication, osteoarthritis treatment, and screening for breast cancer, prostate cancer, colorectal cancer, and lung cancer); and collection of patient-reported outcomes (for patient activation and depression; and for physical function/disability or measures of pain for older adults, diabetic patients, musculoskeletal hip, knee or back patients, and heart failure patients). Ten ordinal response questions assessing how many physicians and staff in the practice adopted specific patient engagement capabilities were scored as 0 for "none," 33.3 for "some," 66.6 for "most," and 100 for "all." Twenty dichotomous response questions assessing overall practice-level adoption for specific patient engagement capabilities were scored as 0 for "no" and 100 for "yes." A composite scale was calculated by averaging the 30 item responses (range = 0-100; α = 0.917).

Appendix B – Supplemental Tables (Chapter 3)

Exhibit A. Counties with Multiple (2 or more) Positive Deviant (PD) Outcomes

# of PDs	State	County	Positive Deviant for Below Outcome?			
			Low birth weight	Preschool	Teen Birth	Graduation
3	NY	Rockland County	Yes	Yes	Yes	-
3	WI	Vernon County	Yes	-	Yes	Yes
2	AL	Cleburne County	-	Yes	-	Yes
2	AL	Marengo County	-	Yes	-	Yes
2	AL	Sumter County	-	Yes	-	Yes
2	AR	Clay County	-	Yes	-	Yes
2	AR	Searcy County	Yes	-	-	Yes
2	CA	Butte County	Yes	-	Yes	-
2	CA	Calaveras County	Yes	-	Yes	-
2	CO	Sedgwick County	Yes	Yes	-	-
2	FL	Leon County	-	Yes	Yes	-
2	FL	Miami-Dade County	-	Yes	Yes	-
2	GA	Bleckley County	Yes	Yes	-	-
2	GA	Hancock County	-	Yes	-	Yes
2	ID	Madison County	Yes	-	Yes	-
2	IL	Jackson County	-	Yes	Yes	-
2	IL	Pike County	Yes	Yes	-	-
2	IA	Davis County	Yes	-	Yes	-
2	IA	Lucas County	Yes	-	-	Yes
2	KS	Kingman County	Yes	Yes	-	-
2	KY	Calloway County	-	-	Yes	Yes
2	KY	Larue County	Yes	-	-	Yes
2	KY	Livingston County	-	Yes	-	Yes
2	KY	Rowan County	-	-	Yes	Yes
2	LA	Lincoln Parish	-	Yes	Yes	-
2	MD	Kent County	-	Yes	Yes	-
2	MA	Dukes County	-	Yes	Yes	-
2	MA	Hampshire County	-	Yes	Yes	-
2	MI	Alcona County	Yes	-	Yes	-
2	MI	Houghton County	Yes	-	Yes	-

2	MI	Mecosta County	Yes	-	Yes	-
2	MN	Watonwan County	Yes	Yes	-	-
2	MO	Adair County	-	Yes	Yes	-
2	MO	Douglas County	Yes	-	-	Yes
2	NV	Lincoln County	-	Yes	Yes	-
2	NY	Kings County	-	Yes	Yes	-
2	NY	New York County	-	Yes	Yes	-
2	NY	Tompkins County	-	Yes	Yes	-
2	NY	Yates County	Yes	-	Yes	-
2	NC	Orange County	-	Yes	Yes	-
2	OH	Holmes County	Yes	-	Yes	-
2	OR	Baker County	Yes	Yes	-	-
2	PA	Indiana County	Yes	-	Yes	-
2	SD	Clay County	Yes	-	Yes	-
2	TN	Perry County	Yes	-	-	Yes
2	TX	Bandera County	-	-	Yes	Yes
2	TX	Baylor County	-	Yes	-	Yes
2	TX	Bosque County	Yes	-	-	Yes
2	TX	Brewster County	-	Yes	-	Yes
2	TX	Collingsworth County	Yes	-	-	Yes
2	TX	Franklin County	-	Yes	-	Yes
2	TX	Hall County	-	Yes	-	Yes
2	TX	Hamilton County	Yes	-	-	Yes
2	TX	Hansford County	Yes	-	-	Yes
2	TX	Haskell County	Yes	-	-	Yes
2	TX	Lampasas County	Yes	-	-	Yes
2	TX	Lavaca County	-	Yes	-	Yes
2	TX	Oldham County	-	-	Yes	Yes
2	TX	San Saba County	Yes	-	-	Yes
2	TX	Shackelford County	-	Yes	-	Yes
2	TX	Wood County	Yes	-	-	Yes
2	TX	Young County	Yes	-	-	Yes
2	VT	Caledonia County	Yes	Yes	-	-
2	VA	Page County	Yes	-	-	Yes
2	VA	Bristol city	Yes	-	Yes	-

2	VA	Buena Vista city	Yes	-	Yes	-
2	VA	Charlottesville city	-	Yes	Yes	-
2	VA	Fredericksburg city	-	Yes	Yes	-
2	WA	Jefferson County	Yes	-	Yes	-
2	WA	San Juan County	Yes	-	Yes	-
2	WV	Hardy County	-	Yes	-	Yes
2	WI	Clark County	Yes	-	Yes	-
2	WI	Richland County	Yes	-	Yes	-

Exhibit B. Comparing Characteristics of Positive Deviant (PD) versus Negative Deviant (ND) Counties

Low Birth Weight		PD mean	ND mean	P value
Demographics	Population	39282.35	76251.04	0.001
	% of population below 18	22.17	22.39	0.525
	% of county that is rural	62.43	54.76	0.009
	% minority	17.47	42.09	0.000
Social Determinants of Health	% w/ housing problems	15.55	16.14	0.189
	% w/ poor access to healthy food	8.30	9.41	0.119
	Pollution	8.40	9.23	0.000
	% adults unemployed	5.68	6.26	0.011
	% of children uninsured	6.54	5.16	0.000
Community Capacity	Population to PCP ratio	2546.87	2674.71	0.542
	Population to dentist ratio	2678.77	3442.53	0.001
	Number of nonprofits	201.23	396.75	0.003
	Social capital	0.32	-0.23	0.000
Preschool		PD mean	ND mean	P value
Demographics	Population	163578.44	26200.32	0.000
	% of population below 18	21.64	22.74	0.001
	% of county that is rural	48.49	67.70	0.000
	% minority	33.64	20.56	0.000
Social Determinants of Health	% w/ housing problems	16.30	13.68	0.000
	% w/ poor access to healthy food	7.68	6.46	0.041
	Pollution	9.09	8.85	0.085
	% adults unemployed	5.56	5.60	0.795
	% of children uninsured	5.22	7.52	0.000
Community Capacity	Population to PCP ratio	2422.06	3480.32	0.000
	Population to dentist ratio	2934.58	4124.20	0.000
	Number of nonprofits	878.32	112.99	0.000
	Social capital	0.01	-0.37	0.000
Teen Birth		PD mean	ND mean	P value
Demographics	Population	151053.20	33752.49	0.003
	% of population below 18	18.94	25.71	0.000
	% of county that is rural	47.65	48.37	0.836
	% minority	20.17	37.89	0.000
Social Determinants of Health	% w/ housing problems	18.93	14.42	0.000
	% w/ poor access to healthy food	8.06	9.48	0.101
	Pollution	8.84	8.59	0.122
	% adults unemployed	5.05	5.82	0.000
	% of children uninsured	5.58	8.81	0.000

Community Capacity	Population to PCP ratio	1734.29	3064.66	0.000
	Population to dentist ratio	2566.89	3557.15	0.001
	Number of nonprofits	818.89	134.48	0.002
	Social capital	-0.05	-0.63	0.000
Graduation		PD mean	ND mean	P value
Demographics	Population	17850.61	222814.71	0.000
	% of population below 18	22.53	22.49	0.911
	% of county that is rural	73.69	38.84	0.000
	% minority	22.52	37.27	0.000
Social Determinants of Health	% w/ housing problems	13.70	17.47	0.000
	% w/ poor access to healthy food	7.41	9.96	0.000
	Pollution	8.90	8.25	0.000
	% adults unemployed	5.91	5.69	0.300
	% of children uninsured	9.22	5.93	0.000
Community Capacity	Population to PCP ratio	3680.19	2413.99	0.000
	Population to dentist ratio	4486.10	2387.87	0.000
	Number of nonprofits	78.99	1103.77	0.000
	Social capital	-0.41	-0.14	0.012